Facoltà di Ingegneria

Programs

2016/2017

Acustica Applicata ed Illuminotecnica

Gianni Cesini

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
Basic knowledges of mathematical analysis and physics

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
This course aims at giving students the basic knowledge of Applied Acoustic and Lighting. This knowledge, by integrating the knowledge gained in the Analysis and Physical teachings, will allow to enrich the knowledge in the field of acoustics and lighting. the study allows the student to learn and use systems and technologies for design, lighting design and noise control.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to apply the basic concepts for a basic engineering education in industrial learned during the study, the student must know how to perform acoustic and lighting calculations in order to dimension a lighting system, choose the most suitable equipment according to the lighting requirements and energy saving, evaluate the acoustic characteristics of an environment, dimension an acoustic barrier. The student will be able to receive a lot of technical notions, such as: 1. basic knowledge of applied acoustics and lighting; 2. ability to conduct analysis of acoustic data from measurements; 3. ability to select the most appropriate lighting system according to the different destination of an environment.
TRANSVERSAL SKILLS:
The ability to solve numerical problems will help improve the degree of independence of judgment in general, both the communication skills that comes from knowing of its powers, is the ability to learn independently and to draw the student's conclusions.

Program
APPLIED ACOUSTICS. Sound and vibration. Sound levels. Sound propagation. Frequency of sound. Sound spectrum and frequency analysis. Sensitivity of hearing. Loudness perception. A-weghted sound levels. Noise exposure limits. Sound level meters. Sound absorption. Sound absorption by materials and structures. Sound propagation in a room. Reverberation time. Room noise reduction. Sound isolation. Mass law. Sound isolation in civil and industrial buildings. LIGHTING. Nature of light. Electromagnetic spectrum. Standard spectral luminous visibility curves for human eye. Lighting terms and units. Light sources. Elementary illumination design methods

Development of the course and examination
LEARNING EVALUATION METHODS
Oral exam

LEARNING EVALUATION CRITERIA
Knowledge of the subjects and ability on solving problems

LEARNING MEASUREMENT CRITERIA

Level of the knowledge of the subjects and of the ability on solving problems

FINAL MARK ALLOCATION CRITERIA
On the basis of an inevitably personal evaluation, that I hope is more objective as possible, of the above mentioned criteria

Recommended reading
Bibliographic material Lezioni del prof. Cesini di Acustica Applicata e Illuminotecnica that can be downloaded from the page Allegati of prof. Cesini in www.univpm.it P. Ricciardi, Elementi di acustica e illuminotecnica, McGraw-Hil

Aerodinamica e Gasdinamica

Renato Ricci

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Basic knowledge of Calculus, Mechanics and Fluidynamics

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course allows to the students to obtain a basic knowledge of applied aerodynamics of airplanes and cars. Compressible and supersonic flows will be also introduced. By means of the integration of expertise gathered in the undergraduate courses (Applied Thermodynamics and Heat Transfer and Fluid Dynamics) the students complete their knowledge about fluid flows phenomena. The students will obtain a deeper knowledge of mechanical engineering sciences with particular emphasis to applied aerodynamics.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to face complex design problems in the field of aerodynamics the student should be able to correctly analyze the main aerodynamic phenomena involved in the interaction between a fluid and solid body in relative motion. At the of the course the students will be talented to: 1. analyze subsonic and supersonic airfoils; 2. design an airfoil for a specific application; 3. analyze a complex aerodynamic phenomenon.
TRANSVERSAL SKILLS:
The knowledge and the expertise aforementioned will provide an increment to students free learning abilities

Program
Aerodynamic loads. The drag: shape and viscous components. Evaluation of the drag coefficient by using the momentum conservation equation. Potential flow theory and thin sheet theory. Aerodynamic shapes. Boundary layer separation on curved surfaces. Flaps and turbulators. Finite wing theory. Longitudinal stability of the airplane. Fundamentals of compressible fluid flow.

Development of the course and examination
LEARNING EVALUATION METHODS
Interactions with students during the lessons

LEARNING EVALUATION CRITERIA
Evaluation of the learning state

LEARNING MEASUREMENT CRITERIA
Problem solving skills

FINAL MARK ALLOCATION CRITERIA
Level of knowledge and analytical capacity

Recommended reading

J. D. ANDERSON Jr. Fundamentals of Aerodynamics. Mc Graw-Hill Book Co. On www.termofluido.univpm.it you'll find the lecture notes

Affidabilità e Sicurezza delle Costruzioni Meccaniche

Marco Rossi

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
none

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire knowledge to critically evaluate a mechanical design in terms of reliability and risk analysis. This knowledge will complement the basic technical education for the engineer's professional role, providing the student with extremely important notions in the mechanical field, notions that are present in most of the scientific and technical problems in the various areas that are the basis of engineering applications and mechanics. In addition, the knowledge received on reliability and safety of mechanical systems will allow the student to interact with specialists from different areas (electronics, computer science, economics) that, under different conditions, face similar problems
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student needs to demonstrate the ability of selecting and applying suitable analytical and modelling methods, based on the mathematical analysis and numerical methods, in order to simulate the behaviour of components and systems in terms of reliability and safety. This capacity will be evaluated on the basis of a series of vocational skills that the student must have. For instance, the ability of selecting and use tools, procedures and appropriate methods, knowing the limits and potentials of each. During the course, the student is required to solve real practical problems of engineering interest, taken by the current industrial practice. He must be able to assess, in terms of safety and reliability, systems that can also have a high functional complexity, taking into account the implications related to environment, economics and ethics
TRANSVERSAL SKILLS:
The solution of exercises based on engineering data taken from the current industrial practice will improve the student's ability to make independent and informed decisions during his/her professional activities, assessing the effectiveness and efficiency of each possible design choice, and, in particular, estimating the risks for safety and verifying the compliance with the current regulations

Program
The course is divided into three parts: 1. probabilistic and statistical methods: failure functions (Gaussian function, Weibull function, exponential function, etc.), reliability function, failure rate, MTBF. Interpolation of the experimental data, parameter estimation. Reliability of complex mechanical systems. 2. Mechanical design through probabilistic methods. Study of components of interest (vessels, plates, etc.). Choice of the safety factor based on probabilistic considerations. Methods to increase reliability: component selection, testing, derating, redundancy. FMEA and FMECA: examples of preparation of the tables to simple operation of mechanical organs. Fault tree analysis. 3. Understanding the regulation of safety and reliability in the industry.

Development of the course and examination

LEARNING EVALUATION METHODS

the learning evaluation will be assessed by two tests: - A written test, in which the student must demonstrate knowledge of the tools for studying the reliability of mechanical systems and know how to apply in actual engineering cases. - An oral exam where the topics of the course will be discussed in order to evaluate the level of knowledge of the subject.

LEARNING EVALUATION CRITERIA

the student will be evaluated on the understanding of issues related to the reliability and safety of mechanical systems. In the written exam, he must demonstrate a good knowledge of the studied statistical distributions and he must be able to solve mechanical engineering problems using probabilistic tools. In the oral examination, the student must know the topics described in the course and be able to do critical thinking. The highest vote will be given if, in addition to having successfully passed the exam, the student will demonstrate a complete mastery of the subject, that is not limited to the simple memorization of the topics.

LEARNING MEASUREMENT CRITERIA

The learning measurement will be done on the basis of the results obtained in the final exams and in other verifications conducted during the course.

FINAL MARK ALLOCATION CRITERIA

The final mark will be the average of the marks given to the written and the oral exams. The minimum vote for the written exam that allows the admission to the oral exam is 18/30. Laude will be assigned in case the student shows an outstanding knowledge of the matter during the oral exam.

Recommended reading

Stefano Beretta, Affidabilità delle costruzioni meccaniche , springer 2009

Algebra e Logica

Maria Chiara Brambilla

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
Basic notions of Linear Algebra

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course will teach to students basic notions of algebra and logic. In particular the course will concern the notions of sets, equivalence relations, order relations, groups, rings, fields; logic thought and basic rules of proposition and predicative logic.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Students will be able to use the course topics, to provide correct proofs, to solve exercises on groups, rings and fields, to read and write well posed expressions in logic and to compute the true value of a logic expression.
TRANSVERSAL SKILLS:
The study and the exercises proposed in this course will consolidate also the transverse skills obtained by the students. In particular the ability of critically analyze a problem and the ability of use a correct, precise and formal language. The ability to learn in autonomy and to develop the study will be strenghtened too.

Program
Set theory. Arithmetic: division, prime numbers, GCD, Bezout's identity, Euclid's algorithm. Equivalence relations, quotients, integers modulo n. Order relations and lattices. Groups, subgroups, group homomorphisms, quotient group. Lagrange Theorem. Rings and fields, integral domains, ideals, quotient ring. Polynomial rings. Introduction to mathematical logic. Propositional logic: syntax, semantics, natural deduction system. Soundness and completeness theorems. First-order logic: syntax and semantics.

Development of the course and examination
LEARNING EVALUATION METHODS
The learning evaluation is carried out by two exams: - a practical examination, which consists of solving exercises and problems related to the topics explained in the course. - a theoretical examination, consisting in a discussion of the topics of the course. In particular the knowledge and the understanding of all definitions, theorems and proofs explained in the classes will be tested. The practical exam is preliminary to the theoretical one. It is necessary to pass the practical exam in order to do the theoretical one.

LEARNING EVALUATION CRITERIA
In order to pass the learning evaluation, the student must demonstrate that he/she has understood the basic concepts of algebra and logic explained in the course. In particular in the practical test the student must show that he/she is able to apply independently the learned techniques in solving exercises and problems. In the theoretical exam the student must be able to expose the theoretical

contents with the correct language and accuracy.

LEARNING MEASUREMENT CRITERIA
Each of the tests is graded on a scale from 0 to 30. The final grade will be decided starting from the two test grades.

FINAL MARK ALLOCATION CRITERIA
The final grade will be positive only if in both of the tests the students gets the passing grade (18/30). The maximal grade is reached if the student proves a knowledge and a thorough understanding of the course content. The maximal grade with honors is reserved to the students who passed both of the tests in a complet and correct way, showing special independence and excellence.

Recommended reading
Facchini, Algebra e matematica discreta , Zanichelli. Asperti, Ciabattoni, Logica a informatica , McGraw-Hill.

Algebra Lineare e Geometria

Maria Chiara Brambilla

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
none

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course gives the students the basic knowledges in geometry and in the field of complex numbers, using in particular tools in linear algebra and analytic geometry such as vector spaces, linear applications and their representations in terms of vectors and matrices. These knowledges cooperate with the ones learned in the courses of Mathematical Analysis I and II so that the student acquires the ability to understand criteria, procedures and limits of application of mathematical methods to real problems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student must develop the ability to apply the tools of linear algebra and analytic geometry such as vector spaces, linear applications and their representations in terms of vectors and matrices in order to formalize, identify and solve problems in Information Engineering.
TRANSVERSAL SKILLS:
Solving problems and exercises, that will be worked out both during practice hours and at home, and the preparation for the oral part of the exam will improve judgment independence in general, communication skills, autonomous learning abilities and the capability of the student to draw conclusions.

Program
Vector spaces. Basis and dimension of a vector space, coordinates. Grassmann's theorem. Linear maps. Kernel and image of a linear map. Dimension theorem. Linear systems. Rouche'-Capelli's theorem. Ladder reduction. Operation on matrices and linear maps. Sum and composition of linear maps. Isomorphisms. Product of matrices. Invertible matrices.Change of basis. Matrix associated to a linear map with respect to two basis. Similar matrices. Determinant. Eigenvalues and eigenvectors. Diagonalizable endomorphisms. Characteristic polynomial. Algebraic and geometric multiplicity. Necessary and sufficient criterion for diagonalizability of an endomorphism. Symmetric bilinear forms and scalar products. Cauchy's inequality. Congruent matrices. Symmetric and orthogonal endomorphisms. Spectral theorem.

Development of the course and examination
LEARNING EVALUATION METHODS
The learning evaluation is carried out by two exams: - a practical examination, which consists of solving exercises and problems related to the topics explained in the course. The test must be completed in 3 hours; - a theoretical examination, consisting in a discussion, written and oral,of the topics of the course. In particular the knowledge and the understanding of all definitions, theorems and proofs explained in the classes will be tested. The practical exam is preliminary to the theoretical one. It is necessary to pass the practical exam in order to do the theoretical one. The two

exams must be passed in the same exam session. If the student fails the theoretical exam, he/she must repeat also the practical one.

LEARNING EVALUATION CRITERIA
In order to pass the learning evaluation, the student must demonstrate that he/she has understood the basic concepts of linear algebra and geometry explained in the course. In particular in the practical test the student must show that he/she is able to apply independently the learned techniques in solving exercises and problems. In the theoretical exam the student must be able to expose the theoretical contents with the correct language and accuracy.

LEARNING MEASUREMENT CRITERIA
Each of the tests is graded on a scale from 0 to 30. The final grade will be decided starting from the two test grades.

FINAL MARK ALLOCATION CRITERIA
The final grade will be positive only if in both of the tests the students gets the passing grade (18/30). The maximal grade is reached if the student proves a knowledge and a thorough understanding of the course content. The maximal grade with honors is reserved to the students who passed both of the tests in a complet and correct way, showing special independence and excellence.

Recommended reading
The learning evaluation is carried out by two exams: - a practical examination, which consists of solving exercises and problems related to the topics explained in the course. The test must be completed in 3 hours; - a theoretical examination, consisting in a discussion, written and oral,of the topics of the course. In particular the knowledge and the understanding of all definitions, theorems and proofs explained in the classes will be tested. The practical exam is preliminary to the theoretical one. It is necessary to pass the practical exam in order to do the theoretical one. The two exams must be passed in the same exam session. If the student fails the theoretical exam, he/she must repeat also the practical one.

Algoritmi e Strutture Dati

Giuseppa Ribighini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
knowledge of fundamentals of computer and an imperative programming language.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire appropriate knowledge of data structures and algorithms for the solution of remarkable fundamental problems (search, sort) taking into account the computational complexity of each algorithm, and to know how to implement it in an appropriate language, understanding modes and limits for the application of the examined algorithms.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
After completing the course, students will be able to formalize nformation engineering problems using appropriate algorithms and data structures (correct, efficient)
TRANSVERSAL SKILLS:
The group work on the use and comparison of algorithms helps to improve student's ability of making judgements and communicate. Finally it will be stimulated the ability to learn autonomously and in-depth study.

Program
ntroduction to algorithms. Numerical algorithms for solving integrals and systems of linear equations. Design of recursive algorithms. Computational complexity, asymptotic notations, computational complexity of main structures, and computational complexity of recursive functions. Basic data structures. Sorting algorithms and their computational complexity. Dynamic lists: algorithms for search, insertion, and deletion and their computational complexity. Binary search trees: recursive algorithms for search, insertion, and deletion and their computational complexity. A short introduction to red-black trees, B-trees, AVL trees and trees 2-3. Hash tables for closed addressing and routing: algorithms for search, insertion and deletion and their computational complexity. Abstract datatypes: design and realization. The language used in the course is the C programming language.

Development of the course and examination
LEARNING EVALUATION METHODS
The evaluation learning consists of two tests: -a written test on topics covered in the course to be completed in two hours -an oral examination during which students discuss one or more course topics and any gaps arisen in the written test. The written test is preparatory to the oral test. Student must obtain at least the sufficiency in the written test in order to be admitted to the oral test. Students must also submit, prior to the written test or during the same, one project on one of the course topics at its choice. The project must be developed by a groups of four or five people and will be exposed by each group member during the oral examination.

LEARNING EVALUATION CRITERIA

The student must demonstrate an appropriate knowledge about data structures, the most appropriate algorithms for each problem, and how these algorithms should be implemented.

LEARNING MEASUREMENT CRITERIA
Both in the written test and the oral examination, the student must demonstrate to know course topics, expose them in a sufficiently correct way using an appropriate technical terminology. Each test the assign a score up to 30.

FINAL MARK ALLOCATION CRITERIA
In order to obtain a positive overall outcome, the student must achieve a score greater or equal than 18, both in the written test and the oral. The maximum rating is achieved by demonstrating a thorough understanding of content, exhibited with complete mastery of the technical language and presenting a good project. Full mark with distinction is reserved to students who, having played both tests correct and complete way, have shown a particular brilliance both on the written and in the oral test and a good autonomy in project work.

Recommended reading
P.Foggia, M. Vento - Algoritmi e strutture dati - Astrazione, progetto e realizzazione - McGraw Hill 2011. (Book chosen) C. Demetrescu, I. finocchi, G. F. Italiano - Algoritmi e strutture dati -McGraw Hill 2008 C. Demetrescu, I. finocchi, G. F. Italiano - Progetto di algoritmi e strutture dati in Java -McGraw Hill 2007. T. H. Cormen, C. E. Leiserson, R. L. Rivest, C. Stein - Introduzione agli algoritmi e strutture dati -McGraw Hill 2010

Analisi Critica dell'Architettura

Giovanni Bellucci

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Nothing

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course contributes to the training of the Construction Engineer providing a picture of modern and contemporary architecture and design, through the analysis of forms, innovations and technologies from the idea to the construction. The acquired knowledge will improve the skills of the student and introduce him in the field of the renovation and regeneration of the existing buildings.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The course promotes the understanding of the complexity of the phenomena related to the renovation, and to management and transformation of the built environment. The student will acquire the knowlegde the design and construction languages of the history, from the ancient to contemporary times. His skills will be refined through the analysis of case studies of the various periods and cultures. Students will also work in groups through exercises to assess their knowledge.
TRANSVERSAL SKILLS:
The student will acquire the above knowledge through the study of theory and the teaching material provided by the teachers. The interdisciplinary approach will provide critical skills and the capacity of understanding the historical and environmental context. The workshops in the classroom and the direct contact with the work will contribute to the improvement of the abilities of the student. Group work will foster communication skills and knowledge exchange.

Program
Architecture and engineering in ancient and modern times; The Greece (architectural models, materials and construction techniques); The Ancient Rome (materials, building technology and construction, urban models, architectural types); The Early Christian and the Byzanine architecture; The Romanescque and the Gothic architecture; The Renaissance, the Mannerism and the Baroque. Architecture and engineering in contemprary times; the industrial revolution and the birth of the Technical Schools of Engineering in Europe (engineering of concrete and engineering of metals); evolution of modern city (London, Paris, Wien, Barcelona, Philadelphia, New York, Washington, Chicago, Rome). The contribution of great master of the twentieth century: United States and Frank Lloyd Wright; Germany, Deutscher Werkbund, Walter Gropius, Ludwig Mies van der Rohe and the contribution of Peter Behrens; France by August Perret and Le Corbusier; Scandinavia, Finland and Alvar Aalto. Engineering and architecture in Italy in the twentieth century. Engineering and architecture of the late twentieth century in an international context. Monographic lectures on British School (Norman Foster, Richard Rogers, Peter Rice and Nicholas Grimshaw), the United States School (SOM, Pietro Belluschi, Peter Eisenman, Frank Gehry, Steven Holl, Philip Johnson, Richard Meier). Historical evolution of the city of Ancona in ancient and contemporary times.

Development of the course and examination

LEARNING EVALUATION METHODS

Oral exam: the evaluation of learning is based on a discussion of the issues presented in the lectures.

LEARNING EVALUATION CRITERIA

The student must demonstrate that they acquired the ability to investigate an project under several point of view: historical, technical and design.

LEARNING MEASUREMENT CRITERIA

The final knoledge checks are designed to prove not only the understanding of knowledge but the actual understanding of the thems and the real ability to describe buildings or projects. Must prove capable of applying the knowledge set in context broader but related to their field of study.

FINAL MARK ALLOCATION CRITERIA

For a global positive evaluation the student to get the knowledge of full topic. Honours are reserved to student who have demonstrated an exceptionally clear knowledge of the topics.

Recommended reading

K. Frampton, "Tettonica e architettura", Skira, Milano 2005 W.J.R. Curtis, "L'architttura dal 1900", Phaidon, Londra 2006 B. Zevi, "Saper vedere l'architettura", Einaudi, Torino 1953 A. Rossi, "L'architettura della città", Quodlibet, Macerata 2011 E. Torroja, "La concezione strutturale", Città Studi Edizioni, Milano 1966 M. Salvadori, R. Heller, "Le strutture in architettura", Etas Kompass, 1964

Analisi e Controllo di Sistemi Complessi

Anna Maria Perdon

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
The student should have a good knowledge of the notions provided by basic courses in Mathematics and in Automatic Control. It 'also useful to know how to use programming tools

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims at providing the student with quantitative methodologies to support business decisions and management of economic-productive systems and processes in industry and in services and useful tools to analyse qualitatively discrete-time complex models for the description and control of processes related to production management, in particular concerning the supply chain. The student will face from a different point of view topics encountered in other courses, and will verify the potential of the use of more advanced models to describe and analyse the of processes behaviour for prediction and control purposes .
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Students learn to build models of various complexity describing processes related to the management of the system in its various sub-components (logistics, manufacturing, marketing, finance, administration and control), to analyse their theoretical properties, to implement them in Excel and to evaluate the behaviour with parameters variation by means of simulations, to design and implement appropriate control strategies to obtain the desired behaviour.
TRANSVERSAL SKILLS:
Through guided exercises the students develop - Their ability to learn by assessing the completeness and adequacy of their preparation; - The independence of judgment in analysing the behaviour of economic and production processes and formulate and propose solutions to problems inherent in the representation and management of such models; - Communication skills in formulating and properly describe the solutions to the problems under consideration.

Program
The notions of linearity, non linearity, chaos and complexity for dynamical systems. 2. Linear and non linear models SISO and MIMO (dynamic of the populations(Malthus, Verhurst), the logistic map, Lotka-Volterra, Prices dynamics, Fibonacci sequence, 3. Mortages: adjustable rate mortgages (FRM), adjustable rate mortgages (ARM) , Goodwill model, Markov chaines, Leslie matrices). Discrete time systems,. Caotic behavior. 4. Numerical solution of non linear equations: bisection method, fixed point scheme , method of Newton-Raphson. 5. Stability of linear and non linear systems. 6. Problems in modelling the production management with particular regard to "supply chain" . 7. Control methodologies of "model based" type

Development of the course and examination
LEARNING EVALUATION METHODS
The learning evaluation will consist of a written test divided into two parts, each one to be completed in an hour. The first part consists of four questions of a theoretical nature, on the topics discussed in

class and contained in the materials provided to the students. The second part, that takes place immediately after the first, consists of three problems to be solved with the use of Excel. In the case of a negative result of one of the tests, the student can repeat only that part, provided this is done within the same academic year

LEARNING EVALUATION CRITERIA
Correctness, completeness and clarity in answering the questions in the theory test. Accuracy and completeness in solving the exercises. As for the project, the student must prove that he can apply the concepts learned in the course, to properly use the tools and appropriate technologies and to write a clear technical report.

LEARNING MEASUREMENT CRITERIA
The first test consists of 4 groups of questions on the various parts of the program, each group contains a question which is assigned a score between 0 and 10, and a question which is assigned a score between 0 and 6. The student must answer a question in each group, choosing two questions for 10 points and two for 6 points. The second test consists of three questions, each of which is assigned a score between 0 and 10. A test is considered sufficient if the score is greater or equal to 15.

FINAL MARK ALLOCATION CRITERIA
The overall grade is given by the arithmetic mean, rounded up to the whole, of the sum of the scores obtained in the two parts, if both are sufficient. The overall grade required to pass the exam is 18 points. Otherwise the overall grade is Not sufficient . The student who in addition to getting a score greater than or equal to 30 has demonstrated complete mastery of the topics addressed, and clarity of exposition will have a 30 e lode .

Recommended reading
Manuals and handouts provided by the teacher; other material in the site Esse3 Web

Analisi Matematica 1 (BIO)

Cristina Marcelli

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Algebric calculus and analytic geometry.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The aim of the course is that of providing the theoretical, methodological and practical elements of mathematical analysis with the objective of providing (together with the course of Calculus 2) the mathematical tools commonly employed in the engineering sciences. In particular, the course aims at providing the student with the basic knowledge of the differential and integral calculus for real functions of one variable with a number of applications.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to develop the student s ability to use mathematical methods towards the formulation of models, the analysis and the solution of problems, the main classical results of analysis will be introduced, accompanied by numerous applications. This path will lead the student to achieving the capability of: 1. analizing problems; 2. detecting the methods of solution; 3. choosing the best solving technique.
TRANSVERSAL SKILLS:
The expertise acquired in this course will be needed in order to study the material of later courses. Individual and collective problem-solving sessions will improve the ability to develop independent thought and learning capabilities. Oral presentations of the topics taught in the course, with the language proper of the basic disciplines of the degree course will help developing communication skills.

Program
Elements of set theory . The set of the real numbers and its properties. Complex numbers. Numerical sequences and definition of limit. Numerical series and their behavior. Functions of one variable: elementary functions. Limit of a function. Continuous functions and their properties. Differential calculus for functions of one variable. Graph of a function. Some optimization problems. Taylor polynomial . Taylor series . Complex exponential. Integral calculus for functions of one variable: primitive of a function. Improper integral and convergence criteria. Sequences and series of functions: pointwise and uniform convergence. Power series and Fourier series.

Development of the course and examination
LEARNING EVALUATION METHODS
The student will be assessed through on a written test and an oral test. The written test will assess the ability to solve problems by using the learned techniques. The oral test will assess the learning of the theory and the exposition skills.

LEARNING EVALUATION CRITERIA
In the exams the student have to prove that he understands the concepts presented in the course,

that he knows the results and methods presented in the lectures, and finally that he is able to set a problem and solve it properly through the learned methods.

LEARNING MEASUREMENT CRITERIA
In the written test is evaluated the ability to set up and properly solve the posed problems, using their own methods of the course. In the oral exam it is assessed the knowledge of the concepts and results presented in the lectures, the presentation skills and the ability to make connections between the various concepts introduced.

FINAL MARK ALLOCATION CRITERIA
For each of the tests indicated above it is assigned a score between zero and thirty. The student will be admitted to the oral exam only if he passed the written test. The highest rating, equal to thirty of thirty, is achieved by demonstrating in-depth knowledge of the course contents and full autonomy in the performing the test. The minimum assessment, equal to eighteen of thirty, is assigned to students who manage to solve the proposed problems and who demonstrate sufficient knowledge of the topics of matter.The overall grade, out of thirty, is derived from the comparative evaluation of both tests. The praise is reserved to the students who, having carried out the tests correctly and completely, has shown a special independence and excellence.

Recommended reading
Hass - Weir - Thomas, Analisi Matematica 1 - Pearson P. Marcellini - C. Sbordone, Analisi Matematica 1 - Liguori

Analisi Matematica 1 (CA)

Matteo Franca

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Basic elements of Calculus and Analytic Geometry

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The aim of the course is that of providing the theoretical, methodological and practical elements of mathematical analysis needed for the understanding of physical and chemical phenomena and of providing the mathematical tools commonly employed in the engineering sciences. In particular, the course aims at providing the student with the basic knowledge of the differential and integral calculus for real functions of one variable with a number of applications.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The main classical results of analysis will be introduced, in order to develop the student s ability to follow rigorous mathematical thought and to use mathematical methods towards the formulation of models, the analysis and the solution of problems. the theoretical notions will be accompanied by numerous applications. This path will lead the student to achieving the capability of: 1. analizing problems; 2. detecting the methods of solution; 3. choosing the best solving technique.
TRANSVERSAL SKILLS:
The expertise acquired in this course will be needed in order to study the material of later courses. Individual and collective problem-solving sessions will improve the ability to develop independent thought and learning capabilities. Oral presentations of the topics taught in the course, with the language proper of the basic disciplines of the degree course will help developing communication skills.

Program
Natural, Integer, Rational and Real numbers. The Induction principle. Limit of real sequences and its properties. Indeterminate forms. Monotone sequences. The Neper's number and related limits. Limits of real function of real variable and its properties. Indeterminate forms. Asymptotic comparison. Monotone functions. Continuity. The Weierstrass's and the Intermediate Values Theorems. Derivative and Derivative Formulas. Successive Derivative. The Fermat's, Rolle's, Lagrange's and Cauchy's Theorems. Derivative and monotonicity. Convexity. The De L'Hospital's Theorems and Taylor's Formula. Asymptots and study of the graphs of functions. Definite integral and its properties. Fundamental Theorem and Formula of the integral calculus. Indefinite Integral and integration methods: by sum decomposition, by parts and substitution. Improper integral and convergence tests. Numerical series and convergence criteria. Power and Taylor series.

Development of the course and examination
LEARNING EVALUATION METHODS
The student will be assessed through two written tests and an oral test. The first written test will assess the learning of the theory, the second one the ability to solve problems by using the learned techniques. The oral test will focus on a discussion of the two written tests.

LEARNING EVALUATION CRITERIA
In the exams the student have to prove that he understands the concepts presented in the course, that he knows the results and methods presented in the lectures, and finally that he is able to set a problem and solve it properly through the learned methods

LEARNING MEASUREMENT CRITERIA
The first written test will assess the knowledge of the concepts and results presented in the lectures, the presentation skills and the ability to make connections between the various concepts introduced. The second test will assess the ability to set up and properly solve the posed problems, by using the learned techniques. The oral test will focus on a discussion of the two written tests. In the oral exam

FINAL MARK ALLOCATION CRITERIA
For each of the tests indicated above it is assigned a score between zero and thirty. The student will be admitted to the oral exam only if he passed the two written tests. The highest rating, equal to thirty of thirty, is achieved by demonstrating in-depth knowledge of the course contents and full autonomy in the performing the test. The minimum assessment, equal to eighteen of thirty, is assigned to students who manage to solve the proposed problems and who demonstrate sufficient knowledge of the topics of the matter. The overall grade, out of thirty, is derived from the comparative evaluation of the tests. The praise is reserved to the students who, having carried out the tests correctly and completely, has shown a special independence and excellence.

Recommended reading
F.G. Alessio-P. Montecchiari, Note di Analisi Matematica Uno , Esculapio

Analisi Matematica 1 (EA)

Milena Petrini

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 72
Period 1s

Prerequisites
Algebric calculus and analytic geometry

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The aim of the course is that of providing (together with the course of Calculus 2) the basic mathematical tools needed in the planning, designing and building processes related to the degree course topics. In particular, the course offers the basic knowledge of the differential and integral calculus for real functions of one variable with a number of applications.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The main classical results of analysis will be introduced, in order to develop the student s ability to use mathematical methods towards collecting, interpreting and organizing with the correct methodology the data related to the structural and functional aspects of a project; the theoretical notions will be accompanied by numerous applications. This path will lead the student to achieving the capability of: 1. analizing problems; 2. detecting the methods of solution; 3. choosing the best solving technique.
TRANSVERSAL SKILLS:
The expertise acquired in this course will be needed in order to study the material of later courses. Individual and collective problem-solving sessions will improve the ability to develop independent thought and learning capabilities. Oral presentations of the topics taught in the course, with the language proper of the basic disciplines of the degree course will help developing communication skills.

Program
Elements of set theory. The set of real numbers and its properties. Complex numbers. Numerical sequences and definition of limit. Numerical series and their behavior. Functions of one variable: elementary functions. Limit of function. Continuous functions and their properties. Differential calculus for functions of one variable. Graph of function. Taylor polynomial. Taylor series. Complex exponential. Integral calculus for functions of one variable. Riemann's integral. Improper integral and convergence criteria. Sequences and series of functions: pointwise and uniform convergence. Power series and Fourier series.

Development of the course and examination
LEARNING EVALUATION METHODS
The exam consists of a written and an oral test: - the tests will concern the topics covered during the course offered in the same academic year; - the registration to the first written test is mandatory, and has to be done on line on the university web page; - the written test consists of a number of problems and questions (from five to ten, according to difficulty) concerning all topics treated during the course; this test will last two hours; the student will not be permitted the use of any kind of electronic device, not even a pocket calculator; - a minimum score of at least 16/30 in the written

test is required for the admission to the oral test; - the list of the names of the students admitted to the oral test will be published by the teacher on his web page; - the oral test will contain mainly theoretical questions, some of which may be formulated in written form and contain exercises concerning course topics not covered in the written test or course topics in which the student may have shown weaknesses in the written test; - questions of general comprehension may be asked both in the written and in the oral test; - in case of a successful written test, the student may sit for the oral test either in the same session or the next available session, not later; - in case of a successful written test, but a non-passing grade in the oral test, the student may try the oral test again in the next available session; in case of another failure, the student will have to sit for the whole exam again; - all written tests have to be correctly and fluently written, well organized, easily readable and with a negligible presence of corrections which must anyway not mar the esthetics of the text; - honor code: each student pledges that the written tests are entirely his/her own work and that no input from other students or sources has been used; demeanors which are deemed unfair or not in line with these principles entail the failing of the exam.

LEARNING EVALUATION CRITERIA

In order to pass the exam the student must demonstrate a good understanding of all topics and concepts covered during the course, and which will be published on line as Final program or Exam program at the end of the course, and to be able to use them in solving typical calculus problems.

LEARNING MEASUREMENT CRITERIA

Assignement of a numerical score in the range 0-30.

FINAL MARK ALLOCATION CRITERIA

The final score will be given by the teacher on the basis of the score of the written test and of the level of knowledge and comprehension of the topics covered during the course.

Recommended reading

M. Bramanti, C. D. Pagani, S. Salsa: Analisi Matematica 1 S. Salsa, A. Squellati Esercizi di Matematica , vol. 1, Zanichelli. M. Bertsch, R. Dal Passo, L. Giacomelli, Analisi Matematica , McGraw-Hill

Analisi Matematica 1 (EDI)

Alessandro Calamai

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The aim of the course is that of providing the theoretical, methodological and practical elements of mathematical analysis with the objective of understanding physical and chemical phenomena and of providing (together with the course of Calculus 2) the mathematical tools commonly employed in the engineering sciences. In particular, the course aims at providing the student with the basic knowledge of the differential and integral calculus for real functions of one variable with a number of applications.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The main classical results of analysis will be introduced, in order to develop the student s ability to follow rigorous mathematical thought and to use mathematical methods towards the formulation of models, the analysis and the solution of problems. the theoretical notions will be accompanied by numerous applications. This path will lead the student to achieving the capability of: 1. analizing problems; 2. detecting the methods of solution; 3. choosing the best solving technique.
TRANSVERSAL SKILLS:
The expertise acquired in this course will be needed in order to study the material of later courses. Individual and collective problem-solving sessions will improve the ability to develop independent thought and learning capabilities. Oral presentations of the topics taught in the course, with the language proper of the basic disciplines of the degree course will help developing communication skills.

Development of the course and examination
LEARNING EVALUATION METHODS
The student will be assessed through on a written test and an oral test. The written test will assess the ability to solve problems by using the learned techniques. The oral test will assess the learning of the theory and the exposition skills.

LEARNING EVALUATION CRITERIA
In the exams the student have to prove that he understands the concepts presented in the course, that he knows the results and methods presented in the lectures, and finally that he is able to set a problem and solve it properly through the learned methods.

LEARNING MEASUREMENT CRITERIA
In the written test is evaluated the ability to set up and properly solve the posed problems, using their own methods of the course. In the oral exam it is assessed the knowledge of the concepts and results presented in the lectures, the presentation skills and the ability to make connections between the various concepts introduced.

FINAL MARK ALLOCATION CRITERIA
For each of the tests indicated above it is assigned a score between zero and thirty. The student will

be admitted to the oral exam only if he passed the written test. The highest rating, equal to thirty of thirty, is achieved by demonstrating in-depth knowledge of the course contents and full autonomy in the performing the test. The minimum assessment, equal to eighteen of thirty, is assigned to students who manage to solve the proposed problems and who demonstrate sufficient knowledge of the topics of matter.The overall grade, out of thirty, is derived from the comparative evaluation of both tests. The praise is reserved to the students who, having carried out the tests correctly and completely, has shown a special independence and excellence.

Analisi Matematica 1 (ELE)

Flaviano Battelli

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Trigonometry, elements of analytical geometry in the plane and the space.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
To know and understand the theory of functions of one real variable (limits, continuity, differentiability, optimization, integration) and of the sequences and series in R, Taylor, and Fourier, and their applications to solve concrete problems. Students should be able to apply these notions to solve real world problems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student must develop the ability of solving problems by applying theorems, tools and methods.
TRANSVERSAL SKILLS:
The student will be able to critically evaluate different practical solutions in order to identify the most appropriate objectives to be pursued.

Program
Elements of set theory. Natural, relative, rational and real numbers. Completeness, l.u.b. and g.l.b.. Limit points. Open and closed sets. Functions from R to R. The inverse function. The absolute value. Limits of a real valued function. Uniqueness of limits. Right and left limits. Permanence of sign. Comparison principle. Algebra of limits. Few noticeable limits. Monotone functions and their limits. Landau symbols. Algebra of little-o and big-O. The principle of substitution of little-o. Limits of sequences in R. Monotone sequences and their limits. The number e. Series in R. Convergence, divergence and indeterminacy. The geometric and the telescopic series. Convergence criteria for series with terms of constant sign. The armonic and generalized armonic series. Absolute convergence. Leibnitz theorem. Continuous functions from R to R. Zeri, Weierstrass and intermediate values theorems. Discontinuous functions. Continuity of the composition map. Continuity of monotone functions and of the inverse function. Derivative of a function from R to R. Differentiable functions. Differentiability and continuity. Differentiability rules. Right and left derivative. The derivative of the inverse function. Max and min. Fermat, Rolle and Lagrange Theorems. De l'Hopital rule. Monotony test. Taylor and Mac Laurin approximation of functions with remainder in Peano form. Recognizing critical points with Taylor formula. Taylor formula and limits. Convex and concave functions. Asymptotes. Drawing the graph of a function. Riemann integral and its properties. Riemann Criterium. Integrability of continuous and monotonic functions. Mean value and weighted mean value theorems. Fundamental theorem of calculus. Integration rules. Integration of rational functions and some irrational functions. Taylor formula and the remainder in integral, Cauchy, Lagrange and Schlomilch form. Indefinite integral. Improper integrals. Integrability criteria. Integrability of some elementary functions. Absolute integrability. Improper integrals and series. The integral criterium. Analitic function in the real field ans power series.Fourier series.

Development of the course and examination

LEARNING EVALUATION METHODS
Written proof followed by oral proof. To be admitted to the oral proof the student has to receive a mark of at least 15/30 in the written proof. The student must pass the oral proof in the same session of the written proof. Should the oral proof give a negative result the student must repeat also the written proof.

LEARNING EVALUATION CRITERIA
The student must develop the ability of solving problems by applying theorems tools and methods taught in lectures

LEARNING MEASUREMENT CRITERIA
At each proof a mark is given between 0/30 and 30/30

FINAL MARK ALLOCATION CRITERIA
The student will pass the exam if his mark at the written proof is not less than 15/30 and the final mark is at least 18/30. The final mark is obtained adding the 2/5 of the mark obtained in the written proof to the 3/5 of the mark obtained in the oral proof. Full marks and honors is given to the student who deserves full marks and has shown to be particularly brilliant during the oral proof

Recommended reading
1 - Bertsch, Dal Passo, Giacomelli, Analisi Matematica, Mc Graw Hill 2 - Fusco, Marcellini, Sbordone; Analisi Matematica 2; Liguori 3 - Giusti, Analisi Matematica 1; Bollati Boringhieri 4 - Giusti, Analisi Matematica 2; Bollati Boringhieri 5 - Bramanti, Pagani, Salsa, Analisi Matematica 1, Zanichelli 6 - Bramanti, Pagani, Salsa, Analisi Matematica 2, Zanichelli7 Marcellini, Sbordone; Analisi Matematica 1; Liguori

Analisi Matematica 1 (INF)

Piero Montecchiari

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Basic elements of Calculus and Analityc Geometry

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide theoretical, methodological and applicative knowledge of mathematical analysis in order to acquire the criteria, methods and limits of application of mathematical methods to real problems. In particular, the course aims to provide students with the knowledge of the basic elements of differential and integral calculus for functions of one variable and various applications.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to accustom the student to follow simple concatenations of various arguments and to develop the ability to apply mathematical methods to formalize, identify, and resolve problems of Information Engineering, classical results of Mathematical analysis for real functions of one real variable, accompanied by many applications, will be introduced. This path will lead the student to the attainment of the following skills: 1. Ability to analyze problems; 2. ability to identify various solution methods; 3. ability to choose the best solution.
TRANSVERSAL SKILLS:
The resolution in class and individually of many problems and exercises will improve the learning ability and independent judgment. The exposure of the learned topics and the specificity of the language of the basic sciences will develop the ability to communicate.

Program
Sets, Relations and Functions. Natural, Integer, Rational and Real numbers. Complex numbers, trigonometric and exponential representation. De Moivre Formula. The Induction principle. Modulus and powers. Exponential, logaritmic and angular functions. Limit of real sequences and its properties. Indeterminate forms. Monotone sequences. The Neper's number and related limits. Asymptotic comparison. Limits of real function of real variale. Properties. Indeterminate forms. Asymptotic comparison. Monotone functions. Continuity; The Weierstrass's and the Intermediate Values Theorems. Derivative and Derivative Formulas. Successive Derivative. The Fermat's, Rolle's, Lagrange's and Cauchy's Theorems. Derivative and monotonicity. Convexity. Primitives. The De L'Hospital's Theorems. Taylor Formulas. Asymptots and the study of the graphs of functions. Riemann integral and integrability. Definite Integral and its properties. Fundamental Theorem and Formula of the Integral Calculus. Indefinite Integral and integration methods: sum decomposition, by parts and sostitution. Improper integral and convergence tests. Series. The Geometric and Harmonic Series. Convergence tests. Absolute convergence. Leibnitz Theorem. Introduction to Taylor and Fourier series

Development of the course and examination
LEARNING EVALUATION METHODS
The student will be assessed through two written tests. The first written test will assess the learning

of the theory, the second one the ability to solve problems by using the learned techniques.

LEARNING EVALUATION CRITERIA
In the exams the student has to prove that he understands the concepts presented in the course, that he knows the results and methods presented in the lectures, and finally that he is able to set a problem and solve it properly through the learned methods

LEARNING MEASUREMENT CRITERIA
The first written test will assess the knowledge of the concepts and results presented in the lectures, the presentation skills and the ability to make connections between the various concepts introduced. The second test will assess the ability to set up and properly solve the posed problems, by using the learned techniques.

FINAL MARK ALLOCATION CRITERIA
To each test indicated it is assigned a score between zero and thirty. The student will be admitted to the second test only if he passed the first one with an evaluation equal to or greather than eighteen of thirty. The highest rating, equal to thirty of thirty, is achieved by demonstrating in-depth knowledge of the course contents and full autonomy in the performing the test. The minimum assessment, equal to eighteen of thirty, is assigned to students who manage to solve the proposed problems and who demonstrate sufficient knowledge of the topics of the matter. The overall grade, out of thirty, is derived from the comparative evaluation of the tests. The praise is reserved to the students who, having carried out the tests correctly and completely, has shown a special independence and excellence.

Recommended reading
F.G. Alessio e P. Montecchiari, Note di Analisi Matematica uno , Esculapio (ristampa 2015)

Analisi Matematica 1 (MECC) (A/L)

Francesca Gemma Alessio

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Algebric calculus and analytic geometry.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The aim of the course is that of providing the theoretical, methodological and practical elements of mathematical analysis with the objective of understanding physical and chemical phenomena and of providing (together with the course of Calculus 2) the mathematical tools commonly employed in the engineering sciences. In particular, the course aims at providing the student with the basic knowledge of the differential and integral calculus for real functions of one variable with a number of applications.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The main classical results of analysis will be introduced, in order to develop the student s ability to follow rigorous mathematical thought and to use mathematical methods towards the formulation of models, the analysis and the solution of problems. The theoretical notions will be accompanied by numerous applications. This path will lead the student to achieving the capability of: 1. analyzing problems; 2. detecting the methods of solution; 3. choosing the best solving technique.
TRANSVERSAL SKILLS:
The expertise acquired in this course will be needed in order to study the material of later courses. Individual and collective problem-solving sessions will improve the ability to develop independent thought and learning capabilities. Oral presentations of the topics taught in the course, with the language proper of the basic disciplines of the degree course will help developing communication skills.

Program
Elements of set theory . The set of the real numbers and its properties. Complex numbers. Numerical sequences and definition of limit. Numerical series and their behavior. Functions of one variable: elementary functions. Limit of a function. Continuous functions and their properties. Differential calculus for functions of one variable. Graph of a function. Some optimization problems. Taylor polynomial . Taylor series . Complex exponential. Integral calculus for functions of one variable: primitive of a function. Improper integral and convergence criteria. Sequences and series of functions: pointwise and uniform convergence. Power series and Fourier series.

Development of the course and examination
LEARNING EVALUATION METHODS
The student will be assessed through on a written test and an oral test. The written test will assess the ability to solve problems by using the learned techniques. The oral test will assess the learning of the theory and the exposition skills.

LEARNING EVALUATION CRITERIA

In the exams the student have to prove that he understands the concepts presented in the course, that he knows the results and methods presented in the lectures, and finally that he is able to set a problem and solve it properly through the learned methods.

LEARNING MEASUREMENT CRITERIA

For each of the tests indicated above it is assigned a score between zero and thirty. The student will be admitted to the oral exam only if he passed the written test. The highest rating, equal to thirty of thirty, is achieved by demonstrating in-depth knowledge of the course contents and full autonomy in the performing the test. The minimum assessment, equal to eighteen of thirty, is assigned to students who manage to solve the proposed problems and who demonstrate sufficient knowledge of the topics of matter.

FINAL MARK ALLOCATION CRITERIA

The overall grade, out of thirty, is derived from the comparative evaluation of both tests. The praise is reserved to the students who, having carried out the tests correctly and completely, has shown a special independence and excellence.

Recommended reading

Marco Bramanti, Carlo D. Pagani, Sandro Salsa, "Analisi matematica 1", Zanchelli - F.G. Alessio-P. Montecchiari, Note di Analisi Matematica Uno , Esculapio

Analisi Matematica 1 (MECC) (M/Z)

Cristina Marcelli

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Algebric calculus and analytic geometry.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The aim of the course is that of providing the theoretical, methodological and practical elements of mathematical analysis with the objective of understanding physical and chemical phenomena and of providing (together with the course of Calculus 2) the mathematical tools commonly employed in the engineering sciences. In particular, the course aims at providing the student with the basic knowledge of the differential and integral calculus for real functions of one variable with a number of applications.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The main classical results of analysis will be introduced, in order to develop the student s ability to follow rigorous mathematical thought and to use mathematical methods towards the formulation of models, the analysis and the solution of problems. The theoretical notions will be accompanied by numerous applications. This path will lead the student to achieving the capability of: 1. analyzing problems; 2. detecting the methods of solution; 3. choosing the best solving technique.
TRANSVERSAL SKILLS:
The expertise acquired in this course will be needed in order to study the material of later courses. Individual and collective problem-solving sessions will improve the ability to develop independent thought and learning capabilities. Oral presentations of the topics taught in the course, with the language proper of the basic disciplines of the degree course will help developing communication skills.

Program
Elements of set theory . The set of the real numbers and its properties. Complex numbers. Numerical sequences and definition of limit. Numerical series and their behavior. Functions of one variable: elementary functions. Limit of a function. Continuous functions and their properties. Differential calculus for functions of one variable. Graph of a function. Some optimization problems. Taylor polynomial . Taylor series . Complex exponential. Integral calculus for functions of one variable: primitive of a function. Improper integral and convergence criteria. Sequences and series of functions: pointwise and uniform convergence. Power series and Fourier series.

Development of the course and examination
LEARNING EVALUATION METHODS
The student will be assessed through on a written test and an oral test. The written test will assess the ability to solve problems by using the learned techniques. The oral test will assess the learning of the theory and the exposition skills.

LEARNING EVALUATION CRITERIA

In the exams the student have to prove that he understands the concepts presented in the course, that he knows the results and methods presented in the lectures, and finally that he is able to set a problem and solve it properly through the learned methods.

LEARNING MEASUREMENT CRITERIA

For each of the tests indicated above it is assigned a score between zero and thirty. The student will be admitted to the oral exam only if he passed the written test. The highest rating, equal to thirty of thirty, is achieved by demonstrating in-depth knowledge of the course contents and full autonomy in the performing the test. The minimum assessment, equal to eighteen of thirty, is assigned to students who manage to solve the proposed problems and who demonstrate sufficient knowledge of the topics of matter.

FINAL MARK ALLOCATION CRITERIA

The overall grade, out of thirty, is derived from the comparative evaluation of both tests. The praise is reserved to the students who, having carried out the tests correctly and completely, has shown a special independence and excellence.

Recommended reading

Marco Bramanti, Carlo D. Pagani, Sandro Salsa, "Analisi matematica 1", ZanchellHass - Weir - Thomas, "Analisi Matematica 1"- Pearson P. Marcellini - C. Sbordone, "Analisi Matematica 1"- Liguori

Analisi Matematica 2 (CA)

Alessandro Calamai

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Calculus in one real variable. Linear Algebra.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The aim of the course is that of providing further mathematical tools commonly employed in the engineering sciences, by means of introducing the basic elements of the differential and integral calculus for real functions of several variables and of the ordinary differential equations.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The many applications of the course topics in the applied sciences, for example in chemistry and in physics, will provide the student with the ability of modeling and solving practical engineering problems; they will also increase the ability of choosing independently the best solution techniques. The course will also provide the student with the ability to use mathematical laws in general scientific problems.
TRANSVERSAL SKILLS:
The expertise acquired in this course will be needed in order to study the material of later courses. Individual and collective problem-solving sessions will improve the ability to develop independent thought and learning capabilities. Oral presentations of the topics taught in the course, with the language proper of the basic disciplines of the degree course will help developing communication skills.

Program
Functions of two or more variables. Topology in R^n, continuity, derivability, differentiability. Taylor s Formula of first and second order and classification of critical points in open sets. Implicit functions. Dini s Theorem. Maxima and minima for constrained functions. Lagrange multipliers. Smooth curves. Line integrals. Arc length. Vector fields, path integral along a curve. Conservative and irrotational fields. Differential forms. Exact and closed forms. Poincare's theorem. Multiple integrals. Reduction formulas. Change of variables. Green's theorem. Regular surfaces, surface integrals. Ordinary differential equations. Initial problem. Linear first and second order equations. Separable differential equations.

Development of the course and examination
LEARNING EVALUATION METHODS
The learning evaluation is carried out by two exams: - a practical examination, which consists of solving exercises and problems related to the topics explained in the course. The test must be completed in 3 hours; - a theoretical examination, consisting in a discussion, written and oral, of the topics of the course. In particular the knowledge and the understanding of all definitions, theorems and proofs explained in the classes will be tested. The practical exam is preliminary to the theoretical one. It is necessary to pass the practical exam in order to do the theoretical one. The two exams must be passed in the same exam session. If the student fails the theoretical exam, he/she

must repeat also the practical one.

LEARNING EVALUATION CRITERIA
In order to pass the learning evaluation, the student must demonstrate that he/she has understood the advanced concepts of mathematical analysis explained in the course. In particular in the practical test the student must show that he/she is able to apply independently the learned techniques in solving exercises and problems. In the theoretical exam the student must be able to expose the theoretical contents with the correct language and accuracy.

LEARNING MEASUREMENT CRITERIA
Each of the tests is graded on a scale from 0 to 30. The final grade will be decided starting from the two test grades.

FINAL MARK ALLOCATION CRITERIA
The final grade will be positive only if in both of the tests the students gets the passing grade (18/30). The maximal grade is reached if the student proves a knowledge and a thorough understanding of the course content. The maximal grade with honors is reserved to the students who passed both of the tests in a complet and correct way, showing special independence and excellence.

Recommended reading
- Bramanti, Pagani, Salsa, Analisi Matematica 2 , Ed. Zanichelli. - Fusco, Marcellini, Sbordone, Analisi Matematica Due , Ed. Liguori.

Analisi Matematica 2 (EA)

Flaviano Battelli

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 72
Period 1s

Prerequisites
Geometry andFirst course of real analysis

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The aim of the course is that of providing further mathematical tools commonly employed in the engineering sciences, by means of introducing the basic elements of the differential and integral calculus for real functions of several variables and of the ordinary differential equations.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The many applications of the course topics in the applied sciences, for example in chemistry and in physics, will provide the student with the ability of modeling and solving practical engineering problems; they will also increase the ability of choosing independently the best solution techniques. The course will also provide the student with the ability to use mathematical laws in general scientific problems.
TRANSVERSAL SKILLS:
The expertise acquired in this course will be needed in order to study the material of later courses. Individual and collective problem-solving sessions will improve the ability to develop independent thought and learning capabilities. Oral presentations of the topics taught in the course, with the language proper of the basic disciplines of the degree course will help developing communication skills.

Program
Operating with vectors. Scalar product and norm. Cauchy-Schwartz inequality. Neighborhoods, limit points, internal, external and boundary points. Open and closed subsets. Limits for functions of several variables with values in R^n. Limits of components. Limits along a direction. A criterion for the existence of limits. Polar and spherical coordinates. Algebra of limits. Continuous functions and their properties. Connected sets and arc connected sets. Continuous image of a connected set. Zero's and intermediate values theorems. Compact sets. Weierstrass theorem. Differentiable functions. Differentiablity versus continuity. Directional derivatives. The Gradient theorem. Maximal growth direction. The tangent iperplane. C^1 versus differentiability, Continuity e Lipschitzianity of linear functions. Higher order derivatives. Schwartz theorem. The Hessian matrix. Differentiability of vector valued functions and their components. The Jacobian matrix. Rules of differentiations. C^k functions and Schwartz theorem. Taylor formula in several variables with Peano and Lagrange remainder. Local max and min. First order condition. Sign of the Hessian matrix in a max/min/ saddle point. Sufficient condition to recognize stationary points. Sign study of the eigenvalues of a symmetric matrix. Dini's Theorem. Constrained max/min. Smooth points of a variety. Lagrange multiplicators. Differentiable manifolds and tangent space. Gradient of a function and normal line. Smooth curves and their lenght. Integration on curves. Tangent vector and versor. Curvature and normal vector, torsion and binormal versor. Frénét formulae. Measure of a pluri-interval. Measurable sets. Properties of Peano-Jordan measure. Partitions of a mesurable set. Lower and upper sums.

The Riemann integral. Integrability of locally constant functions. Measure zero sets and their neglectability. Reduction formula, integrating by slices and leaves. Change of variables. Volumes calculus and Guldino's theorems. Integration on manifolds. Indipendence of parameterization. Guldino's Theorem for surfaces. Integration of vector fields on curves. Vector fields and 1-forms. Conservative and irrotational vector fields. The curl of a vector field in R^3. The Gauss-Green formula. Differential n-forms. The exterior differential. Orientation of a manifold. Manifolds with boundary and boundary orientation of an orientable manifold. Orientation of a hypersurface and the exterior normal. Stokes theorem and consequences: curl and divergence theorems Differential equations. Peano theorem. Locally Lipschitz functions. Cauchy theorem. Maximal interval of existence and its properties. Linear systems. Superposition principle. The fundamental matrix. Variation of constant formula. Similarity method. Exercises will be solved concerning: search of max/min in open subsets and manifolds, integral calculus in R^n, integrals on manifolds, Stokes and the divergence theorems, solving differential equations.

Development of the course and examination
LEARNING EVALUATION METHODS
Written proof followed by oral proof. To be admitted to the oral proof the student has to receive a mark of at least 15/30 in the written proof. The student must pass the oral proof in the same session of the written proof. Should the oral proof give a negative result the student must repeat also the written proof.

LEARNING EVALUATION CRITERIA
The student must prove to have understood the topics of the lectures and to know how to use them to solve concrete problems.

LEARNING MEASUREMENT CRITERIA
At each proof a mark is given between 0/30 and 30/30.

FINAL MARK ALLOCATION CRITERIA
The student will pass the exam if his mark at the written proof is not less than 15/30 and the final mark is at least 18/30. The final mark is obtained adding the 2/5 of the mark obtained in the written proof to the 3/5 of the mark obtained in the oral proof. Full marks and honors is given to the student who deserves full marks and has shown to be particularly brilliant during the oral proof.

Recommended reading
1) Bottacin, Zampieri, Analisi 2, Bollati Boringhieri 2) Bramanti, Pagani, Salsa Analisi Matematica 2; Zanichelli - 2) Giusti, Analisi Matematica 2; Bollati Boringhieri - 3) Fusco, Marcellini, Sbordone, Analisi Matematica 2, Liguori - 4) Salsa, Squellati, Esercizi di Matematica, Zanichelli - 5) Giusti, Complementi ed esercizi di Analisi Matematica 2, Bollati Boringhieri

Analisi Matematica 2 (EDI)

Cristina Marcelli

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Differential and integral calculus of real functions on one real variable. Matrix and vector algebra.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The aim of the course is that of providing further mathematical tools commonly employed in the engineering sciences, by means of introducing the basic elements of the differential and integral calculus for real functions of several variables and of the ordinary differential equations.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The many applications of the course topics in the applied sciences, for example in chemistry and in physics, will provide the student with the ability of modeling and solving practical engineering problems; they will also increase the ability of choosing independently the best solution techniques. The course will also provide the student with the ability to use mathematical laws in general scientific problems.
TRANSVERSAL SKILLS:
The expertise acquired in this course will be needed in order to study the material of later courses. Individual and collective problem-solving sessions will improve the ability to develop independent thought and learning capabilities. Oral presentations of the topics taught in the course, with the language proper of the basic disciplines of the degree course will help developing communication skills.

Program
Ordinary differential equations. Vector functions. Differential calculs for real functions of more variables.Differential calculs for vector functions of more variables. Multiple integrals Vector fields. Power series and Fourier series.

Development of the course and examination
LEARNING EVALUATION METHODS
The exam consists of a written test and a colloquium: - both tests will concern the topics of the current academic year; possible exceptions will be assessed on a case-by-case basis; - registration to the first written test is mandatory, and has to be done on line on the university platform Esse3 (the link is available on the teacher's web page); - the written test consists of a number of problems and questions concerning all topics treated during the course; this test will last two or three hours, and the student will not be permitted the use of any kind of material, not even a pocket calculator; - a minimum score of at least 18/30 in the written test is required for the admission to the oral test; - the list of the names of the students admitted to the oral test will be published by the teacher on his official web page; - the oral test will contain mainly theoretical questions, some of which may have to be formulated in written form, and may contain problems and exercises concerning course topics not covered in the written test or course topics in which the student may have shown weaknesses in the written test; - questions of general comprehension may be asked both in the written and in the

oral test and may concern any of the course topics; - in the case of a successful written test, the student may sit for the oral test either in the same session or in the next available session, but not later; - in the case of a successful written test, but a not passing grade in the oral test, the student may try the oral test again in the next available session; in case of another failure, the student will have to sit for the whole exam again; - all written tests must be presented in readable form, with a negligible amount of corrections, which must anyway not mar the esthetics of the text; the exposition must be clear, fluent, well organized and consistent both in the mathematical and in the linguistic aspects; - honor code: each student pledges that the written tests are entirely his/her own work and that no input from other students or sources has been used; demeanors which are deemed unfair or not in line with these principles entail the failing of the exam.

LEARNING EVALUATION CRITERIA

In order to pass the exam, the student must demonstrate understanding of all the topics covered and concepts introduced during the course and published on line as Final program or Exam program at the end of the course, and to be able to use them in solving typical mathematical analysis problems.

LEARNING MEASUREMENT CRITERIA

The student must demonstrate to have acquired deep knowledge on the fundamental principles and techniques of mathematical analysis and on the solution of typical differential and integral calculus problems of real and vector valued functions, in one or more variables.

FINAL MARK ALLOCATION CRITERIA

The highest grade of 30/30 will be given to those students which will have shown deep knowledge and perfect mastering of all the course topics and the ability of working with full independence both in solving the assigned problems and in the oral presentation. The lowest passing grade of 18/30 will be given to the students which will have shown sufficient knowledge and good mastering of all the course topics.

Recommended reading

. Bramanti, C. D. Pagani, S. Salsa Anailisi Matematica 2 , Ed. Zanichelli.

Analisi Matematica 2 (ELE)

Lucio Demeio

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Differential and integral calculus for one-variable functions; linear algebra.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The aim of the course is that of providing further mathematical tools commonly employed in the engineering sciences, by means of introducing the basic elements of the differential and integral calculus for real functions of several variables and of the ordinary differential equations.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The many applications of the course topics in the applied sciences, for example in chemistry and in physics, will provide the student with the ability of modeling and solving practical engineering problems; they will also increase the ability of choosing independently the best solution techniques. The course will also provide the student with the ability to use mathematical laws in general scientific problems.
TRANSVERSAL SKILLS:
The expertise acquired in this course will be needed in order to study the material of later courses. Individual and collective problem-solving sessions will improve the ability to develop independent thought and learning capabilities. Oral presentations of the topics taught in the course, with the language proper of the basic disciplines of the degree course will help developing communication skills.

Program
Linear differential equations and equations with separable variables. Laplace transformations in the real field. More-variable functions: infinitesimal and differential calculus, maxima and minima. Curves and integrals over a curve. Multiple integrals. Gauss-Green formula in the plane and applications. Vector fields: conservative fields and potentials. Regular surfaces and integrals over a surface. Flux of a field through a surface. Differential operators: gradient, divergence, rotor. Functions of a complex variable, olomorphic functions and Cauchy-Riemann conditions, analitic functions ad their properties. Integrals of complex functions, Cauchy integral formula. Laurent series, classification of the singularities of an analitic function. Theorem of residues.

Development of the course and examination
LEARNING EVALUATION METHODS
The student will be assessed through on a written test and an oral test. The written test will assess the ability to solve problems by using the learned techniques. The oral test will assess the learning of the theory and the exposition skills.

LEARNING EVALUATION CRITERIA
In the exams the student have to prove that he understands the concepts presented in the course, that he knows the results and methods presented in the lectures, and finally that he is able to set a

problem and solve it properly through the learned methods.

LEARNING MEASUREMENT CRITERIA
In the written test is evaluated the ability to set up and properly solve the posed problems, using their own methods of the course. In the oral exam it is assessed the knowledge of the concepts and results presented in the lectures, the presentation skills and the ability to make connections between the various concepts introduced.

FINAL MARK ALLOCATION CRITERIA
For each of the tests indicated above it is assigned a score between zero and thirty. The student will be admitted to the oral exam only if he passed the written test. The highest rating, equal to thirty of thirty, is achieved by demonstrating in-depth knowledge of the course contents and full autonomy in the performing the test. The minimum assessment, equal to eighteen of thirty, is assigned to students who manage to solve the proposed problems and who demonstrate sufficient knowledge of the topics of matter.The overall grade, out of thirty, is derived from the comparative evaluation of both tests. The praise is reserved to the students who, having carried out the tests correctly and completely, has shown a special independence and excellence.

Recommended reading
Hass - Weir - Thomas, Analisi Matematica 2 - Pearson P. Marcellini - C. Sbordone, Analisi Matematica 2 - Liguori Barozzi, Matematica per l'ingegneria dell'informazione - Zanichelli

Analisi Matematica 2 (INF)

Andrea Sfecci

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The aim of the course is that of providing advanced mathematical tools commonly employed in the engineering sciences, by means of introducing the basic elements of the differential and integral calculus for real functions of several variables, of the teory of holomorphic functions, of the mathematical tools in signal processing and of the ordinary differential equations.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The many applications of the course topics in the applied sciences will provide the student with the ability of modeling and solving practical engineering problems; they will also increase the ability of choosing independently the best solution techniques. The course will also provide the student with the ability to use mathematical laws in general scientific problems.
TRANSVERSAL SKILLS:
The expertise acquired in this course will be needed in order to study the material of later courses. Individual and collective problem-solving sessions will improve the ability to develop independent thought and learning capabilities. Oral presentations of the topics taught in the course, with the language proper of the basic disciplines of the degree course will help developing communication skills.

Development of the course and examination
LEARNING EVALUATION METHODS
The learning evaluation is carried out by two exams: - a practical examination, which consists of solving exercises and problems related to the topics explained in the course. The test must be completed in 3 hours; - a theoretical examination, consisting in a discussion, written and oral, of the topics of the course. In particular the knowledge and the understanding of all definitions, theorems and proofs explained in the classes will be tested. The practical exam is preliminary to the theoretical one. It is necessary to pass the practical exam in order to do the theoretical one. The two exams must be passed in the same exam session. If the student fails the theoretical exam, he/she must repeat also the practical one.

LEARNING EVALUATION CRITERIA
In order to pass the learning evaluation, the student must demonstrate that he/she has understood the advanced concepts of mathematical analysis explained in the course. In particular in the practical test the student must show that he/she is able to apply independently the learned techniques in solving exercises and problems. In the theoretical exam the student must be able to expose the theoretical contents with the correct language and accuracy.

LEARNING MEASUREMENT CRITERIA
Each of the tests is graded on a scale from 0 to 30. The final grade will be decided starting from the two test grades.

FINAL MARK ALLOCATION CRITERIA

The final grade will be positive only if in both of the tests the students gets the passing grade (18/30). The maximal grade is reached if the student proves a knowledge and a thorough understanding of the course content. The maximal grade with honors is reserved to the students who passed both of the tests in a complet and correct way, showing special independence and excellence.

Analisi Matematica 2 (MECC) (A/L)

Francesca Papalini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Differential and integral calculus for functions of one real variable, linear algebra and analytic geometry in the plane and in the space.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The aim of the course is that of providing further mathematical tools commonly employed in the engineering sciences, by means of introducing the basic elements of the differential and integral calculus for real functions of several variables and of the ordinary differential equations
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The many applications of the course topics in the applied sciences, for example in chemistry and in physics, will provide the student with the ability of modeling and solving practical engineering problems; they will also increase the ability of choosing independently the best solution techniques. The course will also provide the student with the ability to use mathematical laws in general scientific problems.
TRANSVERSAL SKILLS:
The expertise acquired in this course will be needed in order to study the material of later courses. Individual and collective problem-solving sessions will improve the ability to develop independent thought and learning capabilities. Oral presentations of the topics taught in the course, with the language proper of the basic disciplines of the degree course will help developing communication skills.

Program
Smooth curves and elements of differential geometry of the curves in R2 and R3. Infinitesimal and differential calculus for functions of several real variables: limits, continuity, derivability, differentiability, Taylor's formula, local maxima and minima. Implicit function and Dini's Theorem. Constrained maxima and minima. Path and mulpliple integrals. Smooth surfaces and surface integrals. Conservative and irrotational vector fields. Flux and circulation of vector fields. Gauss-Green formulas, divergence and Stokes Theorem. Ordinary differential equations, existence and unicity results. Linear ordinary differential equations and resolution of some ordinary nonlinear differential equations.

Development of the course and examination
LEARNING EVALUATION METHODS
The student will be assessed through on a written test and an oral test. The written test will assess the ability to solve problems by using the learned techniques. The oral test will assess the learning of the theory and the exposition skills.

LEARNING EVALUATION CRITERIA
In the exams the student have to prove that he understands the concepts presented in the course,

that he knows the results and methods presented in the lectures, and finally that he is able to set a problem and solve it properly through the learned methods.

LEARNING MEASUREMENT CRITERIA
For each of the tests indicated above it is assigned a score between zero and thirty. The student will be admitted to the oral exam only if he passed the written test. The highest rating, equal to thirty of thirty, is achieved by demonstrating in-depth knowledge of the course contents and full autonomy in the performing the test. The minimum assessment, equal to eighteen of thirty, is assigned to students who manage to solve the proposed problems and who demonstrate sufficient knowledge of the topics of matter.

FINAL MARK ALLOCATION CRITERIA
The overall grade, out of thirty, is derived from the comparative evaluation of both tests. The praise is reserved to the students who, having carried out the tests correctly and completely, has shown a special independence and excellence.

Recommended reading
Teacher's lecture notes (available on teacher's web page) and/or M. Bramanti, C. Pagani, S. Salsa, "Analisi matematica 2", Zanichelli

Analisi Matematica 2 (MECC) (M/Z)

Francesca Gemma Alessio

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Differential and integral calculus for functions of one real variable, linear algebra and analytic geometry in the plane and in the space.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The aim of the course is that of providing further mathematical tools commonly employed in the engineering sciences, by means of introducing the basic elements of the differential and integral calculus for real functions of several variables and of the ordinary differential equations
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The many applications of the course topics in the applied sciences, for example in chemistry and in physics, will provide the student with the ability of modeling and solving practical engineering problems; they will also increase the ability of choosing independently the best solution techniques. The course will also provide the student with the ability to use mathematical laws in general scientific problems.
TRANSVERSAL SKILLS:
The expertise acquired in this course will be needed in order to study the material of later courses. Individual and collective problem-solving sessions will improve the ability to develop independent thought and learning capabilities. Oral presentations of the topics taught in the course, with the language proper of the basic disciplines of the degree course will help developing communication skills.

Program
Smooth curves and elements of differential geometry of the curves in R2 and R3. Infinitesimal and differential calculus for functions of several real variables: limits, continuity, derivability, differentiability, Taylor's formula, local maxima and minima. Implicit function and Dini's Theorem. Constrained maxima and minima. Path and mulpliple integrals. Smooth surfaces and surface integrals. Conservative and irrotational vector fields. Flux and circulation of vector fields. Gauss-Green formulas, divergence and Stokes Theorem. Ordinary differential equations, existence and unicity results. Linear ordinary differential equations and resolution of some ordinary nonlinear differential equations.

Development of the course and examination
LEARNING EVALUATION METHODS
The student will be assessed through on a written test and an oral test. The written test will assess the ability to solve problems by using the learned techniques. The oral test will assess the learning of the theory and the exposition skills.

LEARNING EVALUATION CRITERIA
In the exams the student have to prove that he understands the concepts presented in the course,

that he knows the results and methods presented in the lectures, and finally that he is able to set a problem and solve it properly through the learned methods.

LEARNING MEASUREMENT CRITERIA
For each of the tests indicated above it is assigned a score between zero and thirty. The student will be admitted to the oral exam only if he passed the written test. The highest rating, equal to thirty of thirty, is achieved by demonstrating in-depth knowledge of the course contents and full autonomy in the performing the test. The minimum assessment, equal to eighteen of thirty, is assigned to students who manage to solve the proposed problems and who demonstrate sufficient knowledge of the topics of matter.

FINAL MARK ALLOCATION CRITERIA
The overall grade, out of thirty, is derived from the comparative evaluation of both tests. The praise is reserved to the students who, having carried out the tests correctly and completely, has shown a special independence and excellence.

Recommended reading
Teacher's lecture notes (available on teacher's web page) and/or M. Bramanti, C. Pagani, S. Salsa, "Analisi matematica 2", Zanichelli

Analisi Numerica

Evghenia Sakellariadi

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
Calculus for functions of one real variable. Riemann integral. Linear systems of equations. Basic matrix arithmetic and operations.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
On completion of the course students will have learnt some basic numerical techniques, useful for tackling several types of mathematical problems commonly occurring in the engineering and physical sciences. Full mathematical proofs will not be treated in detail, the emphasis being on the logic behind each technique and the criteria and possible limits for its application. The main focus is on understanding why the methods work, what type of errors can be expected and when a method might lead to difficulties.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
On completion of the course students will be able to produce approximate solutions to several types of mathematical problems, using an appropriate numerical technique. They will also be able to give a rough estimation of the associated approximation error.
TRANSVERSAL SKILLS:
In using specific numerical techniques for solving the various types of problems, students will learn to deal with the difficulties connected to putting theory into practice, which will enhance their capacity for independent learning and making correct choices.

Program
rror analysis and convergence. Solution of non-linear equations of one variable: bisection, secant and tangent (Newton) methods. Interpolation and polynomial approximation: Lagrange polynomials, error formula, divided differences, cubic spline interpolation. Numerical differentiation formulae (two- three- and five-point); round-off error instability. Numerical integration: basic and composite quadrature rules, round-off error stability. Error formulae. Gaussian quadrature. Direct methods for the solution of linear systems: Gaussian elimination, pivoting strategies, LU matrix factorisation, techniques for special matrices. Iterative techniques for the solution of linear systems: Jacobi, Gauss-Seidel. Convergence criteria. Introduction to initial-value problems: Euler s method.

Development of the course and examination
LEARNING EVALUATION METHODS
Final assessment is via a written paper and an oral examination. In the written test students must solve three exercises regarding topics discussed during the course. In the oral examination, which completes the written test, students must comment on the solution of the written test and respond to one or two questions regarding topics discussed during the course. The written test has a three-hour duration. Students are free to refer to any material they may deem useful, such as pocket calculators, personal computers, software, lecture notes, books, etc. In order to sit the oral examination, students must have obtained a minimum pass mark on all three exercises of the

written test. The oral exam must be taken in the same examination session as the written test. If a student doesn't pass the oral examination, they must repeat both written and oral tests.

LEARNING EVALUATION CRITERIA
Students must demonstrate a good understanding of the solution procedures for the specific problems treated during the course. In particular, in the written test, students must explain the details of all operations performed for the solution of the exercises. In the oral examination, students must demonstrate an understanding of the basic theoretical principles and knowledge of the numerical solution techniques discussed during the course. In particular they must know, for each of the methods studied, its specific limitations, and must be able to make an estimation of the error range with respect to the exact analytical solution.

LEARNING MEASUREMENT CRITERIA
Students must be able to choose the solution method appropriately, together with any necessary options, and apply it correctly; more importantly, they must be able to explain the logic and meaning of the various mathematical operations in a clear and thorough way. The written test consists of three exercises, each of which, if solved correctly in every aspect and is presented in thorough detail, will be given a maximum mark of about 15. In order to pass the written test and be able to sit the oral examination, students must tackle, even if incompletely, all three exercises. The oral test will be evaluated with a maximum of 30 points, and the final mark is a weighted mean value of the written and oral exams.

FINAL MARK ALLOCATION CRITERIA
The top grade (corresponding to a mark of 30/30) will be given to students who demonstrate a detailed and exhaustive understanding of all aspects of the course, and who are capable of illustrating concepts with an articulate use of technical terms and can use such acquired knowledge appropriately for solving the exercises. The minimum grade (corresponding to a mark of 18/30) will be given to students who can demonstrate a basic understanding of the principal numerical methods studied during the course, and are able to use them correctly for obtaining an approximate solution in simple exercises.

Recommended reading
R. Burden, J. D. Faires Numerical Analysis , Brooks/Cole, 9th Ed., 2009 R. Burden, J. D. Faires Numerical Methods , Brooks/Cole, 4th Ed., 2013 A. Quarteroni, F. Saleri, Introduzione al Calcolo Scientifico , Springer-Verlag Italia, Milano 2006

Anatomia Funzionale

Pasquapina Ciarmela

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide the bioengineer with concepts of the anatomic logic (logic organization for specific function) present in the micro- and macro-organization of the main human organs and apparatuses. The concepts are propaedeutical both for cultural and technological purposes.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The course will provide the knowledge and verification of the ability to understand the basic concepts of human anatomy essential for bioengineering disciplines.
TRANSVERSAL SKILLS:
Synthesis skill, appropriateness of the medical-scientific language, clarity of exposition, also in order to implement the connections with other disciplines in a context of multidisciplinary of the biomedical engineering.

Program
The cell as structural and functional unit of living organisms. General information of tissues and their organization. Organization of the human body. Musculoskeletal system: mechanisms of ossification; morphology and function of bone, joints and muscles. Organization of the main components of the muscolar system. Morphological and functional aspects of the neuromuscolar junctions. Nervous system: general organization of the central nervous system. Structure of the spinal cord. The reflex arc. Vegetative nervous system. Cardiovascular system: heart, mechanics and dynamics (function of the heart valves and the cardiac cycle), the main aspects of the circulation. Respiratory apparatus: respiratory tract and anatomy and function of lung. Urinary apparatus: general organization and macro-microscopic anatomy and funtion of kidney. Digestive system: morphology and function of the main components and macro-microscopic anatomy of liver.

Development of the course and examination
LEARNING EVALUATION METHODS
The learning evaluation of the students is carried out by written and oral test. The written test consists of multiple choice questions. The written test is preliminary to the oral exam, access to which the student must pass the written test. The oral examination will be in the same exam session of the written test. In case of failure of the oral exam, the student must also repeat the written test.

LEARNING EVALUATION CRITERIA
To pass the exam, the student must demonstrate a comprehensive knowledge of the morphological and functional aspects of the different levels of organization of the human body. In the oral examination, the student has to explain correctly the teaching topics and has to use adequate technical and scientific terminology.

LEARNING MEASUREMENT CRITERIA
Attribution of the final mark up to thirty, considering the acquired knowledge, as well as the synthesis skill, the appropriateness of the medical-scientific language and the clarity of exposition.

FINAL MARK ALLOCATION CRITERIA
The final evaluation is positive if the student passes (obtaining at least eighteen points) each test performed. To reach a sufficient evaluation, it is necessary to aquire the basic concepts of human anatomy essential for bioengineering disciplines.The highest rating is achieved by demonstrating a deep understanding of the course content. Cum laude is given to students who, having done all the tests correctly, perform an outstanding oral exposure.

Recommended reading
G. Ambrosi et al., Anatomia dell Uomo , Edi-Ermes Seeley et. Al., Anatomia , Ed. Idelson-Gnocchi K. S. Saladin, Anatomia Umana di Ed. PICCIN

Antenne

Graziano Cerri

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Knowledge of ordinary and partial derivatives differential equations of the first and second order. Knowledge of curvilinear, surface and volume integrals. Knowledge of divergence, gradient and curl operators. Elements of electromagnetic wave propagation.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course provides elements to understand different antenna families on the base of their electromagnetic characteristics, their performances, allowing also to make choices and comparisons on the base of their use and to develop design procedures for realization of new radiating systems. Mathematical models to characterize the radiation phenomena and wave propagation will be provided as well. This knowledge, as well as elements concerning the disciplines of the Laurea Magistrale, aimed to provide a high expertise of modern technologies, adopting methodologic tools to formulate and solve different problems of the Electronic and Telecommunication Engineering, both at the analysis and design stage, and during realization and testing of the final product, where the radiating system is a significant part
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to face problems related to antennas, also in complex environments, the student has to understand correctly problems of analysis and design of radiating structures, and problems related to the propagation of electromagnetic waves in the ionosphere, in the troposphere, and in urban environment. This means: capability for application of techniques to evaluate radio coverage in realistic environments; capability to carry out measurements critically explained; capability of choice of suitable techniques to design antennas satisfying proper constraints also for use in new, high tech, and emerging contests; capability of applying methods to realize radio links
TRANSVERSAL SKILLS:
Some measurements carried out in laboratory and concerning significant canonical situations, previously described theoretically in the classroom, will lead to the development of technical reports. The aim is to improve the general autonomous judgement, to better the capability to relate with other students, and to develop the critical learning process. Connections with aspects typical of disciplines concerning Electromagnetics, Electronics, and Telecommunications will provide a wide band expertise to the student to be used both in the ICT contest and in other not ICT industrial contests, that use technologies based on electromagnetic fields

Program
Electromagnetic Radiation, Electromagnetic Theorems, Antenna Theory, Wire Antennas, Aperture Antennas, Reflector Antennas, Microstrip Antennas, Antenna Array Analysis and Synthesis, Ionospheric Propagation, Tropospheric Propagation, Propagation In Urban Environment, Wireless Systems. Notes: 1) depending on the number of attending students, and considering the availability of only one measurement set-up, laboratory sessions will be carried out, but it is impossible to quantify this activity in terms of hours. 2) numerical exercises will be carried out during lessons as

integral part of the course aimed to better understanding theoretical and design aspects. 3) a detailed program is available at the teacher web site with cross reference to text books

Development of the course and examination

LEARNING EVALUATION METHODS

The exam is oral. It consists of three questions. The first has a practical feature and consists of the soluton of a test case or a simple design. The second concerns theoretical aspects related to antenna modeling. The third regards propagation of electromagnetic waves aimed to the design of a radio link.

LEARNING EVALUATION CRITERIA

The student has to show his understanding and his capability to handle the fundamental aspects characterizing antenna theory and electromagnetic wave propagation, adopting proper methods to state, approach, and solve autonomously the different problems.

LEARNING MEASUREMENT CRITERIA

It is related to the autonomy of the student to approach the proposed problems, to the correct methodologic approach, and to the discriminating capability to choose the most proper solution.

FINAL MARK ALLOCATION CRITERIA

The three exam questions have equivalent weights. The highest mark cum laude is given if the student shows total autonomy, a rigorous methodologic approach, a great critical sense. The minimum score of eighteen over thirty is given when the student shows sufficient autonomy and sufficient knowledge of the most important antenna aspects.

Recommended reading

1) C. A. Balanis Antenna Theory , John Wiley; 2) E. C. Jordan, K. G. Balmain Electromagnetic waves and radiating Systems , Prentice Hall Inc.; 3) G. Franceschetti Campi elettromagnetici , Boringhieri; 4) R. S. Elliot Antenna theory and design , Prentice Hall; 5) F. Valdoni, M. Mandrioli Corso di Radiotecnica , Pitagora Editrice; 6) K. Fujimoto, J.R. James Mobile Antenna Systems Handbook , Artech House.

Applied Measurement Techniques

Lorenzo Scalise

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Foundamentals of Measurement techniques and Biomedical Instrumentation.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course is aiming to present the main advanced measurement methods for the biomedical engineering and the medicine. In particular, the course will provide advanced knowledge on the technologies and the biomedical instrumentation used in medicine for diagnosis and treatment scopes, describing their working principles and analyzing their main technical characteristics. These knowledges, together with the ones acquired in the Laurea degree courses, and in particular in the course of misure meccaniche e strumentazione biomedica, will allow the student to gain a detailed knowledge on the measurement methodologies, technologies and biomedical instrumentation presently available.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The content of the course will allow the student to efficiently operate in the biomedical engineering sector as a designer of systems or as developer of novel products and technologies. The student will have to be able to analyze the working principle of the biomedical instrumentation and to understand the technologies commonly utilize din the biomedical sector. Moreover, he will develop specific skills for the classification of the instrumentation, for the analysis of the measurement performances of systems and for the identifications of main critical issues in the installation and use of such devices. Finally, the student will have to develop skills for teamwork
TRANSVERSAL SKILLS:
The student will develop the skill to analyze complex measurement systems, identifying their working principles, the main components and the most relevant measurement characteristics. The didactic activity will also include the laboratory sessions and the (voluntary) preparation of a project aiming to analyze and present a biomedical system of high-technology level.

Program
1. Imaging systems : Ultrasound imaging: Generation and propagation of ultrasound; Interaction with tissues; Ultrasound beam shaping; Probes and imaging modes; Image formation and ultrasound tomography; Eco-Doppler, Color Doppler e Power Doppler. X-ray imaging: Generation and propagation of X-rays; Emission spectra and attenuation coefficient; X-ray tube and X-ray machine; Rotating anode; Focal spot; Generation of the image; X-ray system; Fluoroscopy; Image Intensifier and dynamic radiography; X-ray film, anti-diffusion grid, Pottery-Bucky table; Analogue and digital radiography. X-ray Computed Tomography (CT): Tomographic systems; Mechanical tomography; CT scanners modalities; Axial computed tomography; Reconstruction algorithms; Filtering and artifact removal; Gantry; CT machine generations; System components of a modern multislice CT machine; Sensors and CT numbers. Nuclear Medial Imaging (PET e SPECT): Radio-Isotopes and radiation; Physics of radiation and interaction with tissues; Sensors for radiations: Ionization chambers and scintillating crystals; Pulse Height Analyser (PHA); Uptake

monitoring equipment; Gamma camera; PET e PET/CT systems. 2. Therapeutic equipment: Ablation: Tissue ablation; Electric ablation; radiofrequency ablation; Ultrasound ablation; Lithotriptors, Acoustic intensity and focusing; Cryoablation; Microwave ablation; Chemical ablation Biomedical lasers: Physics and laser proprieties; Configuration and classification of laser sources; Laser and tissue interaction; Safety aspects; Clinical use of lasers Radiotherapy: Biological effects of radiations; Dose and fractioning; internal radiotherapy (brachytherapy); External radiotherapy; Planning and modalities of treatment; High-voltage X-ray machine; Betatron; Cobalt-60 machine; Gamma Knife; linear accelerator; Cyberknife. Endoscopy: Functioning principle; Rigid endoscopes; Flexible endoscopes; Main components and scheme; Ultrasound endoscopic probes. Infusion pumps: Modalities of infusion; gravity-fed infusion systems; Mechanical pumps; peristaltic pumps; Volumetric Pumps; Scheme of a infusion pump and alarm systems; closed-loop control system: the insulin portable pump. Ventilators: Respiratory apparatus; Artificial ventilation, types off ventilators; Negative-Positive ventilators; Control systems in ventilators. Biosensors: Chemical sensors; Blood sensors, electrochemical sensors; pH, PO2 and PCO2 s sensors; Glucose sensors; Optical sensors; Pulse-oxymeters; Clinical laboratory instrumentation; spectrophotometry. Telemedicine: The principle of telemedicine; Sensing and sensor networks in telemedicine; Telecardiology; Teleradiology; Home-monitoring systems. 3. Technical norms and standards for biomedical device: Medical device: definition and standard; General aspects on apparatus safety (electric, optic and radiology) for biomedical instrumentation.

Development of the course and examination
LEARNING EVALUATION METHODS
The exam consists in an oral discussion on the course topics. During this exam, the student has to present the various instrumentation, to answer to the eventual questions relative to the measurement methods, object of the course, and to be able to critically discuss the various course topics.

LEARNING EVALUATION CRITERIA
The evaluation criteria are: Completeness of the exposition, student skills on clearly expose the argument requested will be used as evaluation criteria and to analyse the design and opeartive aspects of the different instrumentations. The correct use of terminology and of correct instruments and methods will also be taken in consideration.

LEARNING MEASUREMENT CRITERIA
The measurement criteria are: Capacity to present in an exhaustive manner the course argument and coherent and critical analysis of the arguments object of the exam.

FINAL MARK ALLOCATION CRITERIA
Full mark will be given to the student if during the oral exam he/she will demonstrate a full knowledge of the course arguments, an autonomous and complete capacity of analysis and presentation of the course arguments.

Recommended reading
R.S. Khandpur, Handbook of Biomedical Instrumentation , McGraw-Hill; J.W. Webster, Medical Intrumentation: Application and Design , Houghton. J.D. Bronzino, The Biomedical Engineering - Handbook Vol I & II, CRC Press E.A. Cromwell, F.J. Weibell, E.A.Pfeiffer, Biomedical Instrumentation and Measurements , Prentice-Hall; Francesco Paolo Branca, Ingegneria Clinica , Springer-Verlag; Francesco Paolo Branca, Fondamenti di Ingegneria Clinica vol.2 , Springer-Verlag; Copy of the slides utilised during the course are available on the moodle website of the course (https://lms.univpm.it/enrol/index.php?id=460).

Architettura e Composizione Architettonica 1 (EA)

Paolo Bonvini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 90
Period E/1s-2s

Prerequisites
To better deal with the course the student should master graphing and architecture digital, have a clear knowledge of the historical origins of architecture.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire the knowledge and ability to understand the complexity of the design process at its various scales, from the technical components, the building, the city and the landscape. The understanding of functional, logical-formal, technical and technological reasons that govern the formation of the constituent characteristics of architectural design will be put into practice by the development of a design exercise, to be held in the specific laboratory. The goal is to be achieved both through the critical analysis of significant buildings of architectural culture of the theoretical aspects as the setting tools and project control.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to deal with the design theme of elementary aspects of the project, the student must be able to correctly apply the critical skills of analysis of the design process in its synergy between technical and aesthetic components; in relation to its belonging to a physical environment and therefore with the architectonic pre-existence, with the landscape or the urban context, motivating design and technical solutions in relation to the compatibility and environmental sustainability and to the possible solutions in relation to requirements and to regulatory and contextual constraints.
TRANSVERSAL SKILLS:
Transversal skills will be verified by performing an exercise in solving a problem, (architectural design of a single-family house) that will be done in groups and that will lead to the drafting of drawings that will allow the student to improve his degree of autonomy of judgment in general, his ability to communicate that also originates from the teamwork, his ability to learn independently and to get original conclusions.

Program
The course proposes the study of a small residential building placed inside a part of the consolidated city to be redeveloped. The new building project and its inclusion within the urban system will allow to reason on a double track: the typological investigation and the innovative features of living that contribute to urban regeneration and convey the will to reverse the construction the city for continuous expansion and relative consumption of soil. The course then will work on an area of newly built town with these characters and requires a reinterpretation of his identity character, from comparison with the memory of the place and its urban history, human, productive and social. The introduction of new volumes instead of blank areas, often under-used and then exposed to the easy degradation also allows the recovery of the open space and its reflection on a new type of public space and its role in the need for a new urbanity dynamic and dialogue between activities and functions. In this way the house can be equipped with an additional volume, integrated or not to the main volume, that can offer new spaces designated for public use

activities. In the course will be held exercises topics designed to acquaint students with the basic aspects of the architectural construction: relation strategies with the original context, typological and distributive aspects, disposition and formalization of activities in space and volume, compositional strategies, working on examples driving which requires an analytical and critical reading to be implemented by means of graphical tools of the project.

Development of the course and examination
LEARNING EVALUATION METHODS
The course consists of several experiences during the academic year and consist of an adequate number of exercises that together contribute to the formation of the student during the final exam that will constitute the act of evaluation of the level of preparation . The exercises will have between them a preparatory aspects from the analysis of projects of renowned architects including the masters of modern, up to the identification of how representative of the idea of architecture and the development of their own project in different scales and in the analysis of the different disciplinary contributions to the physical construction of the space with three-dimensional models physical and virtual. The final assessment of the level of learning of the students consists of two tests: - The presentation of architectural projects related to the topic or topics in the program, through elaborate paper which represent a summary agreed with the teacher; - The complete oral presentation of the project, its concept and its theoretical and practical implications, through power point. The project can also be done in groups, with a maximum of two students. In this case, the discussion of the project must take place with the participation of the two students contextually.

LEARNING EVALUATION CRITERIA
To successfully pass the assessment of learning, the student must demonstrate, through the two tests described above, to have good understanding of the criteria and procedures for the design, the need for theoretical implications related to the needs of the contemporary social and ability to respond in appropriate and innovative techniques. The student must prove, in addition, to be able to apply, on their own, these criteria and these procedures to the project, to know how to properly use the materials and construction technologies appropriate and to be able to prepare a presentation planning and technical and knowledgeable publicly expose.

LEARNING MEASUREMENT CRITERIA
The two tests will be evaluated in thirtieth and final grade will be calculated as the average of the two tests. The rating is then the sum of the marks obtained by witnessing the ability of independence from the theoretical issues articulated in the basic course with those obtained by the quality of the draft prepared by the reference laboratory.

FINAL MARK ALLOCATION CRITERIA
To obtain a positive evaluation, the student must achieve at least a passing grade in the two tests described above. The highest rating is achieved by demonstrating a thorough understanding of the theoretical and practical content of the course in the two trials and proving to be able to properly manage a project that is consistent with the content itself and credible at the technical level.

Recommended reading
- Ábalos I. (Autore), B. Melotto (a cura di), Il buon abitare. Pensare le case della modernità . Marinotti Edizioni, Milano 2009 - Banham R., Ambiente e tecnica nell'architettura moderna , Laterza 1995 - Beccu, M. Ficarelli L., La casa dei Maestri. L

Architettura e Composizione Architettonica 2 (EA)

Fausto Pugnaloni

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 90
Period E/1s-2s

Prerequisites
The previous Courses in Architecture and Architectural Design I

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire advanced knowledge related to the distribution and functional aspects of one or more buildings of collective character. This topic is coordinated with the area of representation and of the survey, of architectural design and restoration area, urban area, area of building production and building technologies. The goal is to give the students a full multidisciplinary awareness related to the urban scale and the architectural one.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to deal with the design process, the student must be able to critically interpretate the intervention context. This ability will be carried on through design exercises, aimed at studying the types of public and private buildings in which the interdependences between the building and the city are clear.
TRANSVERSAL SKILLS:
Transversal skills will be verified by the resolution of an architectural problem that will be faced by groups of students. It will be communicated through drawings and posters that will allow the student to improve his own autonomy of judgment, his ability to communicate originating from the team-working, as well as his ability to learn and get the proper conclusions.

Program
The course explicits the aspects of architectural design. The course investigates architectural models that try to find their formal definition generated by the constructive elements; the final aim is to find alternatives both in terms of the volumetric studies and the logic of the functional use of architectural space .

Development of the course and examination
LEARNING EVALUATION METHODS
The evaluation of student learning consists in the presentation of a project, in the form of graphic posters, chosen by the student according to the request of the Professor. The project can also be done in groups, with a maximum of two students. In this case, the discussion of the project must take place with the participation of all students in the context of the same group.

LEARNING EVALUATION CRITERIA
To successfully pass the evaluation, the student must demonstrate, that he has learned the criteria and design procedures. He must prove, in addition, that he properly knows constructive materials and technologies.

LEARNING MEASUREMENT CRITERIA

final mark 30/30

FINAL MARK ALLOCATION CRITERIA
The highest mark is achieved by demonstrating a deepunderstanding of the course contents. Laude will be given to students who, having done all the tests, have demonstrated a particular brilliance in the oral and in the preparation of assignments.

Recommended reading
The bibliography will be provided during the course.

Architettura e Composizione Architettonica 3 (EA)

Gianluigi Mondaini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 90
Period E/1s-2s

Prerequisites
Ability to read the context of intervention and ability to coherence between the proposed project and location. Knowledge of the main building technologies. Capacity of representation of the proposed project ideas

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The class allows the students to enhance in depth the architectural composition techniques already obteined in the same disciplinary sector previous years classes; those aspect are teached at multiple scales of project, and are completed by a constant integration with structural and technical aspect of the design process, in order to develop knowledge and awareness of the hybrid and multidisciplinary character of the engeneer-architect educational path. The course develops a detailed study of a coherent set of buildings, both historic and new, and explore possible different building types with the study of its relationship spaces in the broader urban context and landscape.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to deal with the project themes assigned, the teaching gives to the student the skills to elaborate architectural and technical solutions that understand and interpret both the procedures of the architectural composition and the theoretical implications connected to the contemporary issues. The student will have to correctly understand the context, as proposed and already understood in the previous classes, prooving to have skills to motivate its own project choises; at the same time he will have to verify different possible answer after analyzing a series of requests, duties and restrictions. The proposed project environment will consist in the application of the acquired skills in a project of a selected city area architectural and urban regeneration.
TRANSVERSAL SKILLS:
The acquired skills will be prooved and verified in class exercise and laboratory and workshop activities. The test of these multidisciplinary skills take place with a oral exam that goes through the review and discussion of the student project choises. The proposed project will have to express multiple design characters and features at the urban scale, and at the same time will have to deal with the proper study of the technolocial aspects at the different project scales. This project steps will contribut to improve both the autonoumous capacity of judgment and the ability in oral communication and also the attitude to find solution to a given problem.

Program
The first order of reasoning that the course offers is the need for tout court Sustainability that both in urban and architectural spatial terms, means reconstruct what exists and is condition of degradation rather then simply build less. The second order of interest is relative to how to tackle today the relationship between the new and heritage. Exceeded the proper respect for history and for the role and significance of the architecture of the past, our interest is now primarily oriented towards the large amount of architecture produced in the late twentieth century, whose character, though not without issues and meaning, should stimulate new ways and approaches to architectural

experimentation. More possibilities for critical thinking are traceable within the increasingly central role of technical issues, and could convey new ways of interpreting the physical relationship between new and pre-existence. The recent economic crisis, beyond the measures financed by large capital, private and public, suggests a new way of intervention; economies of scale , which until now often suggested demolition and reconstruction compared to regeneration, are reviewed today with new parameters, stimulating recovery and expansion; all these issues, are the core on which the course will focus.

Development of the course and examination
LEARNING EVALUATION METHODS
The assessment of student learning consists of two parts: - The presentation of architectural projects related to the topics included in the program, with design drowings that represent a synthesis agreed with the teacher; - Complete the oral presentation of the project, its concept and its theoretical and practical implications, through power point. The project can also be done in groups, with a maximum of two students. In this case, the discussion of the project must take place with the participation of the two contextual students.

LEARNING EVALUATION CRITERIA
To pass with success the assessment of learning, the student must demonstrate, through the two tests described above, his understand the criteria and design procedures, the need for theoretical implications related to the needs of the contemporary social and ability to respond in appropriate and innovative techniques. He must prove, in addition, to be able to apply, these criteria and the procedures to the project, to know how to properly use the materials and construction technologies appropriate and knowing how to prepare a presentation design and technical know how and public display.

LEARNING MEASUREMENT CRITERIA
The two tests will be evaluated in thirty and the final vote will be the result of the average of the two tests. The rating is then the sum of the marks obtained by witnessing the ability of autonomy in relation to theoretical issues articulated in the basic course with those obtained by the quality of the draft elaborated for the project.

FINAL MARK ALLOCATION CRITERIA
In order for the overall outcome of the evaluation is positive, the student must achieve at least a pass in the two trials described above. The highest rating is achieved by demonstrating a thorough understanding of the theoretical and practical content of the course in the two tests and proving to be able to project management that is consistent with the content itself and credible technical level. Praise is given to students who, having performed the tests correctly and completely, have demonstrated a particular brilliance in the oral and in the preparation of project works.

Recommended reading
P. S. Byard, The architecture of Additions: Design and Regulation, Norton Books, Londra, 1998 Manuel Gausa, Housing, New alternatives, New systems, Bickhauser Actar, 2002 AA. VV, Parasite Paradise a manifesto for contemporary architecture and flexibleurbanism, NaiPublishers, Rotterdam, 2003 Ed Melet, Rooftop architecture, Building on an elevated surface, Nai Publishers, Rotterdam, 2005 Frederic Druot, Anne lacaton, J.p. Vassal, Plus, 2G, Editorial Gustavo Gili, Barcellona, 2007 Philip Jodidio, 100 great extensions & renovations, Image Publishing, 2007 S. Marini, Architettura Parassita, Strategie di riciclaggio della citt , Quodlibet, Ascoli Piceno, 2009 C. Anselmi C. Prati, Upgrade Architecture, Edilstampa, Roma, 2010 Anthony Vidler, The architectural uncanny, 1992 Santiago Ciruceda, Situaciones Urbanas, 2007 Tadei Pogacar & P.A.R.A.S.I.T.E., Museum of contemporary art the best is yet to come, 2007 AA. VV, Public cities:guidelines for urban regeneration, Mondadori, milano 2009 AA. VV, the ecological sustainability of design, AREA, 2009

G. Mondaini. Ri-Composizioni, Gangemi, Roma 2008 - G. Mondaini. MICROCITIES. Alinea Editori, Firenze, 2011 - G. Mondaini, M. Zambelli, BEHNISCH ARCHITEKTEN. Ance Edizioni, Roma, 2012 .G.Mondaini, D. Potenza, ABDR Architetti Associati. Ance Edizioni, Roma 2014

Architettura e Composizione Architettonica 4 (EA)

Gianluigi Mondaini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 90
Period 1s

Prerequisites
Ability to understand the urban context and ability to relate functional and design choices programs. Knowledge of issues relating to the recovery of existing buildings and technicals of intervention

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The class allows the students to enhance advanced knowledge in the same disciplinary sector of previous years classes, studying in dept the qualities of urban and architectural space, the qualities of construction materials and the technological aspects of the single building. It will be also teached and studied the sperimentation of the sinergy between the formal aspects of the design process, the architectural languages and the relationship with sustainability; those issues will be studied in depth to enrich the knowledge of the multidisciplinary dimension of the architectural project.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to deal with advanced project issues and to adopt innovation trough the connection between compositive formal design and technologies process already studied in the previous years classes, the student will have to proove to be able to apply autonoumously those procedures to the project, and to be able to use correctly materials and construction technologies, and to know how to prepare a project presentation and how to expose it in public.
TRANSVERSAL SKILLS:
Skills and knowledge will be tested in the several project step of the laboratory, both on new or historic buildings. Those skills will be verified in group team works, or autonomously through graphic drawings and presentations that will give the student the chance to verify both the learning process and the ability to communicate the project and get original answers based on the givern architectural issue.

Program
The theme of the recovery has become transversal to all major European cities and organizations stems from the profound transformation occurred on the production system and industrial and also on the radical changes on the development of the city recently. The possibility offered by brownfields oo substitution allows the contemporary city to stop the process of expanding outward and stop the consumption of resources and territory in the creation of new suburbs recovering an internal new urban spaces and new centers . The course then will work on this type of areas, on comparison with the memory of a place that made the industrial and social history of the surrounding area , on the overlap and on the re-use of these areas through the re-use of industrial buildings and on the most significant ' idea of urbanity that the contaminated condition of activities and functions different from each other and activities aimed at the public or the public interest. The methodological approach will work around the possibilities offered by different programs and declination of these over time , aware that contemporary design is a complex organism , the structure of which is able to continuously change through processes of gradual adaptation .

Development of the course and examination

LEARNING EVALUATION METHODS

The assessment of student learning consists of two parts: - The presentation of architectural projects related to the topics included in the program, with design drowings that represent a synthesis agreed with the teacher; - Complete the oral presentation of the project, its concept and its theoretical and practical implications, through power point. The project can also be done in groups, with a maximum of two students. In this case, the discussion of the project must take place with the participation of the two contextual students.

LEARNING EVALUATION CRITERIA

To pass with success the assessment of learning, the student must demonstrate, through the two tests described above, his understand the criteria and design procedures, the need for theoretical implications related to the needs of the contemporary social and ability to respond in appropriate and innovative techniques. He must prove, in addition, to be able to apply, these criteria and the procedures to the project, to know how to properly use the materials and construction technologies appropriate and knowing how to prepare a presentation design and technical know how and public display.

LEARNING MEASUREMENT CRITERIA

The two tests will be evaluated in thirty and the final vote will be the result of the average of the two tests. The rating is then the sum of the marks obtained by witnessing the ability of autonomy in relation to theoretical issues articulated in the basic course with those obtained by the quality of the draft elaborated for the project.

FINAL MARK ALLOCATION CRITERIA

In order for the overall outcome of the evaluation is positive, the student must achieve at least a pass in the two trials described above. The highest rating is achieved by demonstrating a thorough understanding of the theoretical and practical content of the course in the two tests and proving to be able to project management that is consistent with the content itself and credible technical level. Praise is given to students who, having performed the tests correctly and completely, have demonstrated a particular brilliance in the oral and in the preparation of project works.

Recommended reading

- A Terranova. La città e i progetti. Gangemi Editori, Roma 1993 - P. Desideri. La città di latta. Meltemi Editori, Roma 2002 - L. Prestinenza Pugliesi. Hyperarchitettura. Testo & Immagine, Torino 1999 - G. Mondaini. Abitare dopo il moderno. Sala editori, Pescara 2001 - A Terranova. Mostri metropolitani. Meltemi editori, Roma 2001 - G. Mondaini. Forme e tecniche di architettura bioclimatica (). Sala Editori, Pescara 2002 - P. Desideri. Ex-City. Meltemi editori, Roma, 2002 - S. Cantalini, G. Mondaini. Luoghi comuni. Meltemi editori. Roma 2002 - G. Mondaini. Figure Urbane. Alinea Edizioni, Firenze 2004 - H. Ibelings. Supermodernismo. Castelvecchi, Roma 2001 - G. Mondaini. Ri-Composizioni, Gangemi, Roma 2008 - G. Mondaini. LINKS. Affinità Elettive. Ancona 2009 - G. Mondaini. MICROCITIES. Alinea Editori, Firenze, 2011 - G. Mondaini, M. Zambelli, BEHNISCH ARCHITEKTEN. Ance Edizioni, Roma, 2012 .G.Mondaini, D. Potenza, ABDR Architetti Associati. Ance Edizioni, Roma 2014

Architettura Tecnica 1 (EA)

Francesca Stazi

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 90
Period E/1s-2s

Prerequisites
no

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
Students will acquire advanced knowledge about design and construction of buildings with load-bearing structure in reinforced concrete, steel and timber. The course provides the basic knowledge related to the complexity of the design process in its different scales. This implies the understanding of the functional and technical - constructive constraints that govern the design of the building features. To that aim, the course focuses on the basic concepts related to the requirements to satisfy regarding the issues of efficiency in structural design, functionality in the use of interior space and outer envelope optimization for both user comfort and energy savings. The lessons deepen constructive alternative solutions and their realization methods for building technologies in reinforced concrete, steel and timber. This basic knowledge will guide the design choices among several possible solutions.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Student will be able to address complex design themes, to control the whole design process by carrying out critical analyses at every stage in relation to the needs and to elaborate an executive project. Such abilities will applied in several skills, such as: 1. the ability to critically analyse an existing case study in relation to environmental, functional and technological constraints; 2. the ability to identify optimal solutions related to load-bearing structure schemes, functional organization of the interior spaces, and materials; 3. the ability to design solutions and constructive details for building with structures in reinforced concrete, steel and timber.
TRANSVERSAL SKILLS:
Design exercises in groups will lead to the design of a residential building, to be realized with the 3 studied construction techniques (reinforced concrete, steel and timber). The project drawings will be gathered in a "book". This will help the students ability to work in team. The acquisition of independent judgment skills will be evaluated through the discussion of advanced aspects of the discipline during the written and oral exams.

Program
Frontal lessons (50 hours) The performance of buildings: efficiency of the structural design, functional distribution of the interior space (also considering barrier-free environment and fire protection), outer envelope optimization. Constructive components for buildings with load-bearing structure in reinforced concrete, timber and steel: foundations, structures in elevation, envelope layout. General lessons on the building process (relative to the levels and contents of the project) and driving lessons on setting themes of the project (such as site analysis). Design exercises in the classroom (22 hours). Development, by sampling, of the most significant documents of the executive project of a two-family house with basement with the illustrated construction techniques. The case study is chosen by the student and agreed with the teacher.

Development of the course and examination

LEARNING EVALUATION METHODS

The assessment of student learning is done through two tests: - Written test consisting of 3 questions to be completed in an hour on the topics covered in the lectures; - Oral examination focusing on their written report and if necessary on further topics covered in the lessons. It also involves the discussion on the technical documents developed during the exercises. The project can also be done in groups, usually including 2/4 students. Also in this case the discussion of the project is carried out individually.

LEARNING EVALUATION CRITERIA

To successfully pass the learning evaluation, the student must demonstrate, through the abovementioned tests, to understand the criteria and design procedures. The student must also know the basic information regarding the functional and structural aspects of the building.

LEARNING MEASUREMENT CRITERIA

During the exams the student's independent ability to solve technical and constructive problems and to identify, among several possible solutions, the most suitable one to the specific needs, are evaluated.

FINAL MARK ALLOCATION CRITERIA

The highest mark, equal to thirty points with honors, is achieved by demonstrating in-depth knowledge of the course contents and to be able to fully develop a project that is technically feasible. The minimum mark, equal to eighteen, is assigned to students who demonstrate sufficient knowledge of the presented techniques.

Recommended reading

M C. Torricelli, R. Del Nord, P. Felli, Materiali e tecnologie dell architettura , Ed. Laterza Koenig G.K., Furiozzi B., Brunetti F. Tecnologia delle costruzioni 12, Le Monnier. Firenze, AA. VV., Manuale di progettazione edilizia , Hoepli Ed., Milano Course lecture notes available on-line (https://lms.univpm.it/)

Architettura Tecnica 2 (EA)

Placido Munafo'

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 90
Period E/1s-2s

Prerequisites
Knowledge of different buildings technologies and constructive elements, history of architecture.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire knowledge on the topic of masonry construction, with a focus on the existing building stock. Within this theme, the course, integrating the knowledge gained in the areas of architectural design, building technology, structural technology, will enrich the knowledge of the structural design, constructional and engineering issues associated with the renovation of masonry buildings, as well as the physical, technological and functional topics.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to integrate the control of operational methods and instruments geared to the renovation of buildings, the design exercises of the course deal with the topic of renovation of an existing masonry building. These will allow the student to develop his technical skills in order to design buildings that meet the functional, logical-formal, technical and technological reasons that govern the formation of the constituent characteristics of architectural design, also in the field of renovation of existing buildings.
TRANSVERSAL SKILLS:
The execution of design exercises on the topic of renovation of an existing masonry building will be the occasion for the student to know and understand the complexity of the design process at its various scales and processes that guide the project approach through a comparative choice between several possible solutions for the variables reason. In the field of existing buildings renovation, they are particularly expressed in the synergy between the conservation needs of the building or parts thereof, and that of his improvement from a structural, functional and performance point of view.

Program
The course aims to provide the theoretical and practical tools necessary for the functional and architectural maintenance, rehabilitation and requalification of the existing and historical buildings. The lectures will be aimed in particular to deepen the following topics. - Analysis of the building: survey of damage and decay; - Masonry buildings: constituent materials, static behavior, consolidation techniques; - Concrete buildings: degradation of materials, survey of damage and decay, materials and techniques for consolidation, improvement and seismic retrofit; - Wooden structures: analysis of the state of degradation and consolidation of structural elements; - The energy retrofit: diagnosis of the energetic quality of the housing and methods of intervention. The design phase allows to apply what learned during the course on a real case study.

Development of the course and examination
LEARNING EVALUATION METHODS
The assessment of student learning consists of two levels: - an oral test with the aim of estimating

the knowledge of the topics discussed during the course; - a series of short tutorials themes, in the form of drawings and/or technical reports, to be carried out in parallel with the lessons.

LEARNING EVALUATION CRITERIA
To successfully pass the learning evaluation, the student must demonstrate, through a discussion on the topics of the course and the exercises carried out, to have understood the contents covered, and be able to apply them independently in the process of renovation of a building.

LEARNING MEASUREMENT CRITERIA
At each level before indicated, a score between zero and thirty is assigned. The overall mark is the average of the marks obtained at the two levels.

FINAL MARK ALLOCATION CRITERIA
So that the overall result of the evaluation is positive, the student must achieve at least the sufficiency, equal to eighteen points in each of the levels described above. The maximum score is reached when the student demonstrates a thorough understanding of all the course content. Praise is given to students who demonstrate particular skills during the oral presentation and in the exercises.

Recommended reading
Provided reports. Doglioni Francesco, Codice di pratica (linee guida) per la progettazione degli interventi di riparazione, miglioramento sismico e restauro dei beni architettonici danneggiati dal terremoto umbro-marchigiano del 1997, BUR Marche edizione straordinaria n.15 del 29/09/2000. Giuffrè Antonino, Letture sulla meccanica delle murature storiche, 1991, Editore KAPPA. Giuffrè Antonino, Codice di pratica per la sicurezza e la conservazione del centro storico di Palermo, 1999, Editore LATERZA. Giuffrè Antonino, Sicurezza e conservazione dei centri storici. Il caso Ortigia, 2003, Editore LATERZA. AA.VV., Le chiese e il terremoto, 1994, edizioni LINT trieste. AA.VV., Manuale per la riabilitazione e la ricostruzione postsismica degli edifici, 1999, Editore DEI. Munafò Placido, Recupero dei solai in legno, 1990, Dario Flaccovio Editore.Vallucci Sara, Quagliarini Enrico, Lenci Stefano, Costruzioni storiche in muratura, Vulnerabilità sismica e progettazione degli interventi, 2013, Editore Wolters Kluwer Italia

Architettura Tecnica 3 (EA)

Marco D'Orazio

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 90
Period 1s

Prerequisites
Knowledge of structural technologies and building construction technologie

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
Students will acquire Knowledge about methodologies useful to evaluate the environmental impact assessment of building design and construction. Students will integrate previous knowledges regarding building construction (Architectural Engineering and Building construction) in order to acquire consciousness of environmental impacts related to building design and construction.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Students will be able to promote the innovation and the development of building components considering environmental issues related to the production and to the use of buildings. At the end of the course, the students will be able to measure the environmental impact of buildings and components. Considering acquired professional abilities, the students will be able to: 1) choose materials and technologies considering measured environmental impacts; 2) identify and measure environmental impacts; 3) interpret results coming from methodologies previous defined, working in group.
TRANSVERSAL SKILLS:
An exercise of problem solving that will be carried out in groups will lead to the drafting of a report. It will help the students to improve their independence of judgment, their ability to work in team, to learn independently and to draw conclusions.

Program
Contents (Lessons, 30 hours) Environmental sustainability of building constructions: Theoretical basis, laws and regulamentations in Europe and Italy, calculation methods (LCA, Environmental protocols); Sustainability of building technologies and building meterials (EPD and related evaluation criteria); Recicle; Practical activity (building and component analysis, 60 hours) Life cycle cost of a case study; Life cycle assessment of a case study; Enviromental protocol application to a case study.

Development of the course and examination
LEARNING EVALUATION METHODS
The evaluation will be developed in a two stage process. Firstly the Teacher will evaluate results obtained during the practical activity (annual activity) . Secondly the teacher will evaluate during an oral examination the knoledge acquired by the student on the sustainability in the construction process.

LEARNING EVALUATION CRITERIA
Ability to apply acquired knowledges on the design of a building

LEARNING MEASUREMENT CRITERIA
Ability and autonomy of the student to solve problems related to this specific area. Ability regarding the use of methdologies and tools related to the sustainability

FINAL MARK ALLOCATION CRITERIA
The final mark will be comprises between 30 with laude and 18. The highest evaluation will be assigned to students autonomous and able to solve problems related to sustainable design. The lowest evaluation will be assigned to students adequately able to solve problems related to sustainable design.

Recommended reading
Lectures on: http://lms.univpm.it; Books: Architecture in a climate of change, Architectural Press, USA, 2005; Architectural science, the basis of sustainable design, Szokolay, 2004, Elsevier press.; Materials for sustainable sites, Calkins, 2009, Wiley and sons ed.; Life cycle assessment in edilizia. Progettare e costruire in una ottica di sostenibilità ambientale,M.Lavagna, 2008, Hoepli Ed., Milano

Assistive Robotics

Lucio Ciabattoni

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Basic notions of Electronics, Electrictecnology, Infomatics and Automation.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide expertise in the topics of robotics, addressing not only the simple design of mechatronic devices but also the identification of tools and devices for intervention in the biomedical and functional rehabilitation.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
This course is mandatory and provides insight in the themes of Robotics for the design of mechatronic devices and for the identification of tools and devices for the intervention in the biomedical and functional rehabilitation field.
TRANSVERSAL SKILLS:
Capabilities of: synthesis, autonomy, clarity and work in group.

Program
The Assistive Technologies support the activities of users to improve the quality of the life. In this context the Robotics is giving an important contribution. The course is oriented to the integration of robotic devices in biomedical and rehabilitation applications. A particular attention is reserved to smart wheelchairs and assisted manipulators. List of the main topics: Robot modelling: - dynamics, - control - intelligent control Interaction man-machine: - constraints - functionality - modularity - scalability. Assistive Robotics: assisted locomotion and manipulation. Examples of significant applications in research fields and integrated into the health system

Development of the course and examination
LEARNING EVALUATION METHODS
Questions with discussion on the different topics of the course and presentation and discussion of the developed project, if scheduled. Of average 6 exams are planned in the fixed periods at the end of the two didactic cycles.

LEARNING EVALUATION CRITERIA
Technical and scientific knowledge of the field and evaluation of the possible applications, ability to analyse the problems of the field, ability to use design tools in the field, ability to extend the acquired tools in similar contexts.

LEARNING MEASUREMENT CRITERIA
Understanding of the questions, correctness and clarity of the exposition, completeness of responses, consistency in the analysis and synthesis, autonomy of judgment or the ability of critical thinking and formulation of judgments.

FINAL MARK ALLOCATION CRITERIA
The exam consists of three questions (the third one will focus on the project if developed), and for each question is assigned a score of 10 equivalent to a optimal assessment, a score of 8 for a good assessment, a score of 7 for a full sufficient assessment and a score of 6 for a just sufficient assessment.

Recommended reading
Bruno Siciliano, Lorenzo Sciavicco, Luigi Villani, Giuseppe Oriolo, Robotics: Modelling, Planning and Control, Springer Science & Business Media, 2009 King Sun Fu, Rafael C. González, C. S. George Lee, Robotics: control, sensing, vision, and intelligence, McGraw-Hill, 1987 . Annalisa Morini, Fiorenza Scotti, ASSISTIVE TECHNOLOGY Tecnologie di supporto per una vita indipendente , Maggioli Editore, 2005 (in Italian language)

Automazione Industriale (GEST)

Leopoldo Ietto

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Elements of linear algebra, Rudiments of linear matricial algebra., elements of mathematical analysis, Laplace transform. Basic elements of linear system theory.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course is aimed at providing the students with the expertise to adequately face analysis and synthesis of a control systems with analogic components. Particular attention is paid to experimental procedures for attaining the above objectives in the case of industrial processes.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The theoretical and practical topics studied in the course will allow the student to synthesize an analogic control system on the basis of the required closed-loop dynamics. The student will be able to determine the most appropriate design technique and the relative components.
TRANSVERSAL SKILLS:
The general approach adopted for the analysis and synthesis of the control systems will provide the student with the ability of facing different applications within the same methodological framework. In this way, the acquired competence can be also applied to problems relative to fields like e.g. industrial production management, environment and biomedical engineering.

Program
Introduction to control problems and to the related control systems. Feedback control systems. Elements of system analysis. . Frequency response. Bode and Nyquist diagrams. Stability: Routh and Nyquist criteria Transient and steady-state response. Steady-state performance. Sinthesis in the frequency domain. Root locus. Industrial regulators.

Development of the course and examination
LEARNING EVALUATION METHODS
The exam consists of written and oral parts. The written part concerns the analysis and/or design of an industrial control system, possibly using software packages. Lecture notes and books are allowed to be looked at. The oral part consists in a deep discussion on the most important theoretical notions concerning analysis and design of an analog industrial control system.

LEARNING EVALUATION CRITERIA
The primary goal of the exam is to verify the student capability to autonomously evaluate the essential features of a control problem and to recognize the most appropriate tools to solve it.

LEARNING MEASUREMENT CRITERIA
The learning degree is evaluated through the grasp of the basic principles governing the classical approach to the analysis and synthesis of industrial control systems.

FINAL MARK ALLOCATION CRITERIA

The maximum score is 30/30 and is assigned to students solving the given control problems in fully correct way and show a complete awareness oft the methodologies. The minimum score to overcome the exam is 18/30 and is assigned to students possessing the above requisites in a sufficient level. .

Recommended reading

Lecture notes. Available at the typing office. -Isidori: Sistemi di Controllo , Siderea, Roma, 1992. P. Bolzern, R. Scattolini, N. Schiavoni. Fondamenti di controlli automatici , 3/ed, McGraw-Hill, Milano, 2006. Franklin, Powell,Emami-Naemi:Controllo a retroazione di sistemi dianmici,EdiSES

Automazione Industriale (INF)

Silvia Maria Zanoli

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Elements of linear algebra, Rudiments of linear matricial algebra., elements of mathematical analysis.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to illustrate the main elements of an automated industrial production system and provide them with the knowledge on the main modeling and control of automated production systems considered as discrete event systems (DES). Moreover, in the course, the student will become familiar with the equipment typically used for controlling discrete event systems (the logic controllers, or PLCs) and their use.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Tthe student will know how to address the problem of modeling a system starting from the description of its functional properties, enlightening, documenting and explaining deisgn choices. Furthermore, he will be able to apply the learned knowledge for the realization of specific control functions in a lab-scale production line.
TRANSVERSAL SKILLS:
The activities of design and implementation of a control system on a lab-scale production line to be carried out in groups and which will end with the drafting of a report, will help improve the degree of independence of judgment in general, together with the ability of communication which derives from group activities; in addition the student s learner autonomy and his/her capability of drawing conclusions will be stimulated; finally, the student will improve his/he skill on writing of technical reports.

Program
Concepts of production systems and production processes. Automation production systems and their classification. Production equipment. Process and manufacturing productions automation. Flexibility of the manufacturing systems: general elements. Principal performance indexes. DCS systems Parte prima: Introduzione all'automazione Industriale. Concetti generali della produzione industriale: sistemi di automazione della produzione e loro classificazione. Automazione delle produzioni di processo e automazione delle produzioni manifatturiere. Flessibilità dei sistemi manifatturieri: elementi generali. Principali indici di prestazione. Attrezzature di produzione. PLC. Sistemi DCS.

Development of the course and examination
LEARNING EVALUATION METHODS
The assessment of student learning consists of two tests to evaluate the theoretical skills (written test and oral test) and a practical test of the design and implementation of a control system on a time scale manufacturing system aiming at verifying the ability to apply the concepts learned. It 's possible to take the written test in two partial tests by dividing the topics of the course. The written

test is in preparation for the oral exam. The oral examination must be supported in the same examination session of the written test. In case of failure of the oral exam, the student must also repeat the written test.

LEARNING EVALUATION CRITERIA
The evaluation the learning takes into account the results of verification tests / learning measurements and skills acquired and the ability to overcome any deficiency encountered by the results of the tests.

LEARNING MEASUREMENT CRITERIA
The measure of the learning by means of written test is intended to test the modeling ability of discrete event systems and verify the capability of using of the analysis and synthesis tools for such systems. To perform the written test a time limit is given. The written test is in preparation for the oral exam. The measure the learning through oral test is designed to test comprehension of the topics covered in the course deepening both the theoretical aspects and the practical applications. The measurement of learning by the design activity is intended to test the student with problems that arise from the implementation on real systems.

FINAL MARK ALLOCATION CRITERIA
In order to pass the exam with the minimum score,equal to eighteen, the student must have sufficient knowledge of all the topics of the course. Additional points will be awarded by demonstrating in-depth knowledge of the content of the course in the written and oral tests together with good autonomy in setting and solving proposed problems. The "lode" is given to students who, having done all the tests correctly and completetly, have demonstrated a particular brilliance in the oral and in the preparation of written assignments and in the design activity.

Recommended reading
Lecture notes. For further readings the following texts are recommended: Proth Xie, Petri Nets: a tool for Design and Management of Manufacturing Systems , Wiley Moody J.O., Antsaklis P. J., Supervisory Control of Discrete Event Systems Using Petri Nets Kluwer Academic Publishers GianAntonio Magnani. Tecnologie dei sistemi di Controllo, Mc Graw Hill Cassandras- La Fortune, Introduction to Discrete Event Systems Kluwer Academic Publishers L. Ferrarini Automazione Industriale: controllo logico con reti di Petri . Pitagora Editrice Bologna Angela Di Febbraro, Alessandro Giua Sistemi ad eventi discreti, Mc Graw Hill

Azionamenti per l'Automazione

Gianluca Ippoliti

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Elements of modeling and control of dynamical systems; Elements of modeling and control of DC motors; Elements of electronics; Elements of electrotechnics; Elements of computing engineering;

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
This course provides students with knowledge of principles of operation and of the electrical and mechanical characteristics of electric motors. The main objective is to equip the students with the competence to design electrical motor control systems and to choose actuator systems for different industrial applications.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will be able to apply the acquired know to: 1, choose appropriately electric drives for the design and development of automation systems; 2, identify models, approaches and algorithms for the design of advanced control systems to be applied in real world operating conditions; 3, choose appropriately models and methodologies for the evaluation of the performance and sizing of components and systems; 4, laboratory work, design and conduct appropriate experiments, interpret the data and draw conclusions, working in teams with other elements involved in the study of the problem
TRANSVERSAL SKILLS:
The execution of an exercise to solve a problem that will be done in team and that will lead to a report, will improve in the students the degree of independence of judgment, the ability to communicate with others members of a team, and the ability to learn independently and to draw conclusions.

Program
General structure of an electrical drive. Rotating magnetic field. Park transformation. Static and dynamic analysis of asynchronous and synchronous electrical machines. Control systems for electric drives with asynchronous motor and permanent magnet synchronous motor. Electric power converters. Trajectory planning for electric drives.

Development of the course and examination
LEARNING EVALUATION METHODS
The evaluation is oral. In the oral exam the student is asked to present the knowledge gained on the principles of operation and on the electrical and mechanical characteristics of the electric drives illustrated during lessons. An optional project on one of the topics covered during the lessons is proposed to each student.

LEARNING EVALUATION CRITERIA
The student, during the oral test, has to, independently and correctly, present and discuss the eventual developed project and demonstrate that she/he has the necessary knowledge and

expertise on the technologies and methodologies for the design of electrical drives, illustrated during lessons. In addition, students must demonstrate sufficient capacity to judge, select, synthesize and clearly explain ideas, concepts and technological solutions presented during lectures.

LEARNING MEASUREMENT CRITERIA

During the exam, is evaluated the student's independent ability to set and solve the posed problems. It is also evaluated the ability to properly use the technologies and methodologies for the design of electrical drives.

FINAL MARK ALLOCATION CRITERIA

The final mark is assigned summing up the evaluation of the oral examination and of the eventual developed project. The student can achieve up to a maximum of 10 points in the project. The oral exam is divided into two or three questions, depending on whether or not the student will present the project. Each question is evaluated with a score ranging from 0 to 10 points. The maximum mark, equal to thirty points cum laude, is awarded to students who demonstrate a full autonomy to set and solve problems and complete mastery of the methodologies and technologies for the design of electrical drives. The minimum mark, equal to eighteen, is assigned to students who demonstrate to be able to solve placed problems and sufficient knowledge of the methodologies and technologies for the design of electrical drives.

Recommended reading

A. Bellini, Elettronica Industriale 2 Azionamenti con Motore in Corrente Alternata , Aracne Editrice, Roma, 2006. A. E. Fitzgerald, C. Kingsley Jr., A. Kusko, Macchine elettriche , Franco Angeli Editore, 2006. L. Bonometti, Convertitori di Potenza e Servomotori Brushless , UTET Periodici, Editoriale Delfino, Milano, 2001. R. W. Erickson and D. Maksimovic. Fundamentals of Power Electronics . Springer, 2001. C. Melchiorri, Traiettorie per Azionamenti Elettrici , Progetto Leonardo, Società Editrice Esculapio, Bologna, 2000. F. Ciampolini, Elettrotecnica Generale , Pitagora Editrice Bologna, 1990. Teaching materials: https://lms.univpm.it/

Bioengineering of Motor Rehabilitation

Sandro Fioretti

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to apply the methods and techniques for the quantitative evaluation of the movement and related motor disorders through the design, execution and analysis of experiments to be performed in a laboratory motion analysis
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
This course is characterizing for the engineering sector (ING-INF / 06) and provides knowledge about the methods and techniques for the quantitative evaluation of the movement and related movement disorders with particular interest to the techniques for studying kinematic, dynamic and electromyography of the neuro-musculoskeletal system. The course will provide through lectures and laboratory practices the ability to apply the appropriate techniques and methods of measurement, processing and interpretation of data and signals that can be used in health care settings such as a clinical movement analysis laboratory for the functional evaluation of motor disorders. Such competences can be applied also in sport, ergonomy and fitness applications.
TRANSVERSAL SKILLS:
The assessment of students' level of learning is done through the production of a laboratory report relative to the students' activities performed in group, on a possible presentation of a specific topic assigned, and an oral exam. In this way the student will have the opportunity to develop : synthesis skills, team-working skills, communication clarity, ability to interpret the clinical language, programming skills and how to use specific instrumentation.

Program
Elements of Biomechanics of Movement: Kinematics and Inverse Dynamics. Principles of DSP and stereophotogrammetry for Movement Analysis., Use of dynamometric platforms and of basographic and barographic systems. Motor rehabilitation: ICIDH and ICF classification. Clinical scales for functional evaluation . Surface electromyography. Methods and instrumental techniques for the quantitative functional evaluation of movement with particular reference to the control of the orthostatic posture and locomotion. Insights in the methodologies for specific clinical situations (neuropathies, stroke, Parkinson). Theoretical aspects of the functional analysis of locomotion (normality case). Determinants of the gait. Spatiotemporal parameters of gait and gait phases. Laboratory examples and laboratory activities for static and perturbed posture tests, and analysis of locomotion

Development of the course and examination
LEARNING EVALUATION METHODS
The assessment of student learning consists of an oral exam consisting of three parts: - The first part consists of exposing the results obtained during laboratory activities proposed during the

course. The laboratory activities are usually carried out in groups of three or at most four students, and each group will prepare, before the examination a written report. Each student will be assessed individually, even if the work was performed in a group. - A second part of the oral session involves exposing a theme, previously assigned by the teacher, in a concise manner, similarly to what is done usually at a scientific conference. - A third part of the oral session, consists in the discussion on one or more topics covered in the course.

LEARNING EVALUATION CRITERIA
To successfully pass the examination, the student must demonstrate, through the three parts of the oral session, that he/she has fully understood the concepts presented in the course, is able to apply them using algorithms implemented in Matlab, and has ability of synthesis and communicative clarity.

LEARNING MEASUREMENT CRITERIA
For each of the three parts of the oral mentioned before is assigned a score between zero and thirty. The overall score is the average of the scores obtained in the three tests, with rounding to the entire excess

FINAL MARK ALLOCATION CRITERIA
Because the overall outcome of the evaluation is positive, the student must achieve at least the sufficiency, equal to 18/30, in each of the tests described above. The highest rating is achieved by demonstrating a thorough understanding of the course content. Laudem is given to students that have demonstrated a particular brilliance in the exposition and in the preparation of written reports.

Recommended reading
Fioretti S.: Teacher's Notes R.A. Cooper, H. Ohnabe and D.A. Hobson: An introduction to Rehabilitation Engineering, Taylor & Francis, 2007 A.Cappello, A.Cappozzo, P.E. di Prampero (Eds.), Bioingegneria della Postura e del Movimento, Patron Editore, Bologna, 2003.

Bioimaging and Brain Research

Camillo Porcaro

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
none

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to gain in-depth knowledge about the various existing methods for detecting and mapping human brain function.The first part of the course will provide the necessary background so that the students acquire a clear awareness of the more broader multidisciplinary context of the neuroscience with a clear reference to the aspects of neuroimaging and brain research with particular reference to the magnetic/electrical (EEG/MEG) brain activity and haemodynamic (fMRI) response associated with neuronal activity (EEG-fMRI).
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
This course is characterizing for the engineering sector (ING-INF / 06).The student will know how to apply correctly the main techniques for the analysis of biomedical images with particular reference to Neuroimaging techniques (MEG-EEG-fMRI) using advanced tools and numerical and computational methods for the analysis of brain data (such EEGLAB, Brainstorm, Statistical Parametric Mapping - SPM and ICA Group Of fMRI Toolbox - GIFT) and be able to critically interpret the results obtained consequently deepening the mechanisms underlying the central nervous system.The skills acquired allow the student to know how to choose the most appropriate analysis tool, the ability to properly interpret the experimental results and to be able to possibly work with the team involved in the study of the problem.
TRANSVERSAL SKILLS:
The execution of the project will help improve the ability to use general-purpose computational tools (MATLAB) or specific toolboxes for preprocessing and processing of biomedical images and brain signals. The drafting of the report in the style of a scientific paper and its discussion in the classroom, help improve ability to synthesize, communicative and expose clearly the concepts and results, and will also contribute to improving the critical capacity that also stems from teamwork

Program
bjectives The course enables students to gain in-depth knowledge about the various existing methods for detecting and mapping human brain function.The first part of the course will provide the necessary background so that the students acquire a clear awareness of the more broader multidisciplinary context of the neuroscience with a clear reference to the aspects of neuroimaging and brain research with particular reference to the magnetic/electrical (EEG/MEG) brain activity and haemodynamic (fMRI) response associated with neuronal activity (EEG- fMRI). Program: Content (lectures, 48 hours) Principles of Human Nervous Systems: Neurons, Neural Circuits, Organization of the Human Central Nervous System and Functional Analysis of Neuronal System. Overview of Complex Brain Functions: The Association Cortices, Memory, Language and Speech. How to detect direct and indirect signals from the brain in a non-invasively way: Electroencephalography (EEG); Magnetoencephalography (MEG); Functional magnetic resonance imaging (fMRI). Multimodal

imaging approach: Simultaneous EEG fMRI. Biological and non-biological signal detected by neuroimaging techniques. Neuroimaging signal processing: Event Related Potentials (ERPs), Blind Source Separation (BSS) and Independent Component Analysis (ICA). Brain source localization from EEG/MEG recordings. Functional and Effective Brain connectivity: Granger Causality (GC), Directed Transfer Function (DTF), Partial Directed Coherence (PDC). Laboratory exercises (24 hours) - EEGLAB toolbox: an open source framework for EEG/MEG data analysis. - Brainstorm toolbox: an open source tool for data analysis EEG/MEG particularly oriented in brain source localizations; - Statistical Parametric Mapping (SPM) toolbox: an open source framework for MEG/fMRI data analysis. - Group ICA Of fMRI (GIFT) Toolbox: an open source framework for fMRI data analysis.

Development of the course and examination
LEARNING EVALUATION METHODS
The learning assessment of students consists of three parts: - Scientific Report (to be performed in groups of three maximum four students): drafting and powerpoint presentation of a scientific report as a deepening of the topics covered during the course, of particular interest to the students. - Project (to be performed in groups of three maximum four students) is to develop a strategy of pre-processing and processing, using MATLAB and the toolboxes studied during laboratory exercises, on real neuroimaging data. - An oral, consisting in the discussion of one or more topics covered in the course. The oral examination must be supported in the same academic year in which the scientific reports and the project occurred. In case of failure of the oral examination, the student will not have to repeat the scientific reports and the project.

LEARNING EVALUATION CRITERIA
To successfully pass the examinatioin, the student must demonstrate, through the three parts test, that he/she has fully understood the concepts presented in the course, is able to apply them using algorithms implemented in Matlab, and has ability of synthesis and communication clarity.

LEARNING MEASUREMENT CRITERIA
For each of the tests specified above, it is assigned a score between zero and thirty. The overall grade, is the average of the scores obtained in all the tests, with rounding to the entire excess.

FINAL MARK ALLOCATION CRITERIA
In order that, the overall outcome of the evaluation is positive, the student must achieve at least the sufficiency, equal to 18/30, in each of the tests described above. The minimum raiting, equal to eighteen, is assigned to students who demonstrate to be able to solve problems that are placed and sufficient knowledge of the methodologies covered during the course and laboratory. The highest score is obtained by demonstrating in-depth knowledge of the course content in all tests. Laudem is given to students who, having done correctly all tests, have shown a particular brilliance in the exposition and in the preparation of all the tests.

Recommended reading
1. Neuroscience, 3rd Edition. Edited by D. Purves, G.J. Augustine, D. Fitzpatrick, W.C. Hall, A.S. LaMantia, J.O. McNamara, and S.M. Williams. Neurology 2005 vol. 64 no. 4 769-769-a. doi: 10.1212/01.WNL.0000154473.43364.47. Chapters 1, 8, 15, 16, 25, 26, 30 2. Magnetoencephalography: From Signals to Dynamic Cortical Networks. Edited by Supek S. and Aine CJ. Springer-Verlag Berlin Heidelberg 2014. doi: 10.1007/978-3-642-33045-2 Part I, II, III. 3. Teaching materials provided by the teacher.

Bioinformatics and Systems Biology

Leonardo Sorci

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Basics of general, inorganic, and organic chemistry.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course is aimed to apply the computational tools, algorithms and theoretical methods of bioinformatics and computational biology for modeling, mining, and analyzing biological systems: from the single biomolecule to the complex biological networks.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
This course, mandatory for the master students, allows to learn the basic concepts of biology and biochemistry that are fundamental for the use of computational techniques applied to scientific research in the biomedical and biological complex systems (genomics). The student will also acquire necessary critical skills to be able to select and combine, among the acquired bioinformtics tools, those needed to undertake novel and complex computational tasks requested in the work envinronment.
TRANSVERSAL SKILLS:
The integration of bioinformatics knowledge with in-depth knowledge of chemistry, biochemistry and molecular biology delivered within this course will provide added value to the preparation of students of Bioinformatics and Systems Biology. In particular, students will acquire the ability: 1) to interface and integrate in a multidisciplinary work and research team involving research in "wet lab"; 2) to make "predictions" that can be directly tested in laboratory; 3) to support or refute, from a computational standpoint, experimental researches already in place.

Program
Elements of comparative biochemistry. Elements of comparative Molecular Biology. Introduction to Bioinformatics. Functional genomics. Biological Databases and databanks. Name and function of database. Retrieval of data and its description. Gene expression analysis. Pairwise sequence alignments. FASTA and BLAST. Multiple Sequence Alignments. Methods of Gene prediction. Sequence Similarity networks. Comparative genomics. Methods for discovery and characterization of sequence motifs. Phylogenetics and Evolutionary Bioinformatics. Molecular modeling of proteins: from simulation to drug design applications. Introduction to Synthetic and Systems Biology.

Development of the course and examination
LEARNING EVALUATION METHODS
The learning evaluation of the students is carried out by an oral test, which may include a brief written test, depending on the assigned tasks.

LEARNING EVALUATION CRITERIA
To successfully pass the exam, the student must properly address 2-3 questions which will include up to one question related the Biochemistry and Molecular Biology background sections of the

course.

LEARNING MEASUREMENT CRITERIA
Attribution of the final mark up to thirty

FINAL MARK ALLOCATION CRITERIA
The final evaluation is positive if the student obtains at least eighteen out of thirty allocated points. The highest rating is achieved by demonstrating a deep understanding of the course content. Cum laude is given to students who have demonstrated a particular brilliance in the exposition.

Recommended reading
Given the multidisciplinary nature of the course, no specific textbook is recommended. Students will be provided references to web material or other sources to deepen the subjects illustrated over the course lessons.

Bioingegneria

Laura Burattini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Basic knowledge of: systems theory and transfer functions, Fourier series, electrical circuits

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide the student with the fundamentals of mathematical and physical modeling of the cardiovascular system, and the main techniques for the electrocardiographic signal analysis. The knowledge of such fundamentals will allow the student to understand the physiology of the cardiovascular system in an engineering way.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The course will provide the fundamentals to solve practical physiological problems (such as computation of physiological quantities) by using models and signals. Such abilities will be acquired during frontal lessons and lab lessons. A written test and possibly an oral test will demonstrate that the students have indeed acquired such abilities. Specifically, the student will have to demonstrate to have a good theoretical knowledge of the topic, and to be able to use it in order to solve practical problems by hand or using a computer.
TRANSVERSAL SKILLS:
To reach satisfactory levels of knowledge and in order to be able to develop applicative abilities, the course will require the knowledge of some info of anatomy and physiology, of systems and control, of circuits and analysis. Such fundamentals will be provided at the beginning of the course

Program
Electric activity of the cell. Nerst s equation. Goldman s equation. Electric model for the cellular membrane. The action potential. Anatomy and physiology basis of the neuron. Anatomy and physiology basis of the heart. Electrophysiologic basis of the electrocardiography (ECG). The ECG signal: recording techniques and leads systems. Features of the healthy and pathological ECG signal. The digital ECG signal and issues related to sampling. Fourier s analysis of the ECG. Shannon s theorem. Techniques to analyze the ECG in the time vs. frequency domains.The cardiovascular system. Cardiovascular hemodynamics. The concept of input impedence. Windkessel models with two elements, three elements, and viscoelastic. Cardiovascular controls. Exercises of practical application of the theoretical issues. Introduction to how to use Matlab for biomedical signal processing (plot, frequency analysis, resampling, filtering).

Development of the course and examination
LEARNING EVALUATION METHODS
The assessment of student learning level consists of two parts: 1- a written exam, compulsory, lasting two hours, during which students must solve 3 practical exercises, 1 questions of theory and write a small program in Matlab; 2- -an optional oral examination, consisting in the discussion of 3 topics covered in the course, which can be accessed only if the written test is taken at least 18. The optional oral test must be supported in the same appeal of the written test.

LEARNING EVALUATION CRITERIA
In order to pass the written exam, the students must demonstrate that they have acquired a good theoretical knowledge of the subject, and learned how to use the theoretical principles to solve practical problems by hand (exercises) or through the use of the computer (programs)

LEARNING MEASUREMENT CRITERIA
Attribution of the final mark out of thirty

FINAL MARK ALLOCATION CRITERIA
The final grade will coincide with that of the written test in case the student chooses not to take the oral exam, or averaging the grades of written and oral. The honors will be given to students who, having achieved the highest rating, have demonstrated complete mastery of the subject.

Recommended reading
1)L Mainardi e P Ravazzani, Principi di Bioelettricità e Biomagnetismo, Pàtron Editore, 2011. 2)L Landini, Fondamenti di analisi dei segnali biomedici, Edizioni Plus, Pisa University Press, 2005. 3)Lecture notes.

Biomateriali

Francesca Tittarelli

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
-

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to provide the skills to interpret the correlations between atomic/molecular structure, microstructure, macro-structure and behavior of materials.Integrating the knowledge gained in chemistry for bioengineering, chemistry of macromolecules and polymers, plastics technology, allows to acquire the theoretical and practical basis for understanding the methods of production, the chemical-physical -mechanical properties and the characterization techniques for the evaluation of properties and degradation diagnosis. The main applications of the different classes of materials in the biomedical field, which will be deepened in Biomaterials 2, are also introduced
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to address advanced design themes and treat the innovation and development of new products and new technological processes through the application of knowledge, the student should be able to correctly interpret the correlations between structure and properties of biomaterials. This will be reflected in a series of professional skills, such as: 1. the ability to choose the most suitable material for the realization of a particular endo, exo-prostheses or artificial organ; 2. the ability to properly interpret the results of laboratory tests; 3. the ability to identify the causes of failure of a biomaterial, working in a team with other elements involved in the study of the problem.
TRANSVERSAL SKILLS:
Synthesis skills, independent judgment skills and communication skills by exposing clearly concepts and results with an adequate technical and scientific language.

Program
Materials structures and related properties. Covalent, ionic, molecular and metallic solids. Mechanical behaviour. Comparison among the classes of materials. Chemical, physical, morphological and mechanical characterization. Definition of biomaterial and related normative. Classification of biomaterials. Metals and alloys. Ceramics. Polymers. Composite materials. Overview of clinical employment of biomaterials: orthopedics, vascular, dental, surgery, plastic and maxillo-facial surgery.

Development of the course and examination
LEARNING EVALUATION METHODS
Oral examination. To answer some questions, if necessary, short calculations will be carried out by the student during the oral test.

LEARNING EVALUATION CRITERIA
To successfully pass the examination, the student should demonstrate to know how to interpret the

correlations between atomic and molecular structure, microstructure, macrostructure and the behavior of materials, he has acquired the theoretical and practical bases for the physical, chemical and mechanical characterization of materials, to know the methods of production, properties and the main applications for the different classes of materials used in the biomedical field.

LEARNING MEASUREMENT CRITERIA
Attribution of the final mark in thirtieths

FINAL MARK ALLOCATION CRITERIA
In order to pass the exam with a minimum score the student should possess the full knowledge. Further score will be awarded based on the mastery of specific and general skills. The honors will be given to students who, having achieved the highest rating, have demonstrated a particular command of the subject with remarkable ability to connect the different contents.

Recommended reading
. Class notes, slides presented at lessons given by the professor, R. Pietrabissa, Biomateriali per protesi e organi artificiali, Patron Editor, L. BERTOLINI et al.,Tecnologia dei Materiali, Città Studi Editori

Biomaterials 2

Alida Mazzoli

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
Basic acknowledgments regarding classification and properties of biomaterials for the manufacturing of medical devices.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
Once acquired the basic acknowledgements regarding the biomaterials and the medical devices, the course is dedicated to the strengthening of the study ability, the development of biocompatible materials and new applications of materials in medicine. During the course are presented the biomedical applications of materials and particular attention is dedicated to the knowledge and understanding of the chemical composition and of the physical-mechanical properties of materials used in medical/surgical field especially for prostheses. Particular attention is given to the characteristics of biocompatibility, inertness and physiological function of the medical device.. The course analyzes in depth contents regarding design, manufacturing technologies and functional evaluation of natural and artificial materials and systems using chemical and physical characterization facilities and modelling tools.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
This free-choice course, allows the acquisition of knowledge regarding the chemical composition and physical-mechanical properties of materials used in the medical/surgical field especially for prostheses. Moreover will be transfered also information regarding regarding design, manufacturing technologies and functional evaluation of natural and artificial materials and systems using chemical and physical characterization facilities and modelling tools.
TRANSVERSAL SKILLS:
The student will acquire skills in terms of course related proficiency and capacity for self-sustained discussion

Program
DEFINITION OF BIOMATERIAL AND HYSTORICAL OUTLINES. BIOCOMPATIBILITY: definitions; interactions biomaterial/human body; sterilization of medical devices and problems connected with the different presented methods; law regulations in terms of biocompatibility of medical devices. CLASSIFICATION OF MEDICAL DEVICES ON THE BASIS OF THE LAW REGULATIONS. CLINICAL APPLICATIONS OF BIOMATERIALS FOR THE MANUFACTURING OF MEDICAL DEVICES. ORTHOPAEDICS: articular prostheses, bone cements, artificial ligaments, bone fractures fixation. ODONTOSTOMATOLOGY: dental implants, materials for endodontics applications, orthodontics devices. CARDIOVASCULAR: cardiac valves, vascular prostheses. MAXILLOFACIAL SURGERY: bone fillers, custom made prostheses. OFTALMOLOGY: contact lens, artificial crystalline lens. VARIOUS APPLICATIONS: drug delivery devices. ADVANCED TECHNOLOGIES APPLIED TO BIOMATERIALS. SURFACE MODIFICATION OF MATERIALS: plasma-spray, sol-gel methods, pulsed laser desposition, biomimetic treatments. BASICS OF TISSUE ENGINEERING. SOLID FREEFORM FABRICATION IN TISSUE ENGINEERING

APPLICATIONS. SEMINARS: software for the analysis and treatment of medical images, basics of the design of custom made prostheses using free-form surface modelling and reverse engineering systems.

Development of the course and examination

LEARNING EVALUATION METHODS

the evaluation method consists in an oral examination. The student will be required to present the main topics regarding the selection of suitable materials for the design and manufacturing of medical devices.

LEARNING EVALUATION CRITERIA

the student should demonstrate the acquisition of skills in terms of course related proficiency and capacity for self-sustained discussion.

LEARNING MEASUREMENT CRITERIA

during the oral examination will be evaluated the capacity of the student for self-sustained discussion relative to the main topics of the course.

FINAL MARK ALLOCATION CRITERIA

the overall evaluation is set from a maximum scale of thirty cum laude to a minimum of eighteen. The maximun will be assigned to a student that demonstrates the complete acquisition of skills in terms of main topics related proficiency and capacity for self-sustained discussion. The minimum will be assigned to a student that demonstrates a passing grade in terms of main topics related proficiency and capacity for self-sustained discussion.

Recommended reading

B.D. Ratner, A.S. Hoffman, F.J. Schoen, J.E. Lemons Biomaterials - An introduction to materials in medicine , 2013 ISBN: 978-0-12-374626-9.

Biomeccanica del Movimento

Sandro Fioretti

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Notions of the characterizing courses of the first and second year

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims at giving the main concepts for the modelling of human motor system and the main methods and techniques for the analysis of human movement
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
At the end of this course, mandatory for the Biomedical Engineering sector, the student will know how to apply the knowledge of the biomechanics of human movement for the measurement and simulation of motor acts in the medical and sports fields. This knowledge is acquired through lectures and exercises.
TRANSVERSAL SKILLS:
The course will allow the students to: develop capacity of synthesis necessary to integrate concepts given in the course with the mathematical/technical/ anatomical concepts of previous courses; ameliorate technical and biomedical terminology

Program
Preliminary notions about modeling of the neuro-musculoskeletal system. Elements of kinematics of rigid bodies; the problem of 3D kinematic transformations; angular conventions. instantaneous kinematic: Angular velocity, IHA, pivot point Joint kinematics: Relative motion between two articulated rigid bodies; characterization of its kinematics by roto-translation axis for rigid displacements of finite amplitude; the choice of the joint axes; proposals for standardizing the definition of Anatomical Reference Systems and of Joint Axes; effects of various error sources on joint kinematics; Examples of movement analysis protocols used in clinics. Analytic Stereophotogrammetry: Direct Linear Transformation; calibration and intersection problems; model of a pinhole camera: use of homogeneous coordinates; the correspondence problem in stereo vision; epipolar constraint; fundamental and essential matrices. Digital signal processing: sampling theorem, aliasing, Butterworth filter, polynomial filter of Lanshammar, Smoothing Splines. Method for estimating simultaneously the optimum cut-off frequency and the variance of the observation noise Inverse dynamics problem

Development of the course and examination
LEARNING EVALUATION METHODS
The assessment of student learning consists of two parts: - A written test, consisting in the solution of two or three exercises on topics covered in the course, to be completed in 90 or 120 minutes, depending on the type of exercise; - An oral, consisting in the discussion on one or more topics covered in the course. The written test is in preparation for the oral exam, access to which the student must have obtained at least a pass in the written test. The oral examination must be supported in the same appeal of the written test. In case of failure of the oral exam, the student

must also repeat the written test.

LEARNING EVALUATION CRITERIA
To successfully pass the examination, the student must demonstrate, through the tests described, to have fully understood the concepts presented in the course and must demonstrate that he/she has very clear notions of mathematics and physics applied to experimental data typical of human movement

LEARNING MEASUREMENT CRITERIA
For each of the tests specified before it is assigned a score between zero and thirty. The overall grade, is the average of the scores obtained in the two tests, with rounding to the entire excess.

FINAL MARK ALLOCATION CRITERIA
Because the overall outcome of the evaluation is positive, the student must achieve at least the sufficiency, equal to 18/30, in each of the tests described above. The highest rating is achieved by demonstrating a thorough understanding of the course content in the tests. Laudem is given to students who, having done all the tests so correctly, have demonstrated a particular brilliance in the exposition and in the preparation of written test.

Recommended reading
Cappello A., Cappozzo A., di Prampero P.E.: Bioingegneria della Postura e del Movimento, Pàtron editore, 2003. Allard P., Cappozzo A., Lundberg A., Vaughan C.L. : Three-dimensional Analysis of Human Locomotion, Wiley, Chichester, England, 1997. Fioretti S.: Lesson notes

Biomedical Signal and Data Processing

Laura Burattini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Basic knowledge of Matlab and signal processing.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
Know and understand the main theoretical and practical tools for data acquisition and numerical processing of data and one-dimensional biomedical signals. The aim is to extract significant parameter for a clinical classification of the analyzed subjects. Case studies will cover the development of the electrocardiographic signal (ECG) and electromyogram (EMG).
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
This course is characterizing for the engineering sector (ING-INF / 06) and will allow to apply knowledge about the main theoretical and practical tools for biomedical data acquisition and processing to electrocardiographic (ECG) and electromyographic (EMG) signals. The students will also have to use such knowledge to develop a research project during the lab classes.
TRANSVERSAL SKILLS:
Abilities in synthesis, in group working, in orally reporting topics, in understanding clinical issues, in computer programming and in using specific instrumentation. Abilities to understand and critically analyze scientific papers an in contributing to the development of scientific projects, also thanks to basic knowledge of medicine, signal processing and advance analysis.

Program
Theory. Biomedical signals and classification according to their nature and characteristics. The four fundamental stages of biomedical signal processing (acquisition, transformation, selection of parameters and classification). Examples (electrocardiogram, electromyogram, EEG). Frequency analysis of biomedical signals: from the Fourier series to the continuous and discrete Fourier transforms. Analog/digital conversion and sampling theorem. FFT algorithm. Application examples (Tachogram). Z transform. Input-output relations: difference equations and transfer functions. Numeric filters (FIR and IIR) and their graphics solution. Random variables and their use in clinical decision. Bayes theorem. Clinical test, contingency table, correlation measures (sensitivity and specificity) and positive predictive value (prevalence). ROC curves and definition of a threshold. Coefficient of correlation, regression and least squares method. Stochastic process. Stationarity and ergodicity. Wiener-Kinchin for estimating spectral power. Tutorial. Exercises of practical application of theoretical knowledge. Development of a Matlab project.

Development of the course and examination
LEARNING EVALUATION METHODS
The level of student learning will be defined by evaluating: i) a written test, which is mandatory, 2.5-hour long , and consisting of 4 practical e exercises and a theoretical question. II) the developed Matlab project iii) a oral test, which is optional and consisting of 3 theoretical questions. The oral test can be accessed by the student only if he/she passed the written test (score of 18 or more).

Written and oral tests must be done in the same appeal.

LEARNING EVALUATION CRITERIA
In order to pass the written exam, students must demonstrate that they have acquired a knowledge of the subject theoretical principles such that they learned how to use them in solving practical problems. The written test will be considered to be positive if and only if the exercise on the filter is at least partially solved (30%). Overall, the written test will be graded from 0 to 30. The Matlab project will be graded from 0 to 30. The oral test, if sustained, will be graded from 0 to 30.

LEARNING MEASUREMENT CRITERIA
Attribution of the final mark out of thirty

FINAL MARK ALLOCATION CRITERIA
The final mark (V) will be computed using the mark pf the written test (V1), the mark of the Matlab project (V2) and the mark of the oral test (V3), if sustained, as follows: -if no oral test sustained: V=0.7 V1+ 0.3 V2. -if oral test sustained : V=0.7 ((V1+V2)/2)+0.3 V2. The honors will be given to students who, having achieved the highest rating, have demonstrated complete mastery of the subject.

Recommended reading
1)Jackson LB. Digital filters and signal processing , Kluwer Academic Publishers, Boston, 1993. 2) Oppenheim A, Schafer R. Discrete-Time signal processing , Prentice Hall, Englewood Cliffs, NJ, 1989. 3) Peebles PZ. Probability, random variables, and random signals principles , McGraw-Hill Inc., Boston, 2001. 4) Akay M. Biomedical signal processing ,Academic Press, San Diego, 1994. 5) Dispense.

Bionanotechnology

Francesco Simoni

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
Knowledge of basic elements of differential and integral calculus and of the basic physical and chemical processes.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
Acquire the main concepts related to the following topics: interaction of radiation with biological material, optical techniques to the study of biomaterials, biosensors, optical micromanipulation techniques and miniaturization applied to biological systems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
This free-choice course, will provide students with the ability to use optical techniques for the study of biomaterials, biosensors, optical micromanipulation techniques. The student has to demostration to know the main concepts related to the following topics: interaction of radiation with biological matter, techniques optical study of biomaterials, biosensors, optical micromanipulation techniques and miniaturization applied to biological systems
TRANSVERSAL SKILLS:
The course includes subjects related to biophotonics, optical manipulation, nano and microfluidics , they will be studied with the aim of highlighting the need of the student to develop transversal skills in order to get a critique view and a deeper knowledge of devices related to biomedical engineering.

Program
Introduction to biotechnologies, summary on optical biosensors and Lb-on-Chip technology. Basics of optics. Main properties of laser radiation. Basics of microfluidics. Optofluidic microlasers. Biosensors based on optical resonators, evanescent wave,surface plasmons, interferometric effects. Optical tweezers: fundamentals and methods. Applications of optical tweezers in biotechnologies.

Development of the course and examination
LEARNING EVALUATION METHODS
oral examination; the student is asked to present the main concepts concerning some proposed topics included among the ones of the programme.

LEARNING EVALUATION CRITERIA
It is evaluated the acquisition of the main concepts related to the following topics: Lab-on-Chip technology, principles of optical biosensing, optofluidic devices, optofluidic lasers, optical tweezers and its applications in biotechnologies.

LEARNING MEASUREMENT CRITERIA
It is evaluated the degree of acquisition and understanding of the discussed topics. In particular it is evaluated the degree of understanding of working principles and methods of realization of photonic

devices included in the programme.

FINAL MARK ALLOCATION CRITERIA

The maximum score, thirty cum laude, is given to students showing full acquisition of the discussed topics and ability of finding links between the different concepts. The minimum score, eighteen, is given to student showing a sufficient knowledge of the discussed topics and understanding of some methods and devices included in the programme.

Recommended reading

Lecture notes of teachers. Other readings: P.N.Prasad Introduction to Biophotonics - Wiley Interscience, P.N.Prasad Nanophotonics - Wiley Interscience. Review articles on discussed topics.

C.I. - Modulo di Diritto Urbanistico (30 ore) (EA)

Salvatore Menditto

Seat Ingegneria
A.A. 2016/2017
Credits 3
Hours 30
Period 1s

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course programme is constituent part of administrative law, in particular the organisation and procedures of the PA. The matter of territorial Government is specifically addressed. Therefore, planning and scheduling and their instruments: the PRG, implementation plans, the development plan, the building regulations. Is treated also matter of construction or of securities qualifying. Some mention is also offered with regard to environmental proceedings. The student should acquire a good ability to frame the scope of interest in urban development discipline-General construction.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
This course aims not only to make known the on urban development, but also to do gain the ability to orient themselves in the research of the relevant legislation, as well as the correct understanding and interpretation thereof. Another objective is to provide the basics of operating the PA and allow a correct relation with the same.
TRANSVERSAL SKILLS:
Acquisition of legal terminology, such that the actual understanding of the provisions applicable to sectors other than that of course. Ability to search the rules and apply them, even as interpreted by the jurisprudence. Awareness of the importance of the study of legal rules, which constitute and integrate the so called good technique and drive, then, the engineer in the performance of their profession.

Program
Principles generate them and organizational of the government of the territory - Profiles generate them: the urban planning, the government of the territory, the building, the protection of the atmosphere and the jobs publics (distinctions and possible superimpositions) - Organizational Profiles: the relationships between the various constituent Agencies the Republic in the matter of the government of the territory: title V of the Constitution - The legislative competences and the administrative functions: State, Regions, Province and Comuni - The national discipline and the regional role of that (and communal one) - The planning urban planning of directives - The planning metropolitan and communal urban planning - Building Regulations and program of fabrication - The planning performance urban planning - the pluriennali programs of performance (P.P.A.) - The residential public building and the plans of zone for the economic and popular building - The recovery plans - the safeguard measures - Ties to the management of the territory - The regime of urban public works - The eminent domain - Construction activity (fews) - Environmental legislation and environmental processes: VIA; VAS; AIA - Access on urban planning and environmenta

Development of the course and examination
LEARNING EVALUATION METHODS

the evaluation is done through a written exam, with multiple questions and domnda open on topics covered during the course. If the test is not successful or if soddisfarcente we proceed with the oral test.

LEARNING EVALUATION CRITERIA
in the exam, students must demonstrate that they have learned the basics and know how to read and apply the law illustrated lecture. also evaluates the ability to link between different legal institutions and knowledge of the fundamental principles of matter.

LEARNING MEASUREMENT CRITERIA
understanding fundamental institutions - connection capacity - personal study of issues - technical language mastery

FINAL MARK ALLOCATION CRITERIA
correctness and completeness of answers depending on the difficulty of the question - presentation skills - understanding the principles fondamemtali - parameterisation 30/30

Recommended reading
Aldo Fiale, Compendio di Diritto Urbanistico, Ed. Simone, ult. ed.

C.I. - Modulo di Legislazione delle Opere Pubbliche e dell'Edilizia (30 ore) (EA)

Luigi Pianesi

Seat Ingegneria
A.A. 2016/2017
Credits 3
Hours 30
Period 1s

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire knowledge on the following topics: general notions of law. D.lgs. 24 aprile 2006, n. 163. Definition of public procurement; responsible authorities for planning public works and successful performance; private and public contracts; the realization of the public works systems; public works programming; planning and design assignments; participants in the competitions and the qualification system; the procedures for selecting the contractor and the award criteria; contract and concession contract; project financing; the execution of the contract; liability of contractor. The d.lgs. 9 aprile 2008, n. 81 and the security.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will be able to identify, reconstruct and interpret the regulatory framework for the different aspects of the subject and the rules applicable to the concrete case specific, using all the instruments (legal sources, the Supervisory Authority deliberations, jurisprudence) useful also for deal in the future an independent investigation of these issues , certainly necessary for the performance of the profession, both as an independent professional, that employed by a public administration
TRANSVERSAL SKILLS:
The student must acquire a method to identify and understand the legal issues, which also is used in technical subjects that presuppose and require the knowledge of the legal system studied during the course.

Program
General notions of law. D.lgs. 18 aprile 2016, n. 50. Definition of public procurement; responsible authorities for planning public works and successful performance; private and public contracts; the realization of the public works systems; public works programming; planning and design assignments; participants in the competitions and the qualification system; the procedures for selecting the contractor and the award criteria; contract and concession contract; project financing; the execution of the contract; liability of contractor. The d.lgs. 9 aprile 2008, n. 81 and the security.

Development of the course and examination
LEARNING EVALUATION METHODS
Oral exam, possibily preceded by a written test.

LEARNING EVALUATION CRITERIA
Understanding of the subject, ability to link and reconstruction of the discipline, property and precision in language.

LEARNING MEASUREMENT CRITERIA
Understanding of the subject, ability to link and reconstruction of the discipline, property and precision in language.

FINAL MARK ALLOCATION CRITERIA
Understanding of the subject, ability to link and reconstruction of the discipline, property and precision in language.

Recommended reading
The updated text will be indicated as soon as available

C.I. - Modulo di Sociologia (30 ore) (EA)

Norma Barbini

Seat Ingegneria
A.A. 2016/2017
Credits 3
Hours 30
Period 1s

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
From a sociological perspective, the aim of this course is to provide conceptual and analytical tools in order to identify and reflect critically about the main social phenomena related to the development of urban contexts, both in an historical perspective and regarding the ongoing phase. The main urban issues considered in this course will range from the urban structure, to the processes of urban segregation, mobility dynamics and quality of life in urban contexts.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Students will be invited to apply the conceptual and analytical tools provided during the course, through a selection and a critical reflection about one of the main urban issues related to the spatial context in which they live. Moreover, this exercise will be aimed also to identify potential urban policies in order to tackle the social problems related to selected urban questions.
TRANSVERSAL SKILLS:
The aim of this course is to expand the conceptual and analytical tools which can be applied in the design and organization of urban contexts, taking into account also the social implications related to urban dynamics.

Program
Content (30 hours) The course aims to provide students with a thorough insight of the complex interactions between society and territory through an approach that contextualizes the different knowledge of the discipline: analysis of social organization; aid communication and interaction; the city throughout history, urbanization, globalization, sustainable development. The main urban issues that will be addressed will range from the Urbis, the residential segregation processes, the dynamics of mobility and quality of life.They also developed methods of observation and collection of urban and social phenomena data with the presentation of case studies in the classroom.

Development of the course and examination
LEARNING EVALUATION METHODS
The exam consists of an oral test. Are provided for optional tests of ongoing evaluation, substantial: in the preparation of a report group on a topic of your choice of interest of the subject and a discussion of one of the chapters of the recommended text

LEARNING EVALUATION CRITERIA
The student, during the oral test, will have to demonstrate knowledge of the fundamentals of the subject. To successfully pass the oral exam, the student must demonstrate an overall understanding of teaching content, state sufficiently exposed with the use of appropriate technical terminology. The highest rating will be achieved by demonstrating a thorough understanding of

teaching content, exposed with complete mastery of technical language.

LEARNING MEASUREMENT CRITERIA
It evaluates the autonomous capacity not the student to set up and solve problems that are placed. In case the student wishes to take the tests in the pipeline, it will be assigned to each of the tests a score between zero and thirty. The overall grade, out of thirty, is the average of the marks obtained in the tests, with rounding to the entire excess. In case the student wishes to take the oral test, it will be made an attribution of the final mark out of thirty.

FINAL MARK ALLOCATION CRITERIA
At the end of the exam the student must possess the full baggage of knowledge. Additional score, compared to the minimum grade of 18, must be allocated according to the command of general and specific skills. The honors will be given to students who, having achieved the highest rating, have demonstrated a particular mastery of the subject.

Recommended reading
Giampaolo Nuvolati (a cura di), Lezioni di sociologia urbana , Il Mulino

Calcolatori Elettronici e Reti di Calcolatori

Adriano Mancini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Basic knowledge of C programming language

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to get knowledge of the different architectures of single/multi-processor computers, and network architectures and protocols, also introducing elements related to digital security. This knowledge is integrated in a larger framework with the foundations on computer science and operative systems, driving the student to a thorough understanding of the principles underlying the functioning of modern computer systems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
At the end of the course the students will be able to apply the acquired knowledge to: critically analyze several architectures of computers for future projects; critically analyze the HW, FW, SW components that are involved in the implementation of a processing/computing system; critically analyze various protocols for the transmission of data in the context of computer networks; propose efficient and reasoned solutions to complex problems; decode and evaluate the data contained in technical documents such as datasheets with particular reference to the micro-micro-processor/controller.
TRANSVERSAL SKILLS:
The course enables students to reinforce the ability for system analysis & design that usually requires a multi-disciplinary approach also considering the transversality of the course. Small work groups of students will be formed to increase their communication skills becoming part of a team and presenting the result of work in a structured way. This allows the study of a specific theme / topic that develops and enforces analytical and synthesis skills.

Program
The course is divided into two parts. The first is intended to give students a basic understanding of the architecture of computers. The second aims to provide a basic understanding of computer networks. Topics Computers part: 1) Computer Architectures 2) Logic Operations in ALU 3) Registers and Cache 4) Bus and arbitration 5) Instructions and Microinstructions 6) Processors (pipeline, superscalar,) 7) Central Memory 8) Storage Memory 9) Interrupts and I/O devices Computer Networks part: 10) Introduction to computer networks 11) Communication protocols 12) Physical Level 13) Data Link Level 14) Network Level 15) Transport Level

Development of the course and examination
LEARNING EVALUATION METHODS
The exam consists on two main parts: technical report and oral. The technical report part is the development of an educational project that is discussed during the examination session. The discussion starts from the assigned educational project exploring also additional concepts presented during the course (both Computer Architecture and Computer network).

LEARNING EVALUATION CRITERIA
To successfully pass the assessment of learning , the student must demonstrate a well-established knownledge of concepts presented in the course. The education project consists on two parts: state of the art (10h) and development (10h). The work could be done in groups formed by two students.

LEARNING MEASUREMENT CRITERIA
During the exam the student will be prompted to first discuss its project. After the first part of the exam the student should answer to the questions which covers the course and related concepts.

FINAL MARK ALLOCATION CRITERIA
The minimum mark is 18/30. The laude could be assigned to students that demonstrate a complete knowledge of concepts presented during the course.

Recommended reading
William Stallings, Computer Organization and Architecture Designing for Performance, 9th/ed. , Pearson Andrew S. Tanenbaum, Computer Networks 5th/ed , Pearson

Calcolo delle Probabilità e Statistica Matematica

Lucio Demeio

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
Elementary algebra. Differential and integral calculus of the functions of one and more variables.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The aim of the course is that of providing the theoretical, methodological and practical elements of probability theory and statistics with the objective of acquiring the knowledge needed in order to analyze data sets. In particular, the course aims at providing the student with the basic elements of probability distributions and of some standard problems of statistics, suche as parameter estimation and hypothesis testing.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to develop the student s ability to use statistical methods towards the formulation of models, the analysis and the solution of problems, the main classical results of probability and statistics will be introduced, accompanied by numerous applications. This path will lead the student to achieving the capability of using the elements of probability theory and the tools of descriptive and inferential statistics, in order to model quantitatively those problems which arise in information engineering and need a statistical description.
TRANSVERSAL SKILLS:
Individual and collective problem-solving sessions will improve the ability to develop independent thought and learning capabilities. Oral presentations of the main topics introduced in the course will help developing communication skills.

Program
Probability spaces. 2. Discrete random variables. 3. Continuous random variables. 4. Convergence and approximation: law of large numbers and central limit theory. 5. Mathematical statistics: estimates, sampling, regression, hypothesis tests.

Development of the course and examination
LEARNING EVALUATION METHODS
The exam consists of a written test and a colloquium: - both tests will concern the topics of the current academic year; possible exceptions will be assessed on a case-by-case basis; - registration to the first written test is mandatory, and has to be done on line on the university platform Esse3 (the link is available on the teacher's web page); - the written test consists of a number of problems and questions concerning all topics treated during the course; this test will last two or three hours, and the student will not be permitted the use of any kind of material, but for a pocket calculator; - a minimum score of at least 18/30 in the written test is required for the admission to the oral test; - the list of the names of the students admitted to the oral test will be published by the teacher on his official web page; - the oral test will contain mainly theoretical questions, some of which may have to be formulated in written form, and may contain problems and exercises concerning course topics not covered in the written test or course topics in which the student may have shown weaknesses in

the written test; - questions of general comprehension may be asked both in the written and in the oral test and may concern any of the course topics; - in the case of a successful written test, the student may sit for the oral test either in the same session or in the next available session, but not later; - in the case of a successful written test, but a not passing grade in the oral test, the student may try the oral test again in the next available session; in case of another failure, the student will have to sit for the whole exam again; - all written tests must be presented in readable form, with a negligible amount of corrections, which must anyway not mar the esthetics of the text; the exposition must be clear, fluent, well organized and consistent both in the mathematical and in the linguistic aspects; - honor code: each student pledges that the written tests are entirely his/her own work and that no input from other students or sources has been used; demeanors which are deemed unfair or not in line with these principles entail the failing of the exam.

LEARNING EVALUATION CRITERIA

In order to pass the exam, the student must demonstrate understanding of all the topics covered and concepts introduced during the course and published on line as Final program or Exam program at the end of the course, and to be able to use them in solving typical problems of probability and statistics.

LEARNING MEASUREMENT CRITERIA

The student must demonstrate to have acquired deep knowledge on the fundamental principles and techniques of probability and statistics and on the solution of typical problems arising within the topics covered during the course.

FINAL MARK ALLOCATION CRITERIA

The highest grade of 30/30 will be given to those students which will have shown deep knowledge and perfect mastering of all the course topics and the ability of working with full independence both in solving the assigned problems and in the oral presentation. The lowest passing grade of 18/30 will be given to the students which will have shown sufficient knowledge and good mastering of all the course topics.

Recommended reading

Sheldon M. Ross, Probabilità e statistica per l'ingegneria e le scienze (a cura di F. Morandin), Apogeo 2008; T. T. Soong, Fundamentals of Probability and Statistics for Engineers, Wiley 2004

Calcolo Numerico

Dario Genovese

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Mathematics I

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The aim of the course is that of providing the theoretical, methodological and practical elements of numerical analysis. The objective is that of managing efficiently the modeling problems which arise in the analysis of production and logistic processes and, more generally, of business processes and technology organization problems, which arise in firms operating in both the industrial and the services fields. In particular, the course aims at providing the student with: understanding the difference between the analytical and the numerical approach to mathematical problems; the abality of analysing and justifying the algorithms employed; determine the solutions of the problems under study and estimate the errors induced by the numerical approximation
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
: The main classical results of Numerical Analysis, accompanied by numerous applications, will be introduced, in order to develop the student s ability to model, analyze and solve problems. This path will lead the student to achieving the capability of: quantitatively modelling decisional problems by means of mathematical programming; choosing the numerical method best suited to the problem under scrutiny; using mathematical and scientific software as supporting tools for the solution of numerical problems of engineering science.
TRANSVERSAL SKILLS:
The expertise acquired in this course will be needed in order to study the material of later courses. Individual and collective problem-solving sessions, aimed at detecting, formulating and solving engineering management problems, will improve the ability to develop independent thought and learning capabilities. Oral presentations of the topics taught in the course, with the language proper of the basic disciplines of the degree course will help developing communication skills.

Program
LINEAR ALGEBRA - Vectors, matrices, linear systems and transformations, Gauss elimination, diagonalization, eigenvalues and eigenvectors. DIFFERENTIAL EQUATIONS - First order differential equations, n-th order differential equation with constant coefficients, variation of constants method, order reduction method NUMERICAL ALGORITHMS - Lagrange interpolation, spline, numerical integration and differentiation, Euler's method for initial value problems, iterative methods for solving linear systems, least square method, iterative methods for calculating eigenpairs, iterative methods for non-linear systems, numerical methods for boundary values problems. Some of the algorithms will be illustrated also through the implementation of electronic spreadsheet.

Development of the course and examination
LEARNING EVALUATION METHODS

The exam consists in a written and an oral test. If the written test is passed, the student can sustain the final oral test. The student must sustain the oral examination within the date of the next written exam.

LEARNING EVALUATION CRITERIA
In the written exam the student must show to know how to practically and independently use the tools described during lectures to solve simple problems. In the oral examination he must show to know the theoretical fundations of such tools, and to be able to implement the numerical algorithms described during lectures using a programming language or spreadsheet.

LEARNING MEASUREMENT CRITERIA
Written examination consists in 3 problems on linear geometry, linear algebra and differenital equations. Each problems is evaluated up to 4 points. The exam is passed if the student collects a total of 6 points, but he must collect at least one point in each problem. Oral examination is a discussion on an algorithm chosen by the student and implemented on an electronic spreadsheet or computer language. Then, the discussion will be driven by the teacher on the theoretical subjects of the course topics.

FINAL MARK ALLOCATION CRITERIA
Final mark is in thirties, with possible honours. It is given by weightening the resuls of oral and written examinations. Oral examination has a higher weight.

Recommended reading
M.Bramanti, C.D. Pagani, S. Salsa Matematica - Calcolo infinitesimale e algebra lineare . Zanichelli. R.L Burdem, J.D. Faires Numerical Analysis . Cengage Learning

Campi Elettromagnetici

Antonio Morini

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
Electromagnetics, fundamentals, Physics, Calculus, Linear Algebra.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
Knowledge of the equations governing Electromagnetic phenomena and solution in a number of relevant cases, including radiation and guided propagation. Wave propagation speed. Energy and power. Knowledge of the Circuital models of basic. electromagnetic problems Measurement of radiated and guided electromagnetic waves.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Being able to evaluate the electromagnetic fields in problems concerning reflection, refraction, and interference of plane waves in linear and isotropic media. Being able to evaluate the electromagnetic fields of plane waves propagating within a magnetized ferrite. Being able to evaluate the electromagnetic fields of waves propagating in a coaxial and a rectangular waveguide. Being able to select a waveguide. Being able to measure a standing wave in waveguide due to a mismatched load and to determine the corresponding circuit parameters.
TRANSVERSAL SKILLS:
The study of Electromagnetism requires the student to exploit methods and notions acquired from basic lectures, in particular Physics, Fundamentals of Electromagnetism, Calculus, Linear Algebra, as well as Circuit Theory and Signal Theory. Indeed, it is a multidisciplinary activity, deeply stimulating the synthesis ability, which is a paradigm of the way an engineer faces real problems.

Program
Maxwell's equations. Plane waves. Reflection and Transmission. Radiation: hertzian dipole. Waveguides. Transmission lines representing waveguides. Reciprocity theorem. Excitation of electromagnetic waves in waveguides.

Development of the course and examination
LEARNING EVALUATION METHODS
Written and oral examination. Passing the written part with score higher than 18/30 is a prerequisite to be admitted to the oral examination. The written test consists of three exercises, whose individual score ranges from 8/30 to 12/30. Such exercises concern the main three topics of the course: reflection and rifraction of a plane wave, guided waves, circuit analysis.

LEARNING EVALUATION CRITERIA
The two parts of the exams are aimed at evaluating the candidate's skill in the subject, according to the following parameters: knowlegde, understanding, implementation, presentation. Passing the written past, aimed at assessing both knowlegde and implementation, is a necessary condition for exam success.

LEARNING MEASUREMENT CRITERIA
The purpose of the examination is to assess the candidate's skill. There are three reference levels: base - acquistion of procedures for the solution of canonical problems, as those of the written test. Oral presentation sufficient with a few uncertainesses in the usage of specific language.intermediate - ability to apply the above procedures to problems not obviously related to canonical problems. Oral part presented correcly and in proper order. top - ability of exploiting models and developing strategies requiring the combination of procedures for solving non familiar problems. Oral presentation clear, logical and appropriate.

FINAL MARK ALLOCATION CRITERIA
The mark is allocated on the basis of the acquired knowledge. A score ranging from 18/30 and 23/30 is attributed to the level 'base', a score ranging from 24/30 to 27/30 to the intermediate level, and a score between 28/30 and 30/30 to the top level. A candidate is awarded cum laude when they are able to deal even with new problems in a fully autonomous way.

Recommended reading
S Ramo, J. R. Whinnery, T. Van Duzer: 'Fields and Waves in Communication Electronics', J. Wiley; D. Pozar: Microwave Engineering , Mc Graw Hill

Cantieri Edili

Alessandro Carbonari

Seat Ingegneria
A.A. 2016/2017
Credits 12
Hours 96
Period II

Prerequisites
Knowledge of the typical layout of buildings and of the performances to which their components and sub-systems should comply.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
This course will address the operational issues and methodologies related to the development of shop drawings and to the surveying of the execution phase. With specific reference to specific construction scenarios, this course will look into technical, legislation and operational issues in charge of site engineers and either constructors or general contractors staff. The course will transfer to students the skills needed to manage the execution of construction works, and to coordinate and cooperate with related professionals and colleagues when involved in complex construction works.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
This course will address the development of the detailed plans and specifications into shop drawings and fabrication and construction schemes in charge of constructors, besides controlling the transposition of design requirements within the technical solutions.
TRANSVERSAL SKILLS:
Students will develop the skills necessary to assess the consequences deriving from the management of complex situations, that includes even the effect on safety management determined by the adoption of a set of construction processes and techniques. Moreover, students will develop skills useful for efficiently cooperate with other technicians, not only regarding job site management, but even technical issues in general.

Program
Project contributors and basic requirements for construction site supervision. Roles, responsibilities, authority and relationships among project participants. The phases of construction projects, relevant legislation, technical standards and regulations (including health and safety). The outline of documents to be used on construction sites. Development of detailed plans and specifications for shop drawings, fabrication and construction schemes. Methodologies, calculation and technical information to evaluate the construction project's degree of compliance with its detailed design. Basics of activity and schedule management. Site layouting and control, supervision and operational issues. More specifically, layout planning and organization, site labor relations and control, documentation and record keeping at the construction site, site quality control, model for the assessment of the performance of building components, waste and supply management. Established and state-of-the-art operational issues and procedures for the erection of the most popular types of sub-systems typically used in buildings, according to technical and safety constraints.

Development of the course and examination

LEARNING EVALUATION METHODS
The evalutaion will be carried out by means of one written test and one verbal examination. The written test is aimed at checking students' ability to supervise simulated scenarios concerning the execution phase of buildings, and their knowledge of the basics of supervision. The verbal examination will assess students' ability to report the topics of the course and tailor general methodologies to the management of real scenarios.

LEARNING EVALUATION CRITERIA
In the written test students are required to show their knowledge and capabilities to apply the models and methods for control of the performances of building components, supervision and programming of the construction site. In the verbal examination students are required to show their capabilities to sum up and clearly report the topics of the course, and to apply general methodologies for the management of simulated scenarios.

LEARNING MEASUREMENT CRITERIA
In the written test students are evaluated according to the capability of autonomously dealing with scenarios regarding programming and supervision of construction sites, and according to their knowledge of legislation and basics of site supervision. In the verbal examination students will be evaluated according to their ability to sum up and clearly explain the topics of the course, and to apply the basic methodologies to real scenarios of site supervision.

FINAL MARK ALLOCATION CRITERIA
The top score with compliments will be awarded to those students who have an excellent knowledge of legislation and basics of site supervision, who can autonomously apply models and methods for the supervision and programming of the execution phase. The border line will be awarded to those students who have a good knowledge of legislation and basics of site supervision, and who can manage standard scenarios relative to programming and site supervision.

Recommended reading
P. G. Bardelli, S. Coppo (2010) Il cantiere edile , Dario Flaccovio Editore, ISBN: 978-88-579-0013-1. William R. Mincks and Hal Johnston (2011) Construction Jobsite Management , ed. Cengage Learning, 3rd edition, ISBN-13: 9781439080443/ISBN-10: 1439080445. Flaviano Parise (2009) Il progetto cantierabile , FrancoAngeli ed, ISBN: 978-88-568-1677-8 . Lecture nots that students can download from the Moodle webpage.

Chimica (CA) (A/L)

Liberato Cardellini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Causal reasoning, the ability to argue and algebraic skills and computation skills are needed in order to fully benefit from the course

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide the foundation for a correct understanding and interpretation of chemical phenomena, upon which the technologies in use in engineering are based. The course is directed to the knowledge of the structure and properties of matter, creating a link between the microscopic and macroscopic world.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The course provides the skills needed to apply the knowledge acquired to the analysis and to the comprehension of chemical problems in an engineering context, through the use of laws and methods which represent the foundation of the chemical phenomena. These capabilities will be acquired by the student with the development of suitable exercises requiring the use of models and methodologies described in the lectures.
TRANSVERSAL SKILLS:
The course is designed to stimulate and emphasize connections with the other disciplines, with the aim to improve the learning and communication capacities through the mastery of the basic scientific terminology.

Program
Hydrocarbons. Matter. Symbols and valences. Chemical equation. Electronic configurations of the elements. Periodic properties. Oxidation numbers. Balancing of chemical equations. Chemical bonds. Ionic, covalent and coordinate covalent bonds. Electronegativity. Van der Waals interactions. Hydrogen bond. Molecular geometry. Bond energy. Atomic weight. The mole. Stoichiometric calculations. Percent composition. Limiting reagent. Gas laws. Ideal-gas equation. Gas mixtures. Real gases. Van der Waals equation. Energy, bond formation. Vapour pressure. Physical properties of water. Water phase diagram. Concentration. Fractional distillation. Electrolytes. Degree of dissociation. Chemical equilibrium. Chemical equilibrium constant. Heterogeneous equilibrium. Industrial synthesis of ammonia. Ionic equilibria pH. Strong acids and bases. Weak acids and bases. Conjugate acid-base-pairs. Buffers solution. Electrochemistry. Standard potentials. Hydrogen electrode. Nernst equation. Corrosion.

Development of the course and examination
LEARNING EVALUATION METHODS
The assessment of the level of student learning is carried out at the end of the course by two tests: a written and an oral. To facilitate an ongoing commitment of the students, during the course there will be three partial tests of stoichiometry. There will be three problems in each test. The written exam is passed if the mark of the three partial exceeds 54/30. For those that do not exceed 54/30,

or that do not have access to the partial tests, there will be a written exam. The written test consists in solving four problems onall the topics covered in the course. The written test is preparatory to the oral examination, for access to which the student must solve at least three problems properly. By accessing the oral exam, students will have the opportunity to measure their preparation with a written test on the theoretical part. The oral discussion is devote to deepen knowledge of the topics covered in the course, selected with regard to exploring the preparation of the student on the conceptual topics of the course. In case of a negative outcome of the examination, the student has to repeat the written test.

LEARNING EVALUATION CRITERIA
To successfully pass the assessment of learning, through the written and oral tests, the student must demonstrate that he or she has acquired the ability to solve chemical problems in a meaningful way, to have acquired familiarity with the concepts presented in the course, and to possess an adequate knowledge of fundamental chemical knowledge.

LEARNING MEASUREMENT CRITERIA
In the written test, students must demonstrate that they have understood and assimilated the logic of stoichiometric calculations. Problems are considered solved properly if the procedure is correct from the logical point of view and the relative error of the result does not exceed 1%, taking into account the significant digits theory. During the course, students are trained in problem solving and encouraged to make full verification of the results, as well as explaining the logic of each step. Students will also be encouraged to solve appropriate problems designed to develop original and creative solutions. Important is the student's ability to argue and reason causally during the oral examination.

FINAL MARK ALLOCATION CRITERIA
The overall outcome of the evaluation will be positive if the student achieve sufficiency, or at least 18 points, in each of the two tests. The final grade is the result of the average of the marks obtained in the two tests. The honors will be given to students who having achieved the highest rating, have passed brilliantly both tests.

Recommended reading
Per la teoria: L. Palmisano, M. Schiavello, Elementi di chimica, EdiSES: Napoli, 2007; oppure: W.L. Masterton, C.N. Hurley, Chimica. Principi e reazioni, Piccin: Padova, 2010; oppure: N. J. Tro, Introduzione alla chimica, Pearson: Milano, 2013. Per la stechiometria: L. Cardellini, Strategie per il problem solving in chimica, Ragni: Ancona, 2014.

Chimica (EDI)

Pierluigi Stipa

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide the foundation for a correct understanding and interpretation of chemical phenomena, upon which the technologies in use in engineering are based. The course is directed to the knowledge of the structure and properties of matter, creating a link between the microscopic and macroscopic world.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The course provides the skills needed to apply the knowledge acquired to the analysis and to the comprehension of chemical problems in an engineering context, through the use of laws and methods which represent the foundation of the chemical phenomena. These capabilities will be acquired by the student with the development of suitable exercises requiring the use of models and methodologies described in the lectures.
TRANSVERSAL SKILLS:
The course is designed to stimulate and emphasize connections with the other disciplines, with the aim to improve the learning and communication capacities through the mastery of the basic scientific terminology.

Program
Matter and its structure: substances, properties, systems, phases and transformations. Symbols, formulas, equations. Mass conservation, relative atomic, molecular, and equivalent mass; mole. Avogadro's number. Atomic structure. Nuclides and radioactive decays. The Rutherford experiment. Heisenberg Uncertainty Principle and De Broglie equation. Quantization, wavefunction, Schroedinger equation and orbitals. Periodic table and properties. Valence bond theory: energy, angle and bond length. Hybridization and molecular geometry; dipole moment and polar molecules. Molecular orbitals (LCAO). Bonding in metals and electrical conductivity in materials: conductors, semiconductors and insulators; mentions on doping. Ionic bond and lattice energy. Intermolecular interacrions: hydrogen bonds, Van der Waals and London forces. The states of matter. Ionic, covalent, molecular and metallic solids. Crystals: properties and defects. Liquids: vapor pressure, ideal and real solutions. Concentrations: molarity, normality, mole fraction, percentages by volume and by weight, parts per million. Ideal and real gases: state equations and liquefaction. Chemical transformations. Thermodynamics: Reversible and irreversible transformations. First Principle and Thermochemistry: Internal Energy and Standard Enthalpy of Reaction, formation, combustion, solution and phase transition. Hess's Law. Second Principle and Entropy. Probability Thermodynamics State. Third Principle. Spontaneity and Gibbs Free Energy. Chemical equilibrium and equilibrium constant. Van't Hoff equation, Le Chatelier's principle and temperature dependence of the equilibrium constant. Gas phase and solution Equilibria. Aqueous solutions Ionic equilibria: acids, bases and pH. Salts: hydrolysis and solubility product. Phases Equilibria. Phase diagrams

with one and two components with and without miscibility lacunae. Cooling curves, Clausius-Clapeyron Equation and Gibbs Rule. Electrochemical Thermodynamics: double layer, electromotive force and Nernst equation. The redox potentials scale. Corrosion in metals. Electrolysis and Faraday's laws: opposite electromotive force and overvoltage. Chemical kinetics: reaction rate and order. Reaction mechanism, transition state theory and activation energy. Arrhenius equation. Homogeneous and heterogeneous catalysis.

Development of the course and examination

LEARNING EVALUATION METHODS

The method consists in a written test and an oral exam. In the written test, students must deal with stoichiometry problems and answer to selected theoretical questions. In the oral exam students are asked to discuss their written test, and to present the main concepts of basic chemistry developed within the course.

LEARNING EVALUATION CRITERIA

In the course of the exams, students must demonstrate their basic chemical knowledge, and must be able to develop appropriate reasoning for their applications; they must also demonstrate sufficient capabilities to synthesize and clearly present ideas, concepts and possible solutions to basic chemical problems typical in engineering.

LEARNING MEASUREMENT CRITERIA

During the examinations is evaluated the student's ability to set and develop reasoning to interpret the basic chemical problems typical in engineering.

FINAL MARK ALLOCATION CRITERIA

The final mark arises from the average of the written and oral exams. The maximum vote, equal to thirty points (cum laude) out of thirty, is assigned to students who demonstrate, in both exams, full capability in the interpretation of the basic chemical phenomena and to set logical processes for the understanding of basic chemical problems related to engineering. The minimum mark, equal to eighteen points out of thirty, is assigned to students who demonstrate sufficient capability of interpretation of the basic chemical phenomena, and to set logical processes for the understanding of basic chemical problems related to engineering.

Recommended reading

P. Chiorboli, Fondamenti di Chimica , Utet M. Schiavello, L. Palmisano, Fondamenti di Chimica , Edises P. Zanello, R. Gobetto, R. Zanoni, Conoscere la Chimica , Ambrosiana M.S. Silberberg, Chimica, la natura molecolare della materia e delle sue trasformazioni , McGrawHill; L. Laird, Chimica Generale , McGraw-Hill D. W. Oxtoby, H. P. Gillis, Campion, H. H. Helal, K. P. Gaiter, Chimica Moderna , Edises K. W. Whitten, R. E. Davis, M. L. Peck, G. G. Stanley, Chimica , Piccin Slides from lessons download: lms.univpm.it

Chimica (EL)

Liberato Cardellini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Causal reasoning, the ability to argue and algebraic skills and computation skills are needed in order to fully benefit from the course

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide the foundation for a correct understanding and interpretation of chemical phenomena, upon which the technologies in use in engineering are based. The course is directed to the knowledge of the structure and properties of matter, creating a link between the microscopic and macroscopic world.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The course will furnish the skills needed to apply the knowledge acquired to the analysis and to the comprehension of chemical problems in an engineering context, through the use of laws and methods which represent the foundation of the chemical phenomena. These capabilities will be acquired by the student with the development of suitable exercises requiring the use of models and methodologies described in the lectures. The ability to apply the acquired knowledge will be assessed through a written exam followed by an oral exam.
TRANSVERSAL SKILLS:
The course is designed to stimulate and emphasize connections with the other disciplines, with the aim to improve the learning and communication capacities through the mastery of the basic scientific terminology.

Program
Hydrocarbons. Matter. Symbols and valences. Chemical equation. Electronic configurations of the elements. Periodic properties. Oxidation numbers. Balancing of chemical equations. Chemical bonds. Ionic, covalent and coordinate covalent bonds. Electronegativity. Van der Waals interactions. Hydrogen bond. Molecular geometry. Bond energy. Atomic weight. The mole. Stoichiometric calculations. Percent composition. Limiting reagent. Gas laws. Ideal-gas equation. Gas mixtures. Real gases. Van der Waals equation. Energy, bond formation. Vapour pressure. Physical properties of water. Water phase diagram. Concentration. Fractional distillation. Electrolytes. Degree of dissociation. Chemical equilibrium. Chemical equilibrium constant. Heterogeneous equilibrium. Industrial synthesis of ammonia. Ionic equilibria pH. Strong acids and bases. Weak acids and bases. Conjugate acid-base-pairs. Buffers solution. Electrochemistry. Standard potentials. Hydrogen electrode. Nernst equation. Corrosion.

Development of the course and examination
LEARNING EVALUATION METHODS
The assessment of the level of student learning is carried out at the end of the course by two tests: a written and an oral. To facilitate an ongoing commitment of the students, during the course there will be three partial tests of stoichiometry. There will be three problems in each test. The written

exam is passed if the mark of the three partial exceeds 54/30. For those that do not exceed 54/30, or that do not have access to the partial tests, there will be a written exam. The written test consists in solving four problems onall the topics covered in the course. The written test is preparatory to the oral examination, for access to which the student must solve at least three problems properly. By accessing the oral exam, students will have the opportunity to measure their preparation with a written test on the theoretical part. The oral discussion is devote to deepen knowledge of the topics covered in the course, selected with regard to exploring the preparation of the student on the conceptual topics of the course. In case of a negative outcome of the examination, the student has to repeat the written test.

LEARNING EVALUATION CRITERIA
To successfully pass the assessment of learning, through the written and oral tests, the student must demonstrate that he or she has acquired the ability to solve chemical problems in a meaningful way, to have acquired familiarity with the concepts presented in the course, and to possess an adequate knowledge of fundamental chemical knowledge.

LEARNING MEASUREMENT CRITERIA
In the written test, students must demonstrate that they have understood and assimilated the logic of stoichiometric calculations. Problems are considered solved properly if the procedure is correct from the logical point of view and the relative error of the result does not exceed 1%, taking into account the significant digits theory. During the course, students are trained in problem solving and encouraged to make full verification of the results, as well as explaining the logic of each step. Students will also be encouraged to solve appropriate problems designed to develop original and creative solutions. Important is the student's ability to argue and reason causally during the oral examination.

FINAL MARK ALLOCATION CRITERIA
The overall outcome of the evaluation will be positive if the student achieve sufficiency, or at least 18 points, in each of the two tests. The final grade is the result of the average of the marks obtained in the two tests. The honors will be given to students who having achieved the highest rating, have passed brilliantly both tests.

Recommended reading
Per la teoria: L. Palmisano, M. Schiavello, Elementi di chimica, EdiSES: Napoli, 2007; oppure: W.L. Masterton, C.N. Hurley, Chimica. Principi e reazioni, Piccin: Padova, 2010; oppure: N. J. Tro, Introduzione alla chimica, Pearson: Milano, 2013. Per la stechiometria: L. Cardellini, Strategie per il problem solving in chimica, Ragni: Ancona, 2014.

Chimica (GEST)

Liberato Cardellini

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
Causal reasoning, the ability to argue and algebraic skills and computation skills are needed in order to fully benefit from the course

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide the foundation for a correct understanding and interpretation of chemical phenomena, upon which the technologies in use in engineering are based. The course is directed to the knowledge of the structure and properties of matter, creating a link between the microscopic and macroscopic world. Fundamental are the logical skills in problem solving that a correct approach to the stoichiometric calculation allows to acquire. Students are asked to make visible the reasoning and organize the knowledge acquired through summaries and concept maps.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The course will furnish the skills needed to apply the knowledge acquired to the analysis and to the comprehension of chemical problems in an engineering context, through the use of laws and methods which represent the foundation of the chemical phenomena. These capabilities will be acquired by the student with the development of suitable exercises requiring the use of models and methodologies described in the lectures. Students are asked to explain, illustrate, represent and argue the steps in solving the problems.
TRANSVERSAL SKILLS:
The course is designed to stimulate and emphasize connections with the other disciplines, with the aim to improve the learning and communication capacities through the mastery of the basic scientific terminology. To this end, the course aims to encourage students to develop an aptitude for logical reasoning, based on the scientific method. Students are required to work in groups according to the cooperative learning method. This method helps the students to improve both the independent judgment, and the communication skills. Other benefits that stem from the teamwork are the ability to learn independently and to draw conclusions.

Program
Hydrocarbons. Classification of the matter. Symbols and valences. Chemical equations. Atomic number. Atomic weight. The mole. Stoichiometric calculations. Limiting reagent. The Bohr atom. Quantum numbers The Pauli principle of exclusion and the Hund s rule. Electronic configurations of the elements. Periodic properties. Electronegativity. Oxidation numbers. Balancing of redox equations. Chemical bonds. Hydrogen bonding. VSEPR theory. Energy in the chemical reactions. Gas laws. Concentration of solutions. Electrolytes. Chemical equilibrium. The water dissociation. pH. Acid-base theories. Buffer solutions. Hydrolysis. Hardness of water. BOD e COD. Colloids and intermolecular interactions. Zeta potential and aggregation mechanisms.

Development of the course and examination
LEARNING EVALUATION METHODS

The assessment of the level of student learning is carried out at the end of the course by two tests: a written and an oral. To facilitate an ongoing commitment of the students, during the course there will be two partial tests of stoichiometry. There will be three problems in each test. The written exam is passed if the sum of the mark of the two partials exceeds 36/30, (with a minimum mark greater or equal to 15). For those that do not exceed 36/30, or that do not have access to the partial tests, there will be a written exam. The written test consists in solving four problems onall the topics covered in the course. The written test is preparatory to the oral examination, for access to which the student must solve at least three problems properly. By accessing the oral exam, students will have the opportunity to measure their preparation with a written test on the theoretical part. The oral discussion is devote to deepen knowledge of the topics covered in the course, selected with regard to exploring the preparation of the student on the conceptual topics of the course. In case of a negative outcome of the examination, the student has to repeat the written test..

LEARNING EVALUATION CRITERIA
To successfully pass the assessment of learning, through the written and oral tests, the student must demonstrate that he or she has acquired the ability to solve chemical problems in a meaningful way, to have acquired familiarity with the concepts presented in the course, and to possess an adequate knowledge of fundamental chemical knowledge.

LEARNING MEASUREMENT CRITERIA
In the written test, students must demonstrate that they have understood and assimilated the logic of stoichiometric calculations. Problems are considered solved properly if the procedure is correct from the logical point of view and the relative error of the result does not exceed 1%, taking into account the significant digits theory. During the course, students are trained in problem solving and encouraged to make full verification of the results, as well as explaining the logic of each step. Students will also be encouraged to solve appropriate problems designed to develop original and creative solutions. It is also important the student's ability to argue and reason causally during the oral examination.

FINAL MARK ALLOCATION CRITERIA
The overall outcome of the evaluation will be positive if the student achieve sufficiency, or at least 18 points, in each of the two tests. The final grade is the result of the average of the marks obtained in the two tests. The honors will be given to students who having achieved the highest rating, have passed brilliantly both tests.

Recommended reading
For the theory: L. Palmisano, M. Schiavello, Elementi di chimica , EdiSES; or: W.L. Masterton, C.N. Hurley, Chimica. Principi e reazioni , Piccin; Lecture notes. For the stoichiometric calculation: L. Cardellini, Strategie per il problem solving in chimica , Ragni.

Chimica (MECC) (A/L)

Simona Sabbatini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide the foundation for a correct understanding and interpretation of chemical phenomena, upon which the technologies in use in engineering are based. The course is directed to the knowledge of the structure and properties of matter, creating a link between the microscopic and macroscopic world
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The course will furnish the skills needed to apply the knowledge acquired to the analysis and to the comprehension of chemical problems in an engineering context, through the use of laws and methods which represent the foundation of the chemical phenomena. These capabilities will be acquired by the student with the development of suitable exercises requiring the use of models and methodologies described in the lectures. The ability to apply the acquired knowledge will be assessed through a written exam followed by an oral exam
TRANSVERSAL SKILLS:
The course is designed to stimulate and emphasize connections with the other disciplines, with the aim to improve the learning and communication capacities through the mastery of the basic scientific terminology. To this end, the course aims to encourage students to develop an aptitude for logical reasoning, based on the scientific method.

Program
Matter and its structure: substances, properties, systems, phases and transformations. Symbols, formulas, equations. Mass conservation, relative atomic, molecular, and equivalent mass; mole. Avogadro's number. Atomic structure. Nuclides and radioactive decays. The Rutherford experiment. Heisenberg Uncertainty Principle and De Broglie equation. Quantization, wavefunction, Schroedinger equation and orbitals. Periodic table and properties. Valence bond theory: energy, angle and bond length. Hybridization and molecular geometry; dipole moment and polar molecules. Molecular orbitals (LCAO). Bonding in metals and electrical conductivity in materials: conductors, semiconductors and insulators; mentions on doping. Ionic bond and lattice energy. Intermolecular interacrions: hydrogen bonds, Van der Waals and London forces. The states of matter. Ionic, covalent, molecular and metallic solids. Crystals: properties and defects. Liquids: vapor pressure, ideal and real solutions. Concentrations: molarity, normality, mole fraction, percentages by volume and by weight, parts per million. Ideal and real gases: state equations and liquefaction. Chemical transformations. Thermodynamics: Reversible and irreversible transformations. First Principle and Thermochemistry: Internal Energy and Standard Enthalpy of Reaction, formation, combustion, solution and phase transition. Hess's Law. Second Principle and Entropy. Probability Thermodynamics State. Third Principle. Spontaneity and Gibbs Free Energy. Chemical equilibrium and equilibrium constant. Van't Hoff equation, Le Chatelier's principle and temperature dependence

of the equilibrium constant. Gas phase and solution Equilibria. Aqueous solutions Ionic equilibria: acids, bases and pH. Salts: hydrolysis and solubility product. Phases Equilibria. Phase diagrams with one and two components with and without miscibility lacunae. Cooling curves, Clausius-Clapeyron Equation and Gibbs Rule. Electrochemical Thermodynamics: double layer, electromotive force and Nernst equation. The redox potentials scale. Corrosion in metals. Electrolysis and Faraday's laws: opposite electromotive force and overvoltage. Chemical kinetics: reaction rate and order. Reaction mechanism, transition state theory and activation energy. Arrhenius equation. Homogeneous and heterogeneous catalysis.

Development of the course and examination
LEARNING EVALUATION METHODS
The method consists in a written test and an oral exam. In the written test, students must deal with stoichiometry problems and answer to selected theoretical questions. In the oral exam students are asked to discuss their written test, and to present the main concepts of basic chemistry developed within the course.

LEARNING EVALUATION CRITERIA
In the course of the exams, students must demonstrate their basic chemical knowledge, and must be able to develop appropriate reasoning for their applications; they must also demonstrate sufficient capabilities to synthesize and clearly present ideas, concepts and possible solutions to basic chemical problems typical in engineering.

LEARNING MEASUREMENT CRITERIA
The maximum vote, equal to thirty out of thirty points with honors, is assigned to students who demonstrate, in both exams, full capacity in the interpretation of the basic chemical phenomena and to set logical processes for the understanding of chemical problems related to engineering. The minimum mark, equal to eighteen out of thirty points, is assigned to students who demonstrate sufficient capacity of interpretation of the basic chemical phenomena, and to set logical processes for the understanding of chemical problems related to engineering.

FINAL MARK ALLOCATION CRITERIA
The final mark arises from the average of the written and oral exams.

Recommended reading
P. Chiorboli, Fondamenti di Chimica , UTET; M. Schiavello, L. Palmisano, Fondamenti di Chimica , Edises; P. Zanello, R. Gobetto, R. Zanoni, Conoscere la Chimica , Ambrosiana; M.S. Silberberg, Chimica, la natura molecolare della materia e delle sue trasformazioni , McGrawHill; L. Laird, Chimica Generale , McGraw-Hill; K. W. Whitten, R. E. Davis, M. L. Peck, G. G. Stanley, Chimica , Piccin; D.W. Oxtoby, H.P Gillis, A. Campion, Chimica Moderna , EdiSES The slides of the lectures can be found at lms.univpm.it

Chimica (MECC) (M/Z)

Pierluigi Stipa

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide the foundation for a correct understanding and interpretation of chemical phenomena, upon which the technologies in use in engineering are based. The course is directed to the knowledge of the structure and properties of matter, creating a link between the microscopic and macroscopic world
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The course will furnish the skills needed to apply the knowledge acquired to the analysis and to the comprehension of chemical problems in an engineering context, through the use of laws and methods which represent the foundation of the chemical phenomena. These capabilities will be acquired by the student with the development of suitable exercises requiring the use of models and methodologies described in the lectures. The ability to apply the acquired knowledge will be assessed through a written exam followed by an oral exam
TRANSVERSAL SKILLS:
The course is designed to stimulate and emphasize connections with the other disciplines, with the aim to improve the learning and communication capacities through the mastery of the basic scientific terminology. To this end, the course aims to encourage students to develop an aptitude for logical reasoning, based on the scientific method.

Program
Matter and its structure: substances, properties, systems, phases and transformations. Symbols, formulas, equations. Mass conservation, relative atomic, molecular, and equivalent mass; mole. Avogadro's number. Atomic structure. Nuclides and radioactive decays. The Rutherford experiment. Heisenberg Uncertainty Principle and De Broglie equation. Quantization, wavefunction, Schroedinger equation and orbitals. Periodic table and properties. Valence bond theory: energy, angle and bond length. Hybridization and molecular geometry; dipole moment and polar molecules. Molecular orbitals (LCAO). Bonding in metals and electrical conductivity in materials: conductors, semiconductors and insulators; mentions on doping. Ionic bond and lattice energy. Intermolecular interacrions: hydrogen bonds, Van der Waals and London forces. The states of matter. Ionic, covalent, molecular and metallic solids. Crystals: properties and defects. Liquids: vapor pressure, ideal and real solutions. Concentrations: molarity, normality, mole fraction, percentages by volume and by weight, parts per million. Ideal and real gases: state equations and liquefaction. Chemical transformations. Thermodynamics: Reversible and irreversible transformations. First Principle and Thermochemistry: Internal Energy and Standard Enthalpy of Reaction, formation, combustion, solution and phase transition. Hess's Law. Second Principle and Entropy. Probability Thermodynamics State. Third Principle. Spontaneity and Gibbs Free Energy. Chemical equilibrium and equilibrium constant. Van't Hoff equation, Le Chatelier's principle and temperature dependence

of the equilibrium constant. Gas phase and solution Equilibria. Aqueous solutions Ionic equilibria: acids, bases and pH. Salts: hydrolysis and solubility product. Phases Equilibria. Phase diagrams with one and two components with and without miscibility lacunae. Cooling curves, Clausius-Clapeyron Equation and Gibbs Rule. Electrochemical Thermodynamics: double layer, electromotive force and Nernst equation. The redox potentials scale. Corrosion in metals. Electrolysis and Faraday's laws: opposite electromotive force and overvoltage. Chemical kinetics: reaction rate and order. Reaction mechanism, transition state theory and activation energy. Arrhenius equation. Homogeneous and heterogeneous catalysis.

Development of the course and examination
LEARNING EVALUATION METHODS
The method consists in a written test and an oral exam. In the written test, students must deal with stoichiometry problems and answer to selected theoretical questions. In the oral exam students are asked to discuss their written test, and to present the main concepts of basic chemistry developed within the course.

LEARNING EVALUATION CRITERIA
IIn the course of the exams, students must demonstrate their basic chemical knowledge, and must be able to develop appropriate reasoning for their applications; they must also demonstrate sufficient capabilities to synthesize and clearly present ideas, concepts and possible solutions to basic chemical problems typical in engineering.

LEARNING MEASUREMENT CRITERIA
During the examinations is evaluated the student's ability to set and develop reasoning to interpret the basic chemical problems typical in engineering.

FINAL MARK ALLOCATION CRITERIA
The final mark arises from the average of the written and oral exams. The maximum vote, equal to thirty points (cum laude) out of thirty, is assigned to students who demonstrate, in both exams, full capability in the interpretation of the basic chemical phenomena and to set logical processes for the understanding of basic chemical problems related to engineering. The minimum mark, equal to eighteen points out of thirty, is assigned to students who demonstrate sufficient capability of interpretation of the basic chemical phenomena, and to set logical processes for the understanding of basic chemical problems related to engineering.

Recommended reading
P. Chiorboli, Fondamenti di Chimica , Utet M. Schiavello, L. Palmisano, Fondamenti di Chimica , Edises P. Zanello, R. Gobetto, R. Zanoni, Conoscere la Chimica , Ambrosiana M.S. Silberberg, Chimica, la natura molecolare della materia e delle sue trasformazioni , McGrawHill; L. Laird, Chimica Generale , McGraw-Hill K. W. Whitten, R. E. Davis, M. L. Peck, G. G. Stanley, Chimica , Piccin; D. W. Oxtoby, H. P. Gillis, Campion, H. H. Helal, K. P. Gaiter, Chimica Moderna , Edises Slides from lessons download: lms.univpm.it

Chimica per Bioingegneria

Michela Pisani

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide the foundation for a correct understanding and interpretation of chemical phenomena, upon which the technologies in use in engineering are based. The course is directed to the knowledge of the structure and properties of matter, creating a link between the microscopic and macroscopic world.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The course will furnish the skills needed to apply the knowledge acquired to the analysis and to the comprehension of chemical problems in an engineering context, through the use of laws and methods which represent the foundation of the chemical and thermodynamic phenomena, with particular reference to the biological ones. These capabilities will be acquired by the student with the development of suitable exercises requiring the use of models and methodologies described in the lectures.
TRANSVERSAL SKILLS:
The course is designed to stimulate and emphasize connections with the other disciplines, with the aim to improve the learning and communication capacities through the mastery of the basic scientific terminology. To this end, the course aims to encourage students to develop an aptitude for logical reasoning, based on the scientific method.

Program
Matter and its structure: substances, properties, systems, phases and transformations. Symbols, formulas, equations. Mass conservation, relative atomic, molecular, and equivalent mass; mole. Avogadro's number. Atomic structure. Nuclides and radioactive decays. The Rutherford experiment. Heisenberg Uncertainty Principle and De Broglie equation. Quantization, wavefunction, Schroedinger equation and orbitals. Periodic table and properties. Valence bond theory: energy, angle and bond length. Hybridization and molecular geometry; dipole moment and polar molecules. Molecular orbitals (LCAO). Bonding in metals and electrical conductivity in materials: conductors, semiconductors and insulators; mentions on doping. Ionic bond and lattice energy. Intermolecular interacrions: hydrogen bonds, Van der Waals and London forces. The states of matter. Ionic, covalent, molecular and metallic solids. Crystals: properties and defects. Liquids: vapor pressure, ideal and real solutions. Concentrations: molarity, normality, mole fraction, percentages by volume and by weight, parts per million. Ideal and real gases: state equations and liquefaction. Chemical transformations. Thermodynamics: Reversible and irreversible transformations. First Principle and Thermochemistry: Internal Energy and Standard Enthalpy of Reaction, formation, combustion, solution and phase transition. Hess's Law. Second Principle and Entropy. Probability Thermodynamics State. Third Principle. Spontaneity and Gibbs Free Energy. Chemical equilibrium and equilibrium constant. Van't Hoff equation, Le Chatelier's principle and temperature dependence

of the equilibrium constant. Gas phase and solution Equilibria. Aqueous solutions Ionic equilibria: acids, bases and pH. Salts: hydrolysis and solubility product. Phases Equilibria. Phase diagrams with one and two components with and without miscibility lacunae. Cooling curves, Clausius-Clapeyron Equation and Gibbs Rule. Electrochemical Thermodynamics: double layer, electromotive force and Nernst equation. The redox potentials scale. Corrosion in metals. Electrolysis and Faraday's laws: opposite electromotive force and overvoltage. Chemical kinetics: reaction rate and order. Reaction mechanism, transition state theory and activation energy. Arrhenius equation. Homogeneous and heterogeneous catalysis.

Development of the course and examination
LEARNING EVALUATION METHODS
The method consists in a written test and an oral exam. In the written test, the students must solve stoichiometry problems and answer to selected theoretical questions. In the oral exam students are asked to discuss their written test, and to present the main concepts of basic chemistry developed during the course.

LEARNING EVALUATION CRITERIA
During the exams, the students must demonstrate their basic chemical knowledge, and must be able to develop appropriate reasoning for their applications; they must also demonstrate sufficient capabilities to synthesize and clearly present ideas, concepts and possible solutions to basic chemical problems typical in engineering.

LEARNING MEASUREMENT CRITERIA
During the examinations the student's ability is evaluated in order to set and develop reasoning to interpret the basic chemical problems typical in engineering.

FINAL MARK ALLOCATION CRITERIA
The final mark arises from the average of the written and oral exams. The maximum vote, equal to thirty points (cum laude) out of thirty, is assigned to students who demonstrate, in both exams, full capability in the interpretation of the basic chemical phenomena and in the logical processes setting for the understanding of basic chemical problems related to engineering. The minimum mark, equal to eighteen points out of thirty, is assigned to students who demonstrate sufficient capability in the interpretation of the basic chemical phenomena, and in the t logical processes setting for the understanding of basic chemical problems related to engineering.

Recommended reading
M. Schiavello, L. Palmisano, Fondamenti di Chimica , Edises; L. Laird, Chimica Generale , McGraw-Hill; R. Michelin, A. Munari, Fondamenti di Chimica , CEDAM Stechiometria: A. Caselli, S. Rizzato, F. Tessore, Stechiometria , EdiSES

Chimica per Bioingegneria (M/Z)

Simona Sabbatini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide the foundation for a correct understanding and interpretation of chemical phenomena, upon which the technologies in use in engineering are based. The course is directed to the knowledge of the structure and properties of matter, creating a link between the microscopic and macroscopic world.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The course will furnish the skills needed to apply the knowledge acquired to the analysis and to the comprehension of chemical problems in an engineering context, through the use of laws and methods which represent the foundation of the chemical and thermodynamic phenomena, with particular reference to the biological ones. These capabilities will be acquired by the student with the development of suitable exercises requiring the use of models and methodologies described in the lectures.
TRANSVERSAL SKILLS:
The course is designed to stimulate and emphasize connections with the other disciplines, with the aim to improve the learning and communication capacities through the mastery of the basic scientific terminology. To this end, the course aims to encourage students to develop an aptitude for logical reasoning, based on the scientific method.

Program
Matter and its structure: substances, properties, systems, phases and transformations. Symbols, formulas, equations. Mass conservation, relative atomic, molecular, and equivalent mass; mole. Avogadro's number. Atomic structure. Nuclides and radioactive decays. The Rutherford experiment. Heisenberg Uncertainty Principle and De Broglie equation. Quantization, wavefunction, Schroedinger equation and orbitals. Periodic table and properties. Valence bond theory: energy, angle and bond length. Hybridization and molecular geometry; dipole moment and polar molecules. Molecular orbitals (LCAO). Bonding in metals and electrical conductivity in materials: conductors, semiconductors and insulators; mentions on doping. Ionic bond and lattice energy. Intermolecular interacrions: hydrogen bonds, Van der Waals and London forces. The states of matter. Ionic, covalent, molecular and metallic solids. Crystals: properties and defects. Liquids: vapor pressure, ideal and real solutions. Concentrations: molarity, normality, mole fraction, percentages by volume and by weight, parts per million. Ideal and real gases: state equations and liquefaction. Chemical transformations. Thermodynamics: Reversible and irreversible transformations. First Principle and Thermochemistry: Internal Energy and Standard Enthalpy of Reaction, formation, combustion, solution and phase transition. Hess's Law. Second Principle and Entropy. Probability Thermodynamics State. Third Principle. Spontaneity and Gibbs Free Energy. Chemical equilibrium and equilibrium constant. Van't Hoff equation, Le Chatelier's principle and temperature dependence

of the equilibrium constant. Gas phase and solution Equilibria. Aqueous solutions Ionic equilibria: acids, bases and pH. Salts: hydrolysis and solubility product. Phases Equilibria. Phase diagrams with one and two components with and without miscibility lacunae. Cooling curves, Clausius-Clapeyron Equation and Gibbs Rule. Electrochemical Thermodynamics: double layer, electromotive force and Nernst equation. The redox potentials scale. Corrosion in metals. Electrolysis and Faraday's laws: opposite electromotive force and overvoltage. Chemical kinetics: reaction rate and order. Reaction mechanism, transition state theory and activation energy. Arrhenius equation. Homogeneous and heterogeneous catalysis.

Development of the course and examination
LEARNING EVALUATION METHODS
The method consists in a written test and an oral exam. In the written test, students must deal with stoichiometry problems and answer to selected theoretical questions. In the oral exam students are asked to discuss their written test, and to present the main concepts of basic chemistry developed within the course.

LEARNING EVALUATION CRITERIA
In the course of the exams, students must demonstrate their basic chemical knowledge, and must be able to develop appropriate reasoning for their applications; they must also demonstrate sufficient capabilities to synthesize and clearly present ideas, concepts and possible solutions to basic chemical problems typical in engineering.

LEARNING MEASUREMENT CRITERIA
During the examinations is evaluated the student's ability to set and develop reasoning to interpret the basic chemical problems typical in engineering.

FINAL MARK ALLOCATION CRITERIA
The final mark arises from the average of the written and oral exams. The maximum vote, equal to thirty points (cum laude) out of thirty, is assigned to students who demonstrate, in both exams, full capability in the interpretation of the basic chemical phenomena and to set logical processes for the understanding of basic chemical problems related to engineering. The minimum mark, equal to eighteen points out of thirty, is assigned to students who demonstrate sufficient capability of interpretation of the basic chemical phenomena, and to set logical processes for the understanding of basic chemical problems related to engineering.

Recommended reading
M. Schiavello, L. Palmisano, Fondamenti di Chimica , Edises; L. Laird, Chimica Generale , McGraw-Hill; R. Michelin, A. Munari, Fondamenti di Chimica , CEDAM STECHIOMETRY: A.Caselli, S. Rizzato, F. Tessore, Stechiometria , EdiSES The slides of the lectures can be found at lms.univpm.it.

Circuiti e Algoritmi per Applicazioni Multimediali

Stefania Cecchi

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Circuit Theory, Digital filters, Adaptive filters

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
To know and understand advanced Digital Signal Processing (DSP) techniques applied to multimedia applications, with reference to the audio processing. Starting from the courses of Circuits and Algorithms for Digital Signal Processing and Digital Adaptive Circuits and Learning Systems , the acquired knowledge will integrate the student s expertise in the field of electronic and circuit theory, allowing the development of a real-time application in the field of audio processing.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will be able to design and develop real time applications in the field of audio processing exploiting advanced Digital Signal Processing (DSP) techniques applied to multimedia processing. Such skills will be acquired also through the participation in a practical classroom project relative to the real time development on a selected software/hardware platform.
TRANSVERSAL SKILLS:
The participation of the student in the classroom project will be developed in workgroups and it will culminate in the development of a real time application for audio processing and in the writing of a final technical report. These activities will contribute to provide the student with better judgement skills, to strengthen the ability to synthetize and communicate the obtained results, and to develop autonomous learning and analysis proficiency.

Program
Review of circuit theory concepts, Multirate system and filter banks. Adaptive filters banks. Application of adaptive filters banks: Audio equalization algorithms, 3d Audio algorithms for immersive scenarios, Multichannel audio reproduction system, Audio/video teleconferencing systems, Active noise cancellation algorithms, . Real time implementation of multirate adaptive filters banks.

Development of the course and examination
LEARNING EVALUATION METHODS
The learning evaluation methodology consists of the presentation and discussion of a final technical report relative to a classroom project focused on the development of a real time DSP algorithm exploiting the technical background acquired during the lectures.

LEARNING EVALUATION CRITERIA
The student is required to show an adequate comprehension of the concepts discussed during the lectures and to be able to apply them in an autonomous way in the fulfilment of the classroom project. Moreover, it is required that the student is able to clearly explain and synthetize the

development and the results of the project through the discussion of the final report.

LEARNING MEASUREMENT CRITERIA
The evaluation is performed according to 30-point scale, 18 being the minimum passing grade.

FINAL MARK ALLOCATION CRITERIA
To obtain the minimum passing grade, the student is required to show his/her ability in analyzing and correctly solving the proposed project by using the technical background acquired during the lectures. The maximum grade is obtained when the student demonstrates his/her ability to autonomously develop the classroom project, solving technical issues and showing the functional properties of the algorithms through suitable experimental tests. cum Laude is added to the maximum grade when the student shows a scientific attitude in the project development and an outstanding level in the project presentation.

Recommended reading
1) P.P. Vaidyanathan, Multirate systems and filter banks Prentice Hall Signal Processing Series, Alan V. Oppenheim Series Editor 2) R.R. Crochiere, L.R. Rabiner, Multirate Digital Signal Processing , Prentice Hall Signal Processing Series, Alan V. Oppenheim Series Editor 3) Lecture slides (lms.univpm.it).

Circuiti e Componenti Ottici

Luca Pierantoni

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Fundamentals of electromagnetic fields

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to know and understand the advanced concepts of optoelectronics and optoelectronic components. The student will be able to understand and know innovative technical design and analysis of components and integrated optical circuits and optical fiber, thus obtaining knowledge across the spectrum.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Graduates will have the ability to apply the advanced theory, concerning the optical components and devices, to analytical problems and synthesis of circuits and systems in optical fiber and integrated optics with a look to the emerging areas such as nanotechnology.
TRANSVERSAL SKILLS:
The course is structured in order to provide relevant links with the new emerging scientific disciplines, seeking to boost the learning ability of students. This will improve the student's ability to evaluate and know how to apply emerging technologies in the project area. The course provides to the students the tools to work together with interdisciplinary groups.

Program
General properties of the guided propagation at optical frequencies. Propagation in planar dielectric waveguides. Propagation in optical fibers. Attenuation and dispersion. Propagation in anisotropic materials. Semiconductor laser. LED and optical amplifiers. Introduction to nanostructured materials. Carbon nanotubes and graphene. Microscopy for optoelectronic and biological applications

Development of the course and examination
LEARNING EVALUATION METHODS
Oral text

LEARNING EVALUATION CRITERIA
The student must demonstrate mastery of the concepts introduced in the course. In particular, the student must demonstrate that he/she is are able to introduce, to derive, to argue, show and to link relationships and theories related to the topics of the course

LEARNING MEASUREMENT CRITERIA
The exam is performed in order to assess: 1) the efforts made by the student in the preparation, 2) what the student has learned, 3) what he has actually understood, 4) his ability to develop its own considerations and criticisms

FINAL MARK ALLOCATION CRITERIA
The final mark is the results of a weighted evaluation of the learning measurement criteria

Recommended reading
i) T. Rozzi, A. Di Donato, Componenti & Circuiti Ottici , Ed. Pitagora-Bologna, 2005; ii) Notes compiled by the teacher

Circuiti ed Algoritmi per l'Elaborazione dei Segnali

Stefano Squartini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Electrical Circuit Theory, Linear Algebra

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
To know and understand the fundamentals of Digital Signal Processing (DSP), both from the perspective of analysis and synthesis of discrete-time circuits and algorithms.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student is expected to acquire the ability of analyze and design circuit and algorithms for Digital Signal Processing and implement them by means of suitable HW/SW platform, with special focus on audio processing applications.
TRANSVERSAL SKILLS:
The student is expected to understand, process and apply the technical requirements for DSP systems design. Moreover, he/she is expected to evaluate the correposndence of a DSP project to the requirements and to understand the advantages and disadvantages of diverse project solutions, beside to show the ability to analyze and interpret data coming from experiments and simulations carreid outby means of suitable HW/SW platforms.

Program
Introduction to discrete-time circuits and signals. Time domain analysis. Frequency domain analysis. Sampling and reconstruction. Z-transform domain analysis. Introduction to multirate circuits and algorithms. Filter Banks IIR filter design. FIR filter design. Finite-precision implementations. DFT and the Goertzel Algorithm FFT and its applications. DCT and its applications Classical spectrum analysis, for stationary and non-stationary signals Algorithm implementation be means of the Matlab/Scilab programminng environment Real-Time Algorithm implementation on Digital Signal Processors

Development of the course and examination
LEARNING EVALUATION METHODS
The learning evaluation methodology consists in two tests: - a writing exam, consisting in 4 open questions on the topics discussed during the lectures and to be completed in 1 hour and 30 minutes - the presentation and the discussion of a SW project proposed by the teacher. The project can be developed also in groups of maximum two people. The student has 10 working days to fulfill the work and discuss it.

LEARNING EVALUATION CRITERIA
FThe student is required to show an adequate comprehension of the basic concepts of Digital Signal Processing and to be able to apply them in an autonomous way to the fulfillment of the SW project. The student is also asked to explain in a rigorous and synthetic way both the theoretical aspects and the technical report related to the SW project.

LEARNING MEASUREMENT CRITERIA
During the tests, the ability to analyze and design circuits and algorithms for Digital signal Processing applications, together with the ability to implement them on suitable HW/SW Platform, will be evaluated. Moreover, the autonomous capability to understand the technical requirements proposed in the SW project assignment, to assess pros and cons of diverse implementation solutions, and to analyze and interpret data coming from experiments will be evaluated.

FINAL MARK ALLOCATION CRITERIA
For each test, a score within the 18-30 scale is assigned, then the arithmetic average between the two scores is applied and the result is proposed as final score for official registration. To access the second test the student is required to have passed the first one with a score equal or superior to 16/30. The second test has to be completed by the two exam dates following the one in which the student has passed the first test. If the student dous not pass the second test or refuse the final score proposed by the teacher, he is asked to start the examination process from scratch. The maximum evaluation score is given when the student show a deep knowledge of the theoretical contents of the course and a remarkable ability in applying those concepts to practical problems. Honours are given to students who show to have a relevant scientifi rigour in addressing the faced issues and a certain brightness in exposing their answers to specific theoretical questions and in discussing the final project

Recommended reading
1 - A.V. Oppenheim, R.W. Schafer, Discrete-Time Signal Processing, Prentice Hall, (3 ed.); 2 - D. Reay, Digital Signal Processing and Applications with the OMAP - L138 eXperimenter, Wiley and Sons, 2012; 3 - Teacher s material available at the website https://lms.univpm.it/, and specifically at the pages related to this course.

Compatibilità Elettromagnetica per la Progettazione Elettronica

Valter Mariani Primiani

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Fundamentals of electromagnetic fields, basic electronic circuits analysis.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course provides the knowledge and the understanding of the methodologies necessary for the prediction and controlling of electromagnetic interferences among electronic devices and equipment. Broadband knowledge will be provided within an interdisciplinary context ranging from signal theory, electronics, electromagnetics and advanced measurement methods. The student will be informed about the main regulations to be applied in order to achieve the EMC compliance.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The students will apply the knowledge to reduce the conducted and radiated emissions of complex electronic equipment also characterised by high circuit density. In particular, specific techniques will be applied to design filters, shields, and to mitigate emissions in the early design stage. Similarly, the knowledge will be applied to improve the immunity of complex equipment against electromagnetic hostile excitations.
TRANSVERSAL SKILLS:
The course content and teaching methodologies highlight the connections with other subjects. The student is stimulated to a global approach to each problem by making a synthesis effort. This is particularly important to improve the student learning capability. The study of real life cases, with the production of a report, will allow the opinion sharing among students and stimulate the team working methodology so improving the student communication and interaction skills.

Program
The EMC as a design rule Signal integrity Crosstalk in high density printed boards: transmission lines models common impedance coupling and ground planes Common mode noise Digital circuit radiation: exact models Numerical solution techniques: FDTD and MoM Prediction of the conducted and radiated emissions in switching mode power supplies: SPICE example Coupling between radiated field and cables Shielding effectiveness and transfer impedance Efficiency of real shield: apertures, joints and gaskets ESD coupling into electronic equipments EMI receiver functionality Reverberation chambers -Case studied analysis based on laboratory tests - Testing techniques for emission and immunity compliance assessment.

Development of the course and examination
LEARNING EVALUATION METHODS
The examination is oral and it consists in three questions about all the topics. If required, the questions that require some calculation execution will be answered in a written form during the oral examination itself. The questions that require to draw some block diagrams, electric schemes, graphics, and the execution of analytical demonstrations will be answered in a written form during the oral examination itself. Real cases analysed during the course could require to provide a written

report by the student. This report could be used to formulate one question during the examination.

LEARNING EVALUATION CRITERIA
To obtain a positive rating, the student must prove a sufficient knowledge about the course topics. Students must explain the topics in a sufficiently corrected way using adequate technical words and phrases. The ability to demonstrate the electromagnetic compatibility principles will be checked, together with the ability to put in relationship several topics and to analyse real practical cases. The highest score will be obtained showing a deep knowledge of the topics presented using a valuable technical language.

LEARNING MEASUREMENT CRITERIA
A score ranging from zero up to ten will be assigned to each question. The score will be given in thirtieths.

FINAL MARK ALLOCATION CRITERIA
The final score is the sum of the score of all questions. The examination is passed if the total score will be equal or greater than eighteen. The 30/30 with distinction score is reserved to those students who, in addition to a correct and complete answer to all questions, show a strong ability and autonomy in theoretical demonstrations.

Recommended reading
Clayton R. PAUL Introduction to Electromagnetic Compatibility Second Edition, John Wiley & Sons
H. W. Ott Noise reduction in electronic systems Second edition, John Wiley Interscience, New york, 1988. Other material eventually given by the professor, if necessary, available on Moodle website.

Comunicazioni Ottiche

Giovanni Cancellieri

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
Basic theory on electromagnetics, telecommunications and signals

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course provides knowledges about the main operations of the optical telecommunication networks. Aspects regarding terminals, nodes and infrastructures are developed in the transport and access segment.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student is required to recognize the main problems in designing an optical network. He will be able to perform simple calculations on service quality. He will acquire competences in order to picture the structure of components and cables which is most suitable for guaranteeing a prefixed service.
TRANSVERSAL SKILLS:
The student will use elements of Mathematics and notions of Physics for solving simple problems of design. He will employ also easy software instruments for executing simulations, say in channel coding on continental and submarine links of the transport network.

Program
- Optical link budget - Binary optical channel - WDM e DWDM multiplex - Multiple access in WDMA - Optical switching - Active fibre amplifiers - Optical sources and detectors - terrestrial optical cables and installation - Submarine optical cables - Metropolitan and geographic optical rings - Back up optical links - Passive Optical Network (PON) - Optical frequency converters - Error correcting codes for optical links - Optical sensors

Development of the course and examination
LEARNING EVALUATION METHODS
Evaluation of the learning level of the students is based on a single verbal examination. In this test the student is asked for three questions, on different correlated topics. The student is asked also for presenting numerical examples, of the type developed during the course.

LEARNING EVALUATION CRITERIA
In order to obtain a positive judgment in the evaluation of his learning level, the student has to describe practical situations regarding the questions under consideration, demonstrating the capacity of understanding analogies or differences in them. He must demonstrate to have a complete ownership of the technical language.

LEARNING MEASUREMENT CRITERIA
To each one of the three questions proposed a proper score is associated. Two correct answers, at least, guarantee the minimum favourable vote of 18/30.

FINAL MARK ALLOCATION CRITERIA
Once established the rules for evaluating the student learning level, the clearness in expressing concepts, the ownership of the language, the capacity of finding connections between different parts of the programme will be elements for increasing the vote, up to 30/30. For attributing the laude, a fourth question is proposed, to which a possible wrong answer, however, does not influence the previous 30/30 result.

Recommended reading
Lecture notes provided by the teacher downloaded from the website https://lms.univpm.it/

Comunicazioni Wireless

Ennio Gambi

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Basic concepts on signal theory, telecommunications and electomagnetic fields

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
Starting from the study of propagative conditions in contexts of greater importance, teaching enables students to acquire the knowledge necessary to understand the issues related to the solutions proposed in the wireless transmission of information systems, and to know how to apply the related design procedures . This knowledge, by integrating the knowledge gained in the teachings of telecommunications and electromagnetism, will provide the student with a solid technical background, combined with a working methodology that will operate in the areas of design of wireless systems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to deal with advanced design issues, the student must be able to understand the effects of signals degradation in wireless communications and the system requirements, and to implement the correct design choices of engineering practice related to wireless communication systems. This capacity will be manifested through a number of vocational skills, such as: 1. the ability to appropriately choose the transmission technology, and the architecture of the system, to meet the capacity, coverage range and quality requirements; 2. the ability to quantify the magnitudes necessary for the dimensioning of the system, through the use of appropriate mathematical models and design tools; 3. the ability to identify the causes of performance degradation, and the countermeasures.
TRANSVERSAL SKILLS:
The solution of numerical examples for solving dimensioning problems of wireless communication systems, and simulations and practical experience of application issues, will help the student to improve its ability to learn independently and to draw conclusions. Both the ability to communicate that the degree of independence of judgment in general, will be stimulated and refined through the oral discussion of the issues related to the sizing and design of wireless communication systems.

Program
Contents (Classroom lessons 60 hours): Mobile radio channel. Statistical and empirical models. Satellite communcations - link budget. TV Broadcast - DVB-S OFDM - DVB-T Spread Spectrum techniques - CDMA - GPS System. Ultra Wide Band Infrastructurebased wireless networks - GSM - UMTS - HSPA - LTE - 5G. The MIMO technology. IEEE802.11 - Bluetooth - ZigBee - WiMax Wireless Area Network characterization: from WideAN to BodyAN. RADAR Software Defined Radio Laboratory activity (12 hours): Planning and test of a WiFi or Hiperlan radio link. Board programming for WSN.

Development of the course and examination
LEARNING EVALUATION METHODS

The exam consists of an oral test, during which the student is asked to present the main concepts and technological solutions related to the Wireless Communications. It will also be proposed to each student in-depth activity by carrying out a project on one of the topics covered in class, and concerning the design of a wireless communication system.

LEARNING EVALUATION CRITERIA

The student, during the oral test, will present and discuss the project developed (if present) and will demonstrate the knowledge and methodological and technological expertise for the design and dimensioning of wireless communication systems. To successfully pass the oral exam, the student must demonstrate an overall understanding of the 'teaching content, with a sufficiently corrected use of technical terminology. The highest rating will be achieved by demonstrating a thorough understanding of teaching content, exposed with complete mastery of technical language.

LEARNING MEASUREMENT CRITERIA

During the examination the student's independent ability to set and solve problems that are placed will be evaluated. It shall also assess the ability to use properly the relevant methodologies, models and technologies of Wireless Communications.

FINAL MARK ALLOCATION CRITERIA

The highest rating is awarded to students who demonstrate during the exam, full autonomy to set and solve problems and complete mastery of the methodologies, models and technologies of Wireless Communications. The minimum grade is assigned to students who demonstrate during the exam, to be able to solve problems that are placed and sufficient knowledge of the methodologies, models and technologies of Wireless Communications.

Recommended reading

Goldsmith, Wireless Communication , Stanford University

Consolidamento dei Terreni

Marta Di Sante

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
Basic concepts of soil mechanics

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course will provide a specific knowledge of a range of ground improvement techniques for both fine-grained and coarse-grained soils; the student learns the principles behind how the techniques 'work', for which soils they are appropriate and how they are installed or constructed.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will be able to select for each improvement technique the range of application as well as advantages and possible drawbacks. In such a way for a range of ground and site conditions the method that allows to optimise the cost/benefit ratio will be individuated.
TRANSVERSAL SKILLS:
During the course students are encouraged to study some topics in groups, in order to improve their single autonomous assessment, communication skills and learning ability.

Program
Classifications of soil improvement techniques. Relative density of sands. Soil liquefaction. Vibro-compaction. Heavy tamping. Preloading. Vertical drains. Drainage trenches. Stone columns. Reinforced earth. Grouting. Ground anchors. Freezing. Passive piles. Deep mixing. Soil-Lime and soil-cement mixtures.

Development of the course and examination
LEARNING EVALUATION METHODS
Oral test.

LEARNING EVALUATION CRITERIA
To positively pass the exam, the student has to demonstrate to be well acquainted with both theoretical concepts and use of the applicative tools of the Soil Improvement.

LEARNING MEASUREMENT CRITERIA
Final mark, in thirtieths.

FINAL MARK ALLOCATION CRITERIA
The oral test consists of three questions. Each question will be marked between 0 and 10 points. Honours will be given to those students who, reaching the highest marks, demonstrate a full mastery of the topics.

Recommended reading
slides available on sul sito docente e sulla piattaforma . Van Impe Soil improvement techniques

and their evolution . Balkema

Control Techniques for Bioengineering

Giuseppe Orlando

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
Elements of Linear Algebra, Mathematical Analysis, Differential Equations, Laplace Transform.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire knowledge and skills on the analysis and identification of linear feedback systems, and analysis of nonlinear systems, with particular regard to models of biological systems . This knowledge will complement those already learnt in the course Fundamentals of automatic control of the three-year degree course, and will enable students to increase their expertise in the analysis and identification of dynamic systems , in different application contexts, thus allowing them to buy more awareness of the multidisciplinary nature of engineering .
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
This free-choice course, allows to integrate the basic control knowledge with advanced courses in mathematics and in automatic controls focused on bioengineering applications. In order to address issues of modeling and analysis of dynamical systems , linear and non linear, in several contexts of biomedical engineering, the student should possess the methodological skills to select the most appropriate class of models for a particular problem and a particular application. This ability will appear through a series of professional skills, such as: 1. the ability to detect in a given plant which inputs and outputs are the most relevant for the characterization of the plant itself ; 2. the ability to choose the most suitable technique for the identification, or modeling, according to the information known about the physical plant ; 3. the ability to appropriately evaluate the effectiveness of the selected model , both in simulation and on real data ; 4. the ability to critically analyze experimental data , and to draw conclusions , working in teams with other elements involved in the study of the problem.
TRANSVERSAL SKILLS:
The execution of an exercise to solve a problem of identification and analysis of a system, made in the classroom with the help of CAD tools like Scilab - Xcos, will help to improve both the level of the student's independent judgment , both the ability to learn independently , both the communication capacity that results from the interaction with the others .

Program
Feedback in biological systems. References on Time Invariant Linear Systems. Non-linear Systems. Negative feedback systems. Step response and frequency response identification. Parametric identification.

Development of the course and examination
LEARNING EVALUATION METHODS
The assessment of student learning consists of an oral exam, which consists of answering three of the topics covered in the course.

LEARNING EVALUATION CRITERIA
To successfully pass the assessment of learning, the student must have a competence of all the mathematical tools needed to understand the topics covered in the course. Moreover, he must know the system models studied, both linear and non-linear models, negative feedback models, and how to use them in the study and in the identification of biological systems.

LEARNING MEASUREMENT CRITERIA
Each of oral questions is graded with a score between zero and ten. The overall evaluation is the sum of the three scores and is marked out of thirty.

FINAL MARK ALLOCATION CRITERIA
In order to have a positive evaluation, the student must achieve an overall score of at least eighteen, with the constraint that in each of the three oral questions the evaluation must be at least six. Full marks cum laude are given to students who have achieved the highest rating in the oral exam, and have shown a particular brilliance.

Recommended reading
C. Cosentino, D. Bates, "Feedback Control in Systems Biology", CRC Press, Taylor & Francis Group. Lecture notes available at: https://lms.univpm.it/course/view.phpid=388

Controlli Automatici

Giuseppe Orlando

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Elements of Linear Algebra and Calculus, Differential Equations, Laplace Transform, Linear Time Invariant Systems.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire knowledge and skills on the analysis and synthesis of linear feedback control systems. This knowledge will complete what has been already learnt in the Fundamentals of Automatics, and will enable students to increase their expertise in the study and synthesis of automatic systems for various applications , thus allowing them to acquire a greater awareness of the multidisciplinary nature of engineering
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will be able to deal with topics of automated systems synthesis, in different application contexts and with often conflicting specifications, and to select the architecture which best fits the particular problem of control. This ability will appear through a series of professional skills, such as: 1. the ability to classify the design requirements; 2. the ability to choose the most suitable synthesis methodology; 3. the ability to appropriately evaluate system performances; 4. the ability to critically analyze experimental data , working in teams with other elements involved in the study of the problem
TRANSVERSAL SKILLS:
The execution of an exercise in solving a control problem , made in the classroom with the help of CAD tools , will help to improve both the level of the student's independent judgment , both his ability to learn iindependently, both the communication capacity that results from the interaction with the others

Program
Fundamentals on analysis and design of automatic control systems for linear plants. Characteristics and performance of feedback control systems. Frequency response and root locus design techniques for SISO feedback systems. PID industrial compensators. Digital control systems.

Development of the course and examination
LEARNING EVALUATION METHODS
The assessment of student learning consists of a written test and an oral test. The written test consists in solving two problems of analysis and / or synthesis related to the feedback control systems. The oral exam consists of answering two of the topics covered in the course and, for organizational reasons, it can be carried out on the same day of the written test, or in the immediately following days. In any case, the oral exam must be taken in the same exam session of the written test. In the event that the overall assessment is insufficient, the student must repeat the exam entirely.

LEARNING EVALUATION CRITERIA
To successfully pass the assessment of learning, the student must first have a competence of all the mathematical tools needed to understand the topics covered in the course. He must also know the basic structure of feedback control systems and the properties that these systems should possess. Finally, he must be able to analyze and to synthesize a feedback control system, using the tools learnt in the course, both from a theoretical point of view, showing that he has understood in depth all the topics studied, and from a practical point, showing to be able to solve examples and exercises on the analysis and synthesis of these systems.

LEARNING MEASUREMENT CRITERIA
The written test and each of the two oral questions are graded by a score between zero and thirty. The overall evaluation is the average grade of the three scores and is marked out of thirty. In order to be admitted to the oral examination, the student should have obtained an assessment equal or more than twelve out of thirty.

FINAL MARK ALLOCATION CRITERIA
In order to have a positive evaluation, the student must achieve an overall score of at least eighteen, with the constraint that in each of the two oral questions the evaluation must be at least eighteen. In order to be admitted to the oral examination, the student should have obtained an assessment equal or more than twelve out of thirty. Full marks cum laude are given to students who have achieved the highest rating in the written test and in the oral exam, and have shown a particular brilliance.

Recommended reading
A. Isidori, Sistemi di Controllo , Siderea, Roma. M.L. Corradini, G. Orlando, Fondamenti di Automatica , Pitagora Editrice, Bologna, 2002. M.L. Corradini, G. Orlando, Controllo Digitale di Sistemi Dinamici , Franco Angeti, Milano, 2005.

Controllo non Lineare

Giuseppe Orlando

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Elements of Linear Algebra and Calculus, Differential Equations, Laplace Transform, Linear Time Invariant Systems.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire knowledge and skills on the analysis and synthesis of nonlinear control systems . This knowledge will complete what has been already learnt in the automation courses of the three-years degree, and will enable students to increase their expertise in the study and synthesis of nonlinear systems in different application contexts , thus allowing them to acquire a greater awareness of the multidisciplinary nature of engineering.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will be able to deal with topics of nonlinear automated systems synthesis, in different application contexts and with often conflicting specifications, and to select the architecture which best fits the particular problem of nonlinear control. This ability will appear through a series of professional skills, such as: 1. the ability to classify the design requirements ; 2. the ability to choose the most suitable nonlinear synthesis methodology; 3. the ability to appropriately evaluate nonlinear systems performances; 4. the ability to critically analyze experimental data, working in teams with other elements involved in the study of the problem.
TRANSVERSAL SKILLS:
The execution of an exercise in solving a nonlinear control problem , made in the classroom with the help of CAD tools , will help to improve both the level of the student's independent judgment , both his ability to learn iindependently, both the communication capacity that results from the interaction with the others.

Program
References on Time Invariant Linear Systems. Nonlinear Systems Analysis. Stability of Autonomous Nonlinear Systems. Lyapunov Stability. Stability of non Autonomous Nonlinear Systems. Ultimate Boundedness, Input-to-State Stability. Synthesis Elements: Local Relative Degree. Zero Dynamics. Feedback Linearization, Sliding Mode Control, Passivity based control.

Development of the course and examination
LEARNING EVALUATION METHODS
The assessment of student learning consists of an oral exam, which consists of answering three of the topics covered in the course.

LEARNING EVALUATION CRITERIA
To successfully pass the assessment of learning, the student must have a competence of all the mathematical tools needed to understand the topics covered in the course, and of all the concepts that are the basis of automatic control theory fot linear time invariant systems. He must also know

the fundamental properties of nonlinear dynamical systems and finally he must be able to perform the analysis and the synthesis of a non-linear control system, using the tools learnt in the course, both from a theoretical point of view, showing that he has understood in depth all the topics studied, and from a practical point of view, showing the capability ofsolving examples and exercises on the analysis and synthesis of these systems.

LEARNING MEASUREMENT CRITERIA

Each of oral questions is graded with a score between zero and ten. The overall evaluation is the sum of the three scores and is marked out of thirty.

FINAL MARK ALLOCATION CRITERIA

In order to have a positive evaluation, the student must achieve an overall score of at least eighteen, with the constraint that in each of the three oral questions the evaluation must be at least six. Full marks cum laude are given to students who have achieved the highest rating in the oral exam, and have shown a particular brilliance.

Recommended reading

Hassan K. Khalil, Nonlinear Control - GLOBAL EDITION , Pearson, 2014. Hassan K. Khalil, Nonlinear Systems - Third Edition , Prentice Hall, 2002.

Corrosione e Protezione dei Materiali

Gabriella Roventi

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
the knowledge of the fundamentals of Chemistry and Materials tecnology is highly reccomenmended

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course has the aim to make the students able to acquire the knowledge of the corrosion phenomena of metallic materials as well as the protection techniques . This knowledge, by integrating the knowledge gained in the teachings of the basic sciences, are intended to implement technical training and scientific base of the students on the behavior of materials when they are in contact with the working environment and to address their preparation keeping account the interdisciplinary nature of the topics covered
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to address the design project successfully, which are the basis of practical applications of the knowledge, teaching aims to put students in a position to know correctly interpret the reasons for the behavior of various metallic materials, when used in engineering practice. These qualities will be acquired through the illustration of the most typical forms of interaction between materials and environment, and with the help of practical case histories. The students will acquire the following capabilities : 1- know how to appropriately choose the metal material to be used in a given work environment ; 2- identify the causes of failure or bad behavior of a service component ; 3- identify appropriate prevention and protection
TRANSVERSAL SKILLS:
The knowledge gained by the students will enable the resolution of problems related to practical cases of component failure . These cases were dealt with in the working groups, will result in the drafting of a report. In this way the student will get used to working in partnership developing capacity for critical evaluation.

Program
Chemical, physical and mechanical interactions of the materials with the environment. Economic aspects of the materials deterioration. Technical and scientific aspects of the corrosion phenomena. High temperature oxidation and corrosion by means of electrochemical mechanism. Typical forms of corrosion: galvanic, pitting , crevice, intergranular , stress corrosion, etc. Effect of environment type on the corrosion of metal structures: atmosphere, fresh waters, sea water, soil, concrete, artificial environments. Corrosion inhibitors. Constructive strategies to avoid corrosive phenomena. Deterioration processes of the materials with particular reference to metallic materials. Thermodynamic and kinetic aspects. Chemical, physical and mechanical interactions of the materials with the environment. Techniques for corrosion prevention and protection. Superficial pretreatments. Organic and inorganic superficial coatings: painting, galvanizing, enamelling, etc. Criterions of materials selection. Cathodic protection of the structures. Recovery/restoration techniques of corroded materials. Constructive strategies to extent the structure and manufactured

articles durability.

Development of the course and examination
LEARNING EVALUATION METHODS
The assessment of student learning consists of an oral test: - the oral test consists in the discussion of two or three topics covered in the course. During the oral test some real objects or some pictures of them are also shown; these objects were subjected to corrosion phenomenon and the student will perform a diagnosis of the causes of damage and possible methods of prevention.

LEARNING EVALUATION CRITERIA
The measurement of learning is performed by giving a numerical weight to each of the following parameters: - knowledge of a given topic; - reasoning ability; - ability to identify practical cases of corrosion and to indicate how to solve them.

LEARNING MEASUREMENT CRITERIA
To each parameter is assigned a mark between zero and thirty useful for the formulation of the final mark.

FINAL MARK ALLOCATION CRITERIA
In order to obtain an overall positive evaluation, the student must achieve at least a pass, amounting to eighteen points in each of the three parameters mentioned above. Full marks with distinction is given to students who, answering to all questions correctly, have demonstrated a complete knowledge of the course topics.

Recommended reading
G. Wranglen, Ed. Italiana a cura R. Fratesi: Elementi di Corrosione e protezione dei metalli , ECIG Genova. P. Pedeferri, Corrosione e protezione dei materiali metalici , Vol. 1 e 2, Ed. Polipress - Milano

Costruzione di Autoveicoli

Dario Amodio

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
The course uses the vehicle as an example of interesting and significant "mechanical system" and is addressed to students with good knowledge of the functional, structural and technological aspects of Mechanics.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire knowledge of the main design solutions used in the modern manufacturing of motor vehicles. This knowledge, by integrating the knowledge gained in the teachings of Applied Mechanics, Machinery and Mechanical Technology, will form the insights that enrich knowledge in the automotive field, so that the student acquires a clear awareness of the wider multidisciplinary context engineering, with a clear reference to the aspects connected with the design of machines and mechanical systems and manufacturing technologies
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to address advanced design themes, even of considerable complexity, and treat the innovation and development of new products and new technological processes through the application of knowledge, the student must know how to use simulation tools to support design and production, and must be able to analyse the machines and mechanical systems. Such capacity is expressed by professional skills, such as: 1. the ability to choose the most suitable architecture and technical solution to get the desired performance from a vehicle; 2. the ability to implement a numerical or analytical calculation model for the studying of vehicle behavior
TRANSVERSAL SKILLS:
The technical discussions held with the teacher during lessons will help improve the degree of technical maturity and the ability to properly assess the appropriateness and effectiveness of each design choice

Program
Technical history of the automobile construction, with a critical review of the evolution of the architecture and construction techniques and a look at possible future developments. Major design, structural and technological aspects of automobile construction: structure of the vehicle, materials and technologies; vehicle dynamics, suspensions and behaviour of tires; structural aspects of power train; the braking system; notes on the aerodynamics of the vehicle.

Development of the course and examination
LEARNING EVALUATION METHODS
The student is asked to present and discuss critically some aspects of construction of automobiles, among those presented during the course.

LEARNING EVALUATION CRITERIA
The student must demonstrate the ability to properly describe the parts of the vehicles presented

during the lessons, understand and discuss the major design concepts and theoretical models that underlie it.

LEARNING MEASUREMENT CRITERIA
The critical analysis capacity of the student I valuated, with regard to architecture, design solutions for the vehicles and appropriate and correct use of design methodologies.

FINAL MARK ALLOCATION CRITERIA
The maximum mark is given to students who demonstrate deep expertise in the topics covered in the lessons, autonomous capacity of critical evaluation of the constructive solutions and use of planning procedures. The minimum mark is assigned to students who demonstrate to understand and properly discuss the main design solutions for passenger cars and their design procedures

Recommended reading
H.Heisler, Vehicle and Engine Technology, SAE Int., 1999. A. Morelli, Costruzioni automobilistiche , Istituto Editoriale Internazionale, Milano, 1973. E. Zagatti, R. Zennaro, P. Pasqualetto, L'assetto dell'autoveicolo , Levrotto & Bella, Torino. G. Genta, L. Morello*L autotelaio, 2007volume 1, progetto dei componentivolume 2, progetto dei sistemi H.B. Pacejka *Tyre and vehicle dynamics, 2012

Costruzione di Macchine (A/L)

Dario Amodio

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Basic knowledge of the mechanics of materials and solids, and of the dynamic and kinematic of rigid bodies.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire knowledge on the main criteria for the selection, verification and design of technical solutions of mechanical systems and components. This knowledge, by integrating the knowledge gained in the courses of solid mechanics, applied mechanics and mechanical technology, will provide the insights of design methodologies, so that the student acquires knowledge of the broader context of mechanical and industrial engineering, with a clear reference to the aspects concerning materials, structural mechanics, machines and production technologies.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student acquires the ability to use appropriate techniques and tools to solve engineering problems that concern the analysis and design of machine components or simple mechanical systems. This capacity is expressed through professional skills, such as: 1. the ability to identify structural solutions suitable to achieve the expected performance, both using consolidated architectures and introducing innovative elements; 2. the ability to identify and apply the most suitable calculation methods for the analysis and the design of the mechanical components; 3. the ability to appropriately select materials and manufacturing technologies for the realization of mechanical components; 4. the ability to choose standard components from the catalogues for the design of simple mechanical systems
TRANSVERSAL SKILLS:
The solution of exercises and simple structural problems carried out during the lessons helps to improve both the ability to select relevant information and the degree of independent judgment. Moreover, in the discussion the student exercises the ability to communicate information, ideas, and solutions with adequate technical language

Program
The course consists of two parts: the first is devoted to the mechanics of materials, observed by the mechanical designer's point of view; the second part reviews the major machine components, with illustrations of the main relationships and procedures for design and verification. Outline of engineering materials and on the main items of interest for the mechanical designer; concept of damage of a mechanical component and safety factor; the concept of equivalent stress; the contact stress: the Hertz theory; the phenomenon of elastic instability; analysis of the fatigue behavior of materials; procedures for design and verification of components subject to high cycle fatigue; models of cumulated damage in load variability conditions. Thin wall pressure vessels; axes and shafts; keying systems: sticks, tabs, splines; gear units: spur gears and helical gears, bevel gears; power transmission by flat and V-belts; bending and torsion springs; radial, axial and angular

contact bearings; disassembling joining: bolts; fixed joining: notes on welds calculation according to UNI-EN 10011.

Development of the course and examination

LEARNING EVALUATION METHODS

This is assessed through written and oral test. In the written examination, students must address structural verification or design problems of components or simple mechanical systems, with the aid of methods, mathematical models and tools discussed during the lectures. In the oral exam the student is asked to present the main concepts and theoretical bases of machine design, answering questions or discussing his written report.

LEARNING EVALUATION CRITERIA

In the examination the student must demonstrate the ability to use independently and correctly, the methodologies, models and tools of mechanical design presented during the lessons; furthermore, the student must demonstrate sufficient ability to judge, select, synthesize and clearly present ideas, concepts and construction solutions related to machine design.

LEARNING MEASUREMENT CRITERIA

It Is evaluated the student's independent ability to set and solve problems that he is aksed to face. Also, it is evaluates the ability to correctly use the methodologies, the models and tools of mechanical design.

FINAL MARK ALLOCATION CRITERIA

The maximum mark, equal to thirty points with laud, is awarded to students who demonstrate, in the two tests, full autonomy to set and solve problems and close acquaintance with the methods, models and tools of mechanical design. The minimum mark, equal to eighteen, is assigned to students who demonstrate to succeed the problems they are asked to face and sufficient knowledge of the methods, models and tools of mechanical design.

Recommended reading

"Shigley's Mechanical Engineering Design", McGraw-Hill; lessons notes available on Moodle platform.

Costruzione di Macchine (M/Z)

Marco Sasso

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Basic knowledge of the mechanics of materials and solids, and of the dynamic and kinematic of rigid bodies.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire knowledge on the main criteria for the selection, verification and design of technical solutions of mechanical systems and components. This knowledge, by integrating the knowledge gained in the courses of solid mechanics, applied mechanics and mechanical technology, will provide the insights of design methodologies, so that the student acquires knowledge of the broader context of mechanical and industrial engineering, with a clear reference to the aspects concerning materials, structural mechanics, machines and production technologies.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student acquires the ability to use appropriate techniques and tools to solve engineering problems that concern the analysis and design of machine components or simple mechanical systems. This capacity is expressed through professional skills, such as: 1. the ability to identify structural solutions suitable to achieve the expected performance, both using consolidated architectures and introducing innovative elements; 2. the ability to identify and apply the most suitable calculation methods for the analysis and the design of the mechanical components; 3. the ability to appropriately select materials and manufacturing technologies for the realization of mechanical components; 4. the ability to choose standard components from the catalogues for the design of simple mechanical systems
TRANSVERSAL SKILLS:
The solution of exercises and simple structural problems carried out during the lessons helps to improve both the ability to select relevant information and the degree of independent judgment. Moreover, in the discussion the student exercises the ability to communicate information, ideas, and solutions with adequate technical language

Program
The course consists of two parts: the first is devoted to the mechanics of materials, observed by the mechanical designer's point of view; the second part reviews the major machine components, with illustrations of the main relationships and procedures for design and verification. Outline of engineering materials and on the main items of interest for the mechanical designer; concept of damage of a mechanical component and safety factor; the concept of equivalent stress; the contact stress: the Hertz theory; the phenomenon of elastic instability; analysis of the fatigue behavior of materials; procedures for design and verification of components subject to high cycle fatigue; models of cumulated damage in load variability conditions. Thin wall pressure vessels; axes and shafts; keying systems: sticks, tabs, splines; gear units: spur gears and helical gears, bevel gears; power transmission by flat and V-belts; bending and torsion springs; radial, axial and angular

contact bearings; disassembling joining: bolts; fixed joining: notes on welds calculation according to UNI-EN 10011.

Development of the course and examination

LEARNING EVALUATION METHODS

This is assessed through written and oral test. In the written examination, students must address structural verification or design problems of components or simple mechanical systems, with the aid of methods, mathematical models and tools discussed during the lectures. In the oral exam the student is asked to present the main concepts and theoretical bases of machine design, answering questions or discussing his written report.

LEARNING EVALUATION CRITERIA

In the examination the student must demonstrate the ability to use independently and correctly, the methodologies, models and tools of mechanical design presented during the lessons; furthermore, the student must demonstrate sufficient ability to judge, select, synthesize and clearly present ideas, concepts and construction solutions related to machine design.

LEARNING MEASUREMENT CRITERIA

It Is evaluated the student's independent ability to set and solve problems that he is aksed to face. Also, it is evaluates the ability to correctly use the methodologies, the models and tools of mechanical design.

FINAL MARK ALLOCATION CRITERIA

The maximum mark, equal to thirty points with laud, is awarded to students who demonstrate, in the two tests, full autonomy to set and solve problems and close acquaintance with the methods, models and tools of mechanical design. The minimum mark, equal to eighteen, is assigned to students who demonstrate to succeed the problems they are asked to face and sufficient knowledge of the methods, models and tools of mechanical design.

Recommended reading

"Shigley's Mechanical Engineering Design", McGraw-Hill; lessons notes available on Moodle platform.

Costruzioni di Strade (A/L)

Maurizio Bocci

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Elements of the fundamental chemical analysis and the continuum mechanics.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course intends to provide insights on theoretical methods and practical applications required for a rational approach to the analysis and understanding of engineering issues concerning road construction. The course aims at providing information about mechanical properties and durability characterization of road materials as well as technological solutions concerning pavement construction activities.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The course will provide students with specific skills useful for the critical analysis of practical issues directly related to road construction. The course will consist of classroom lectures.
TRANSVERSAL SKILLS:
Analytical and methodological skills acquired during the course will be helpful for solving issues common to other subjects within the framework of Civil and Environmental Engineering with the aim to improve learning and communication skills in a multidisciplinary context.

Program
Road classification. General considerations on horizontal and vertical alignment, and cross section for the design of roads. Natural soil as construction material for road applications. Soil classification criteria. Compaction and densification of soils. Bearing capacity of subgrades: main experimental methods for evaluation. Soil stabilization with lime and cement. Road embankment construction, protection techniques from moisture and frost phenomena. Aggregates production and sampling. Geometrical, physical and chemical properties of aggregates. Physical and mechanical requirements of aggregates for road mixtures and bituminous concretes: main laboratory characterization tests. Bituminous binders for road applications, classification and conventional performance analysis. Unbound granular mixture, cement treated mixture and bituminous concrete. Mix design methodology of bituminous concrete. Road pavement classification. Design criteria of flexible road pavements. Pavement construction: bituminous concrete facilities, transportation, laydown and compaction operations. Recycling materials from demolition operations of distressed road pavement. Quality control procedures during and after pavement construction. Final overview of performance-based technical specifications for road materials and construction.

Development of the course and examination
LEARNING EVALUATION METHODS
Final examination consists in an oral discussion on one or more topics concerning the properties characterization of road materials as well as road construction techniques.

LEARNING EVALUATION CRITERIA

At the oral examination student has to prove a suitable understanding and technical ability to properly use tools and methods aimed at investigating the main properties of materials and an adequate critical analysis in identifying the most specific road construction technique.

LEARNING MEASUREMENT CRITERIA
A comprehensive knowledge and an adequately correct exposition with technical terminology of discussed topics are evaluated during the oral exam. The level of insight of the knowledges aimed at solving specific and practical engineering issues through a proper selection of materials and construction techniques are evaluated too.

FINAL MARK ALLOCATION CRITERIA
An adequate understanding of all topics discussed during the exam is required to pass the examination with the minumum mark (18 out of 30). Further score is assigned on the basis of learning level of discussed topics. The full marks (30 cum laude) is achieved to the students which showed clearness and brightness of exposition as well as a complete mastery in the selection and use of analysis methods aimed at solving tipical engineering issues concerning road construction.

Recommended reading
Tesoriere G., Strade ferrovie ed aeroporti , vol. I-II, UTET Ferrari P., Giannini F., Ingegneria stradale , vol. I-II, ISED Slide presentations shown in classroom that are available on the official teacher page on UNIPM website.

Costruzioni di Strade (M/Z)

Fabrizio Cardone

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Elements of the fundamental chemical analysis and the continuum mechanics.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course intends to provide insights on theoretical methods and practical applications required for a rational approach to the analysis and understanding of engineering issues concerning road construction. The course aims at providing information about mechanical properties and durability characterization of road materials as well as technological solutions concerning pavement construction activities.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The course will provide students with specific skills useful for the critical analysis of practical issues directly related to road construction. The course will consist of classroom lectures.
TRANSVERSAL SKILLS:
Analytical and methodological skills acquired during the course will be helpful for solving issues common to other subjects within the framework of Civil and Environmental Engineering with the aim to improve learning and communication skills in a multidisciplinary context.

Program
Road classification. General considerations on horizontal and vertical alignment, and cross section for the design of roads. Natural soil as construction material for road applications. Soil classification criteria. Compaction and densification of soils. Bearing capacity of subgrades: main experimental methods for evaluation. Soil stabilization with lime and cement. Road embankment construction, protection techniques from moisture and frost phenomena. Aggregates production and sampling. Geometrical, physical and chemical properties of aggregates. Physical and mechanical requirements of aggregates for road mixtures and bituminous concretes: main laboratory characterization tests. Bituminous binders for road applications, classification and conventional performance analysis. Unbound granular mixture, cement treated mixture and bituminous concrete. Mix design methodology of bituminous concrete. Road pavement classification. Design criteria of flexible road pavements. Pavement construction: bituminous concrete facilities, transportation, laydown and compaction operations. Recycling materials from demolition operations of distressed road pavement. Quality control procedures during and after pavement construction. Final overview of performance-based technical specifications for road materials and construction.

Development of the course and examination
LEARNING EVALUATION METHODS
Final examination consists in an oral discussion on one or more topics concerning the properties characterization of road materials as well as road construction techniques.

LEARNING EVALUATION CRITERIA

At the oral examination student has to prove a suitable understanding and technical ability to properly use tools and methods aimed at investigating the main properties of materials and an adequate critical analysis in identifying the most specific road construction technique.

LEARNING MEASUREMENT CRITERIA
A comprehensive knowledge and an adequately correct exposition with technical terminology of discussed topics are evaluated during the oral exam. The level of insight of the knowledges aimed at solving specific and practical engineering issues through a proper selection of materials and construction techniques are evaluated too.

FINAL MARK ALLOCATION CRITERIA
An adequate understanding of all topics discussed during the exam is required to pass the examination with the minumum mark (18 out of 30). Further score is assigned on the basis of learning level of discussed topics. The full marks (30 cum laude) is achieved to the students which showed clearness and brightness of exposition as well as a complete mastery in the selection and use of analysis methods aimed at solving tipical engineering issues concerning road construction.

Recommended reading
Tesoriere G., Strade ferrovie ed aeroporti , vol. I-II, UTET Ferrari P., Giannini F., Ingegneria stradale , vol. I-II, ISED Slide presentations shown in classroom that are available on the official teacher page on UNIPM website.

Costruzioni Edili (EA)

Stefano Donati

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 90
Period 2s

Prerequisites
knowledge of building systems used in construction

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
Costruzioni Edili deals with the detailed design on the basis of legislation which is binding and voluntary rules. the study of matter leads the student to effectively understand the key points of the project as seen in its integration of different aspects and areas. In this view they are are also set out managerial methods for project management that are a prerequisite to the management of multidimensional models (BIM). The course operates a training summary of the student who will have the opportunity to make a concrete experience by deepening the connections, interactions and necessary additions as part of the construction project.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The constructibility of the architectural project is the guideline that leads the student to a conscious approach and high professional level aimed at achieving the formal image of the architectural project. The backbone of the course is precisely the application, with a strong practical point of view, the knowledge acquired to real cases.
TRANSVERSAL SKILLS:
Conducting guided exercises, while the allocation of an annual theme, aim to provide the student the ability to synthesize and the ability to weigh the various design alternatives to the light of a multidisciplinary approach.

Program
Planning in the building industry. Customer planning documents (contents, techniques a.s.o.) are discussed. Building requirements and features are analysed (three levels foreseen by the standards) Management of the building design. In-depth analysis of the contents and methods expected in the different design steps Safety in buildings Knowledge of the EN and ISO standards (building materials, building elements, design methods). Quality (e.g. ISO 9000) in the building industry. Guidelines for planning and design. Cost analysis of buildings. Ability to perform the analysis of prices and costs of architecture. Introduction to the geometry of the costs. Methods for determining the costin the different levels of design. The use of regional price lists.

Development of the course and examination
LEARNING EVALUATION METHODS
oral examination in which the themes of the program are discussed and the results of the exercises carried out by the individual candidates

LEARNING EVALUATION CRITERIA
assessment of knowledge of the issues and the personal re-elaboration of capacity at such tem

LEARNING MEASUREMENT CRITERIA
measuring the ability to solve practical issues

FINAL MARK ALLOCATION CRITERIA
sum of the assessments of the knowledge and ability to apply the same knowledge

Recommended reading
M. Lemma, Qualità e Sicurezza negli edifici, Il Sole24Ore ed./ Ulteriori materiali necessari per la preparazione vengono distribuiti nel corso delle lezioni

Costruzioni Edili (EDI)

Massimo Lemma

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Basic Knowledge of building systems

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
Students will learn the basics about UE basic requirements for Construction Works. This course is based on the knowledge acquired by students in the Building Typologies course, and it adds more skills about the topic Performance Based Building Design (PBBD). The thorough knowledge about UE basic requirements and additional features that characterize the behavior of building components and sub-systems provides students with the capability of discriminating technical choices according to usage requirements and with awareness about the multi-disciplinary approach towards building design. A top down approach from the building as a whole to its components is adopted.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
This course is preparatory to the involvement in big design teams, which asks that designers are able to perform assessment of building actions and Design Aims, explicitly referred to mechanical resistance and stability, safety in case of fire, safety and accessibility in use. Moreover, designers must have a deep knowledge of detailed performances of any component of a building, in the way they are defined in UE standards, and as referred to their role in the whole building.
TRANSVERSAL SKILLS:
Given the acquired knowledge about performance level assessment (that is connected to Design aims), students will be able to convey, both through written and verbal communication, the reasons underlying technical choices. Students will be able to retrieve and understand technical documents, thanks to self-sufficiency in standard selection and search (e.g. ISO, EN specifications).

Program
Basics of Performance Based Building Design (PBBD). UE-Requirements satisfaction in Building Design. Performances in Buildings and their technologies Safety in Building Contructions: Loadbearing Capacity; Fire Safety and Safety in Use. Customer planning documents (contents, techniques a.s.o.) are discussed. Building requirements and features are analysed (three levels foreseen by the standards)

Development of the course and examination
LEARNING EVALUATION METHODS
Test and discussion are foreseen

LEARNING EVALUATION CRITERIA
Knowledge (design targets, design methods, reference standards) are evaluated

LEARNING MEASUREMENT CRITERIA

Know how (problem solving a.s.o.) measurement

FINAL MARK ALLOCATION CRITERIA
Test and discussion average score

Recommended reading
Materials necessary would be provided during the lectures

Costruzioni Idrauliche

Giovanna Darvini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Concepts related to Hydraulics and graphing techniques.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course allows the students to acquire methodological and analytical capabilities useful in identifying, formulating and solving classic problems of the Hydraulic structures using methods, techniques and advanced tools. The course also aims at deepening the more professional aspects of classic themes of the Hydraulic structures related to the water resources management in urban areas, with particular reference to the drainage and water distribution systems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
To the aim of facing advanced planning and applicative themes, the student will have to acquire capabilities of design and critical analysis for the practical problems typical of the Hydraulic structures. Such capabilities will be expressed through the solution of applicative problems of Hydraulic structures, with specific reference to the design and management of the urban water systems.
TRANSVERSAL SKILLS:
The solution of a problem as a practice and the discussion of advanced aspects of the discipline in oral examinations and through the written tests, will contribute to improve the level of the judgement autonomy as well as the written and oral communication ability. Self-study and practice contribute to the development of independent learning ability.

Program
Measurement and collection of hydrometeorological data. Statistical elements for Hydrology. Analysis of the rainfall. Overview of sewer collection systems and regulations. Storm and sanitary sewer discharge evaluation. Design of sewer pipelines. Piping materials and aspects of construction. Storm drains and manholes. Grills and sand channels. Road, fluvial and railway crossings. Pump system design. Combined sewer overflow and detention basins: quality aspects of overflow management. Overview of water distribution systems and regulations. Water consumption. Development, transmission and distribution of drinking water. Storage tanks. Valves.

Development of the course and examination
LEARNING EVALUATION METHODS
The exam is based on a written test and on a oral discussion. The written test consists in resolving some exercices about the topics of the course. The oral test consists in a oral discussion of the course contents.

LEARNING EVALUATION CRITERIA
The positive result of the exam is reached if the student shows, by means of the previously described tests, to have well understood the topics proposed during the lessons and to be able to

apply autonomously to problems concerning the Hydralic Costructions.updated methods and procedures.

LEARNING MEASUREMENT CRITERIA
Assignment of the final grade in thirtieths. The final grade is obtained by considering the evaluation of the written and oral test.

FINAL MARK ALLOCATION CRITERIA
A positive final evaluation is reached by obtaining at least the passing grade in each of the tests (written and oral). Maximum evaluation is reached when the candidate shows a deep and complete knowledge of the topics of the course in both the tests.

Recommended reading
Da Deppo L., Datei C., Fognature , Edizioni Progetto - Padova, 2011. Da Deppo L., Datei C., Fiorotto V., Salandin P., Acquedotti , Edizioni Progetto - Padova, 2011.. Slides and solutions of written tests available on the teacher web page.

Costruzioni Idrauliche (EA)

Luciano Soldini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 90
Period 1s

Prerequisites
Basic knowledge of mathematics, physics and geometry.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course of Urban Hydraulic Constructions wants to supply the basic knowledge to design and realize the hydraulic infrastructures in the urban area, in order to integrate the mastery of methodology and solutions oriented to design an architectural or urbanistic work with the capacity of supervising the complete and correct realization of the work.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to allow to the students of making architectural projects that fulfill both aesthetic and technical requirements of the designed work, the student has to be able to apply the basic principles of Hydraulics and Hydrology to dimension the hydraulic networks as pressure pipe system and storm and sanitary sewer at both urban scale and single building. Moreover he/she has to be able to deal with the problems concerning the realization of the work and the materials choice.
TRANSVERSAL SKILLS:
The exercise work, based on the project of a primary hydraulic network in a urbanizing area and on the redaction of a technical report and some graphic arts, permits to the student to apply his knowledge and learning ability to a planning process and to improve his own judgement autonomy and communication ability.

Program
Generalities on hydraulics works and their design. References of the regulations in force. Generalities on fluids. Basic principles of hydrostatics. Basic principles of hydrodynamics. Pressure and open-channel flow. Design of pressure piping systems. Basic principles of hydrology. Design of storm and sanitary sewer. Materials and pipe-laying. Design of internal waterworks.

Development of the course and examination
LEARNING EVALUATION METHODS
The exam is based on: 1) an exercise work; 2) a written test and 3) an oral test. The exercise work consists on the solution of some applied problems on the main topics of the course, assigned during the lessons; the written test consists on the solution of two exercises and has the duration of three hours; the oral test is based on the discussion of the exercise work and of two or more questions about the topics of the course. The written test is preliminary to access to the oral test; the written test has a positive evaluation if both exercises have a final mark at least of eighteen points. The oral test has to be discussed in the same session. A final negative mark involve to repeat all the tests.

LEARNING EVALUATION CRITERIA
The positive result of the exam is proved if the candidate shows, by means of the previously described tests, 1) to understood the basic priciples of the Hydraulics; 2) to describe the main topics

of planning and constructions of the hydraulic structures; 3) to be able to apply autonomously the methods and the procedures for the planning of the same structures.

LEARNING MEASUREMENT CRITERIA
Assignment of the final grade in thirtiethes.

FINAL MARK ALLOCATION CRITERIA
The candidate that obtains at least a mark of eighteen points in every test previously described, get a positive evaluation. Full mark evaluation is obtained when the candidate shows a deep and complete knowledge of the topics of the course. Full mark and honour is reserved to those candidates that carry out all the test exactly and completely and that distinguish themselves for their special excellence in the oral presentation and in the editing of their exercise work.

Recommended reading
Citrini D., Noseda G., Idraulica , Ed. Casa Editrice Ambrosiana, Milano, ISBN 88-408-0588-5. - Da Deppo L., Datei C., Fiorotto V., Salandin P., Acquedotti, Ed. Progetto, Padova, ISBN 88-7784-230-X. - Da Deppo L., Datei C., Fognature, Ed. Progetto, Padova, ISBN 88-7784-242-3. - Gallizio A., Impianti sanitari, Ed. Hoepli, Milano, ISBN 88-203-2131-9. - Da Deppo L., Datei C., Le opere idrauliche nelle costruzioni stradali, Ed. BIOS, Cosenza, ISBN: 88-7740-269-5.- Becciu G., Paoletti A., Fondamenti di Costruzioni Idrauliche, Ed. UTET Scienze Tecniche, ISBN: 978-88-598-0522-9 Supplementary notes, slides and exercises can be found at https://lms.univpm.it/

Costruzioni in Zona Sismica

Laura Ragni

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 90
Period 2s

Prerequisites
Elements of Linear Algebra, Mathematical Analysis, Differential Equations, Laplace Transform.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide the student with the basic theoretical knowledge and practical skills of the seismic engineering, necessary to design buildings with an established seismic hazard risk level with reference to both ultimate and service conditions. In particular, basic concepts for the correct conception and structural design of new buildings are provided, with particular reference to reinforced concrete structures and hints to other structural systems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Disciplinary knowledge gained in the topic of seismic engineering allows the student to design new structural complex systems making use of appropriate design solutions, consistently with requirements and possible constraints. The necessary skills, critical judgment and capacity for choice, are developed through lectures, including specific practical tutorials.
TRANSVERSAL SKILLS:
The individual practical exercises help to improve the self-learning skill, the ability to communicate results and to generalise the acquired knowledge. Furthermore, an active involvement of the student is developed.

Program
Feedback in biological systems. References on Time Invariant Linear Systems. Non-linear Systems. Negative feedback systems. Step response and frequency response identification. Parametric identification.

Development of the course and examination
LEARNING EVALUATION METHODS
The assessment of student learning consists of an oral exam, which consists of answering three of the topics covered in the course.

LEARNING EVALUATION CRITERIA
To successfully pass the assessment of learning, the student must have a competence of all the mathematical tools needed to understand the topics covered in the course. Moreover, he must know the system models studied, both linear and non-linear models, negative feedback models, and how to use them in the study and in the identification of biological systems.

LEARNING MEASUREMENT CRITERIA
Each of oral questions is graded with a score between zero and ten. The overall evaluation is the sum of the three scores and is marked out of thirty.

FINAL MARK ALLOCATION CRITERIA
In order to have a positive evaluation, the student must achieve an overall score of at least eighteen, with the constraint that in each of the three oral questions the evaluation must be at least six. Full marks cum laude are given to students who have achieved the highest rating in the oral exam, and have shown a particular brilliance.

Recommended reading
C. Cosentino, D. Bates, Feedback Control in Systems Biology , CRC Press, Taylor & Francis Group. Lecture notes available at: https://lms.univpm.it/course/view.phpid=388

Costruzioni Marittime

Alessandro Mancinelli

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
notions of the bachelor degree.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course allows the students to acquire the basic engineering knowledge of the Maritime construction inshore and offshore structures. The course face to the specific knowledge of the maritime environment. Design variables (waves and current) are defined in a probabilistic way. Along with the previous teaching the course provides to integrate the advanced knowledge useful for the design.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
To the aim of facing advanced applicative themes and technological processes, the student will have to acquire capabilities of understanding the problems and to reconstruct the waves characteristics. The student will be also able to make the more suitable choice in terms of design of a civil work in the environment and to prevent natural risk.
TRANSVERSAL SKILLS:
The design of a Maritime Engineering work will be carried out in group so allowing the student to acquire the capabilities to cooperate in a team and promoting his skills to face the typical design activity issues.

Program
Wind waves, tides, tsunami. Wave statistics small-amplitude water wave theory formulation and solution. Stationary and progressive waves. Linear and nonlinear wave theory. Energy propagation in progressive waves. Wave refraction and diffraction. Harbours. Design of rubblemound breakwaters and vertical structures. Typologies offshore structures and pipelines.

Development of the course and examination
LEARNING EVALUATION METHODS
The exam consists in an oral test and in the discussion of the exercise work that the candidate presents for the exam. The oral test consists in some questions requested to the candidate about the topics of the course. The exercise work consists in resolving some applying practices about the topics of the course, proposed during the lessons and individually carried out by the candidate.

LEARNING EVALUATION CRITERIA
The positive result of the exam is proved if the candidate shows, by means of the previously described tests, to have well understood the topics proposed during the lessons and to be able to apply, autonomously and correctly, the tipycal methods, the models and the procedures of the maritime engineering.

LEARNING MEASUREMENT CRITERIA

Assignment of the final grade in thirtiethes.

FINAL MARK ALLOCATION CRITERIA

If the candidate obtains at least the pass grade for both the oral test and the exercise work and in describing the applyied methods, he reaches a positive final evaluation. Maximum evaluation is reached when the candidate shows a deep and complete knowledge of the topics of the course. The praise is reserved to those candidates that carry out oral test and exercise work exactly and completely and that distinguish themselves for them special excellence both for the oral presentation and for the editing of their exercise work.

Recommended reading

Goda Y., Random Seas and Design of Maritime Structures , University of Tokyo Press, Tokyo, 1985. Dean R.G., Dalrymple R.A., Water wave mechanism for engineers and scientists , World Scientific Publishing Co. Ote. Ltd., Singapore, 1991. Matteotti G., Lineamenti di Costruzioni marittime , Servizi Grafici Editoriali, Padova, 1995. Notes of the course lessons.

Digital Adaptive Circuits and Learning Systems

Stefano Squartini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Linear Algebra, Electrical Circuit Theory, Circuits and Algorithms ofr Digital Signal Processing

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The student is expected to know and understand advanced Digital Signal Processing (DSP) techniques, with special focus to the analysis, synthesis and implementation of adaptive discrete-time circuits and algorithms, both linear and nonlinear, including the artificial neural networks.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student is expected to acquire the ability of applying the advanced DSP techniques discussed during the lectures in specific audio processing problems. On purpose, the student will be asked to accomplish a project targeted to the implementation of an algorithm by means of suitable SW tools (both on PC and embedded platforms)
TRANSVERSAL SKILLS:
The student is expected to design advanced DSP algorithm and to accomplish suitable analytical studies by exploiting theoretical models, computer simulations and laboratory experiments. Moreover, the student is expected to be able to critically evaluate the data obtained from experiments and simulations, to draw conclusions and take decisions with the objective to optimize the performance of proposed solutions.

Program
Review of basic DSP concepts. Review of Estimation Theory concepts Optimal FIR filters. Linear prediction and modern spectral analysis. Adaptive FIR filter in both time and frequency domains. IIR adaptive filters. Adaptive filter relevant applications. Static and Dynamic Neural Networks. Neural Networks applications Advanced Algorithms for Computational Audio Processing. Implementation of adaptive algorithms and neural networks in MATLAB Real-time implementation of adaptive algorithms on Digital Signal Processors

Development of the course and examination
LEARNING EVALUATION METHODS
The learning evaluation methodology consists in the presentation and discussion of a technical report related to a project focused on the Advanced Digital Signal Processing and Computational Intelligence presented during the lectures, with special focus on Audio Processing applications, and to be develoepd by means of suitable SW tools (running on PC and/or Embedded Platforms). The project is proposed by the teacher in agreement with the student's preferences and it can be fulfilled also in groups of maximum two people. The student can also propose something on the basis of his/her interests: the teacher will carefully evaluate the suitability of student's suggestion in relationship with the course contents, and will also calibrate the implementation aspects before finalizing the project proposal. The student has 6 months to fulfill the work and present it, starting

from the date in which the project proposal is given to him/her.

LEARNING EVALUATION CRITERIA
The student is required to show an adequate comprehension of the concepts discussed during the lectures and to be able to apply them in an autonomous way to the fulfillment of the assigned project. The student is also asked to explain in a rigorous and synthetic way the technical report related to the project.

LEARNING MEASUREMENT CRITERIA
During the project fulfillment and related final discussion, the learnign measurement criteria will be focused on the ability to apply the advanced Digital Signal Processing and Computational Intelligence methodologies and techniques, studied during the lectures, and in relationship with the project objectives. Moreover, the capability to autonomously face the issues raising during the project development will be evaluated. These issues will be related to the analysis of the technical requirements, the implementation on the selected HW/SW platform and the critical assessment of performance. Finally, the capability to carry out suitable analytical studies by exploiting theoretical models, computer simulations and laboratory experiments, will be also evaluated.

FINAL MARK ALLOCATION CRITERIA
The test is evaluated with a score within the 18-30 range. To pass the exam, the student is required to show his/her ability in analyzing the problems related to the proposed project, by using the technical background acquired during the lectures, and develop suitable algorithms for their solutions. The maximum score is reached when the student show to be able to work in an autonomous and costructive way to face the technical issues experienced during the project fulfillment, and to motivate, by means of adequate experimental tests, the functional properties of the algorithms. Honours are given to students who show to have a relevant scientific rigour in addressing the faced issues and a certain brightness in exposing their answers to specific theoretical questions and in discussing the final project.

Recommended reading
-P. M. Clarkson, Optimal and Adaptive Signal Processing, CRC Press, 2000; 2 -S.Haykin, Neural Networks, IEEE Press, 1994 (o edizioni successive); 3- D. Reay, Digital Signal Processing and Applications with the OMAP - L138 eXperimenter, Wiley and Sons, 2012; 4- Teacher s material available at the website https://lms.univpm.it/, and specifically at the pages related to this course.

Dinamica delle Strutture

Giovanni Lancioni

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
Mathematical analysis, linear algebra, statics and strength of materials

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course intends to provide the fundamental modelling tools for the study of the dynamics of discrete and continuous systems. Methods will be proposed for the analysis of the dynamical response of structures (rigid bodies, beams, bars, frames). The student must be able of solving problems regarding the dynamics of continuum bodies by means of discrete reduction and by using the solving technique of modal superposition.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will learn how to face complex problems of structural dynamics, reducing them to simplified models and solving them by means of appropriate techniques. The student will acquire those skills needed for the interpretation and comprehension of the outputs given by the numerical codes of structural dynamics usually used in the engineering practice.
TRANSVERSAL SKILLS:
The student will acquire scientific method and capability of organizing and simplifying complex problems, which represent essential ingredients in the management and development of engineering projects.

Program
Dynamics of single and multi-degree of freedom systems. Modal analysis and modal superposition. Dynamics of frames. Dynamics of continuum systems: beams, trusses, plates. Wave propagation.

Development of the course and examination
LEARNING EVALUATION METHODS
Written test, with exercises of structural dynamics analogous to those developed in lessons, and oral exam where the main issues of the course are discussed.

LEARNING EVALUATION CRITERIA
Capability of solving exercises, and comprehension of the main issues of the course are checked.

LEARNING MEASUREMENT CRITERIA
Written test and oral exam are evaluated through marks

FINAL MARK ALLOCATION CRITERIA
The final marks take into account the marks of both the written test and the oral exam.

Recommended reading
R.W. Clough, J. Penzien, Dynamics of Structures, Computers & Structures, Inc.

Dinamica delle Strutture

Giovanni Lancioni

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Mathematical analysis, linear algebra, statics and strength of materials

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course intends to provide the fundamental modelling tools for the study of the dynamics of discrete and continuous systems. Methods will be proposed for the analysis of the dynamical response of structures (rigid bodies, beams, bars, frames). The student must be able of solving problems regarding the dynamics of continuum bodies by means of discrete reduction and by using the solving technique of modal superposition. As the discretization techniques is concerned, special attention will be paid to the finite element method, which is widely used in numerical codes of structural design.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will learn how to face complex problems of structural dynamics, reducing them to simplified models and solving them by means of appropriate techniques. The student will acquire those skills needed for the interpretation and comprehension of the outputs given by the numerical codes of structural dynamics usually used in the engineering practice.
TRANSVERSAL SKILLS:
The student will acquire scientific method and capability of organizing and simplifying complex problems, which represent essential ingredients in the management and development of engineering projects.

Program
Dynamics of single and multi-degree of freedom systems. Modal analysis and modal superposition. Dynamics of frames. Dynamics of continuum systems: beams, trusses, plates. Wave propagation.

Development of the course and examination
LEARNING EVALUATION METHODS
Written test, with exercises of structural dynamics analogous to those developed in lessons, and oral exam where the main issues of the course are discussed.

LEARNING EVALUATION CRITERIA
Capability of solving exercises, and comprehension of the main issues of the course are checked.

LEARNING MEASUREMENT CRITERIA
Written test and oral exam are evaluated through marks

FINAL MARK ALLOCATION CRITERIA
The final marks take into account the marks of both the written test and the oral exam.

Recommended reading

R.W. Clough, J. Penzien, Dynamics of Structures, Computers & Structures, Inc.

Diritto Applicato all'Economia

Giovanni Zampini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
no previous requirements

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to give students extensive knowledge of the various and complex legal issues relating to: (a) interpretation of legal rules, with particular reference to those of technical nature; (b) multi-level system of governance of economy and global market (WTO, EU, state and local governments); (c) the institutions of capitalistic economy and their evolution in the globalization process (ownership and membership models, torts and contracts, intellectual property); (d) the business organization models and personnel management (corporate governance, safety at work, privacy of stakeholders).
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to address advanced design themes, even of considerable complexity, and treat the innovation and development of new technological processes through the application of knowledge, the student will be able, at the end of the course, to express a fundamental professional skills: identify and apply properly the complex and varied regulations relating to systems and production technologies and management personnel, with particular reference to: contracts, intellectual property, safety at work and arrangements for employee control.
TRANSVERSAL SKILLS:
In industrial engineering multidisciplinary context, the acquisition of a specific legal culture (and its technical vocabulary) is a contribution to a better understanding of the production environment.Digita il testo o l'indirizzo di un sito web oppure traduci un documento. In particular, the future industrial engineer, aware of their civil and criminal liability, can profitably: (a) frame their decisions, that presuppose scientific knowledge of various kinds, in compliance with the law; (b) assess the impact, in terms of organizational efficiency and cost effectiveness, of the various organizational options permitted by current regulations; (c) deal with the public administration and with all policy makers

Program
The course aims to teach and analyze, in a law and economics perspective, legal rules provided for property, contracts, torts, enterprise, market regulation and market promotion, competition law, market authorities, public utilities (national and local level).

Development of the course and examination
LEARNING EVALUATION METHODS
oral examination.

LEARNING EVALUATION CRITERIA
to successfully pass the oral exam, the student will demonstrate an overall knowledge of teaching

content, with the use of appropriate technical and legal terminology.

LEARNING MEASUREMENT CRITERIA
attribution of the final mark out of thirty

FINAL MARK ALLOCATION CRITERIA
The oral test will be divided into two or three questions . Each question will be evaluated with a score ranging between 18 and 30 points. The final grade will be the arithmetic mean of the result of the votes achieved in individual questions. The honors will be given to students who, having achieved the highest rating, have demonstrated the complete mastery of the subject

Recommended reading
(1) Campobasso, Manuale di Diritto Commerciale, Utet Giuridica, 2015 (esclusa la parte quinta sulle procedure concorsuali); (2) AA.VV., Fondamenti di diritto del lavoro, Wolters Kluwer CEDAM, 2015.

Diritto e Sicurezza del Lavoro

Giovanni Zampini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
no previous requirements

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to give students extensive knowledge of the various and complex legal issues relating to: (a) professional activities (professional law, intellectual property, ethics, civil and criminal liability); (b) the territorial government (planning regulations and construction); (c) public works legislation; (d) safety at work, with particular reference to construction shipbuilding.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to address advanced design themes (also of considerable complexity) and treat the innovation and development of new technological processes through the application of knowledge, the student will be able at the end of the course be able to identify and apply the regulations correctly indicated above. This capacity will be expressed through a range of vocational skills, like the ability to: (1) evaluate the most appropriate legal title in relation to the project of building work to be performed; (2) program the construction activities related to the requirements for safety; (3) prepare correctly all the documentation required by law in the elaboration and execution of projects and in the construction site management.
TRANSVERSAL SKILLS:
The acquisition of a specific legal culture (and its technical vocabulary) will help to improve the understanding of the future building engineer who, aware of civil and criminal liability, can profitably: (a) frame their decisions, that presuppose scientific knowledge of various kinds, in compliance with the law; (b) assess the impact, in terms of organizational efficiency and cost effectiveness, of the various organizational options permitted by current regulations; (c) deal with the public administration and with all policy makers

Program
The course aims to teach and analyze legal rules for the activity of building engineers. After an introductory part, dedicated to the pivotal principles of the European and Italian legal system, particular attention will be paid to: town planning and building laws, contracts more known to operators in construction industry, legislation on public works contracts, safety at work, as well as the ethics and professional responsibility of building engineers.

Development of the course and examination
LEARNING EVALUATION METHODS
oral examination.

LEARNING EVALUATION CRITERIA
to successfully pass the oral exam, the student will demonstrate an overall knowledge of teaching content, with the use of appropriate technical and legal terminology.

LEARNING MEASUREMENT CRITERIA
attribution of the final mark out of thirty

FINAL MARK ALLOCATION CRITERIA
The oral test will be divided into two or three questions . Each question will be evaluated with a score ranging between 18 and 30 points. The final grade will be the arithmetic mean of the result of the votes achieved in individual questions. The honors will be given to students who, having achieved the highest rating, have demonstrated the complete mastery of the subject

Recommended reading
ut supra

Disegno

Ramona Quattrini

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide fundamental skills required for the interpretation and preparation of complex technical representation adopted at various project levels in civil and environmental engineering.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to address advanced design themes, even of considerable complexity, and treat the innovation and development of new products and new technological processes through the application of knowledge, the student will be able to identify the method of representation that best fits case to deal with. This ability through a series of skill in the base part is partly governed by professional skills, such as: 1. the ability to appropriately choose the correct methods of representation and the appropriate technologies for its implementation; 2. The ability to make the most suitable choice to the representation of the case in question; 3. The ability to interpret and communicate the ideas that gave rise to the representation.
TRANSVERSAL SKILLS:
Practical activities, which will be conducted in groups or individually, will allow to apply the knowledge acquired to specific case studies. In particular, the drafting of a representation of the product will help improve the degree of independence of judgment, the ability communication that is also derived from the work group, the ability to learn independently and to draw conclusions.

Program
Contents (lessons and lectures- 40 hours): tThe fundamental problem of graphic representation - Fundamental geometrical entities - The concept of point and straight line to infinity - The geometrical operation of projection and section - Representation methods - Orthogonal projections - Preliminary remarks - The reference system - Representation of the point - Representation of the straight line - Representation of the piane - Conditions of belonging - Conditions of parallelism - Conditions of perpendicularity - Transformation of projections - Representation of solids - representation of geometrical elements in oblique axonometry - Conditions of belonging - Conditions of parallelism - Oblique axonometry - Orthogonal axonometry Mathematical basis of a CAD 2D system - Digitalisation - Identification -Choice of geometrical elements - Graphics primitive - Modifications and construction in CAD systems - CAD drawing techniques. The graphical process will be developed as a primary instrument of engineering design, regarding the need to manage numerous workgroups and with several technical skills. It will pay particular attention to complex graphics used in the various levels of planning of civil and environmental engineering. Exercises (8 hours) : graphical applications

Development of the course and examination

LEARNING EVALUATION METHODS
The exam consists in two phases: - presentation of a graphical applications and exercices developed during the course - oral or paper examination about issues treated in the course with graphical applications

LEARNING EVALUATION CRITERIA
The student must demonstrate, through the two tests above, knowledge of civil engineer drawings. He must also to be autonoumous to choose graphical norms, level of detail and representation scales, concerning several project phases. The student must know reference elements of main representation systems and resolve descriptive geometry problems through graphical applications.

LEARNING MEASUREMENT CRITERIA
The vote will be attributed adding the evaluation of the oral examination and that of the graphical exercices

FINAL MARK ALLOCATION CRITERIA
The final evaluation will be given thirty. Laude will be given to students who have the highest rating and demonstrate full knowledge of the subject.

Recommended reading
. Docci , Teoria e pratica del disegno , Laterza M. Bocconcino, A. Osello, C. Vernizzi, IL DISEGNO E L'INGEGNERE DISEGNO E GEOMETRIA. PRINCIPLES OF ENGINEERING DRAWINGS , Levrotto e Bella, 2006 P. Clini, Architettura in CAD , Pitagora editrice, Bologna, 2008 G. Parra, Il disegno dell'architettura , Pitagora editrice, Bologna, 2007 Dispense del corso reperibili su Moodle https://lms.univpm.it/course/index.phpcategoryid=2

Disegno Assistito dal Calcolatore

Ferruccio Mandorli

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course allows the students to acquire the necessary technical knowledge required to develop digital models of solid objects and free-form surfaces. This knowledge will allow the student to acquire the skill required for the development and the efficient use of geometric models to support the different tasks related to the product development process.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
For the purpose of addressing the design and productive issues through the implementation of the acquired skills, the student will have to be able to summarise and represent the results of the design activity using appropriate and updated methods, techniques and tools. This ability will be acquired through a series of professional skills such as: the ability to define 3D geometric models of components and assemblies by means of hybrid modelling techniques, which integrate the use of surface modelling and solid modelling systems; the ability to exchange the developed geometric models among different geometric modelling and analysis systems.
TRANSVERSAL SKILLS:
In their professional activity, especially in the industrial sector, engineers need to communicate information, ideas, problems and solutions to other technical interlocutors; a significant part of this information is geometric information and it needs the application of rigorous methods for its representation. The practical exercises which consist in the creation of geometric 3D models require, for their development, the application of methods which stimulate and transmit to students the methodological rigour aimed at developing the attitude towards a logic reasoning strongly based on the scientific method and to train and reinforce concentration skills.

Program
Role of geometric models in the product development process: characteristics and classification of MCAD systems; characteristics of the surface, solid and hybrid models; type of user interaction supported by the different types of systems; application fields of the MCAD technology; criteria for the quality and usability assessment of 3D geometric models in industrial processes; criteria and techniques to support standardization, modification and re-use of geometric models. 3D geometric modelling techniques: free-form surface modelling techniques (patch modelling, global deformation modelling); solid modelling techniques (feature-based parametric modelling; explicit modelling). Interoperability of models: integrated systems, optimization methods for data exchange, types of exportable data, formats of data exchange. Production of technical documentation: production of 2D technical tables, definition and automatic filling of the legend and the bill of materials; production of realistic images and animations; integration of 3D models in technical documents. Use of CAD systems for surface modelling and solid modelling for the development of integrated projects.

Development of the course and examination

LEARNING EVALUATION METHODS

The assessment of the students' learning level consists in the production and oral presentation of a modelling project. The project is chosen by the student and it must be developed autonomously by means of using different types of 3D MCAD systems. The student must submit all the files related to the developed project (component models, general models, technical drawings, any rendering and animations) and he/she must compile a short report on the performed work according to a preset template; the files can be delivered on a CD-ROM or they can be uploaded on the eLearning platform of the course.

LEARNING EVALUATION CRITERIA

The marking of the project takes into account the following factors: complexity and quality of the surface models (i.e. free-form components with double curvature); correct parametrization of solid components (i.e. use of dimensions in the sketch); complexity and quality of the assembly model; clarity and accuracy of the technical drawings; level of integration between solid and surface models; employment of advanced modules and functionalities. In order to pass the exam the student has to prove, through the project, his/her correct understanding of the aspects related to the development of geometric models to be employed in the product development processes, with particular reference to the combined use of solid and surfaces models.

LEARNING MEASUREMENT CRITERIA

The grading scale is from 1 to 30. In order to get a sufficient evaluation (18/30), the student must prove, through the project, to have acquired a sufficient skill in the use of 3D geometric modeling systems. The mark increases accordingly with the project complexity and with the demonstration that the student has acquired enough competency in order to understand the issues related to the development of 3D geometric models that will be usable within the product development processes. The maximum mark (30/30 cum laude) is reserved only to the students who have developed a very complex project, showing a deep understanding of the techniques and the issues related to the development of integrated models.

FINAL MARK ALLOCATION CRITERIA

The final mark is computed by starting from the mark of the project evaluation and by adding or subtracting a maximum of 2 points, depending on the quality of the oral presentation.

Recommended reading

Papers and documents handed out during the course and material available on the eLearning platform (https://lms.univpm.it)

Disegno dell'Architettura 1 (EA)

Giorgio Parra

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 90
Period E/1s-2s

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course address the methods and tools to "read, see and draw" the architectural space; the student attendpractical sessions using different ways and techniques of architectural representation. The workshop deals with simple works on the themes of drawing an representation of architecture, the laboratory activity iscoordinated with other disciplines in the areas: History of architecture and art.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to address advanced design themes, even of considerable complexity, and treat the innovation and development of new products and new technological processes through the application of knowledge, the student will be able to identify the method of representation that best fits case to deal with. This ability through a series of skill in the base part is partly governed by professional skills, such as: 1. the ability to appropriately choose the correct methods of representation and the appropriate technologies for its implementation; 2. The ability to make the most suitable choice to the representation of the case in question; 3. The ability to interpret and communicate the ideas that gave rise to the representation.
TRANSVERSAL SKILLS:
The execution of practical activities that they will apply the knowledge gained on specific case studies, which will be conducted in groups or individually and that will lead to the drafting of a representation of the product will help improve the degree of independence of judgment in general, and the ability communication that is also derived from the work group and the ability to learn independently and to draw conclusions, the student.

Program
THEORY: Fundamentals elements about visual perceiving and descriptive geometry. The concept of projection and representation methods (parallel and convergent projection). The orthogonal projection, different types of axonometric representations and direct and indirect perspective (measuring points method). Representation of plane and solid figures, plans of section and conic sections; representation of rotation surfaces and helix, solid intersections, real form of plane figures. The different graphic techniques: free hand drawing and by computer (autocad); relief drawing and planning drawing. The normative. The critical graphic reading of historic architecture. EXERCISE: The student will have to master the different drawing techniques: free hand and by computer. The exercises in the class-room, based on descriptive geometry applications, will consist on 2D and 3D critical representation of historic architecture.

Development of the course and examination
LEARNING EVALUATION METHODS

The assessment of the level of learning takes place in two stages. - Evaluation of the work performed during attendance at the laboratory - Interview which focuses on the topics covered by the lectures the interview, the student must present all graphics boards made during the exercises. The questions will take their cue from as graphically represented in the tables presented.

LEARNING EVALUATION CRITERIA
To successfully pass the assessment of learning, the student must show that they understand the concepts presented during the During the lessons demonstrating a clear understanding of the concepts related to the generation of various graphic signs beyond the proper implementation of the various graphic constructions.

LEARNING MEASUREMENT CRITERIA
evaluation of the work performed during attendance at the laboratory is assigned a rating

FINAL MARK ALLOCATION CRITERIA
In order for the outcome of the evaluation is positive to be achieved sufficiency (eighteen) in each of the two assessments. The praise is reserved for those who, having passed the evaluation of the laboratory and the interview (or proof of any graphics) so correctly demonstrate particular excellence in the presentation of the basic concepts of generation of the drawings.

Recommended reading
G. Parra e altri, Il Disegno dell Architettura, Ed. Pitagora Bologna M.Docci, D. Maestri, Scienza del Disegno, Ed. UTET Libreria, Torino C. Mezzetti e altri, Il disegno analisi di un linguaggio, Ed. Goliardica Roma

Disegno e Gestione della Documentazione di Prodotto

Maura Mengoni

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Principles and basis of the main manufacturing processes

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims at providing knowledge on basic principles of technical drawing (execution and interpretation), on solid modeling for product representation and on new documents management techniques. The main topics are the following ones. Technical drawing: role of drawing in design/production process, standards, methods of representation, roughness, dimensions, dimensional and geometric tolerances, threads and threaded components, mechanical components.Geometric modeling: main techniques, CAD systems, solid modeling of parts and assemblies, digital drawing. Document management: evolution of traditional and digital documents management, data bases management, evolution of management MRP/ERP and PDM/PLM/cPLM systems, main functionalities, architectures, impact on extended enterprise, collaborative product development systems and workflow management.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The achieved knowledge can be applied to different industrial contexts, spreading from manufacturing enterprises to product-related services companies. In particular, the expertise in mechanical design methods and representational techniques will be used to interpret all technical drawings. This is a valid support to industrialize a product, to analyse costs, to manage the Bill of Materials, to schedule production cycles and manage logistics. CAD modeling and virtual prototyping will be very useful to manage extended enterprises, virtual teams, distributed knowledge, product development processes. Finally the achieved knowledge on product data management along its lifecycle will be useful to really create the technical background for a management engineer that will face problems of knowledge formalization and management, implementation of complext SW platforms, process management and automation during his/her career.
TRANSVERSAL SKILLS:
The cross expertise regards: 1) the ability to create a strong relationship between design and production through the use of different representational means (both traditional and virtual) in order to reduce design errors, technical modifications and improve the product/service quality; 2) the ability to perform a benchmark of technologies and services taking into account not only the systems' functionalities and company's needs, but also the characteristics of the organization, human resourses skill, processes to be implemented and assigned budget; 3) the ability to drive Business Process Reengineering by combining actions oriented to improve human resourses skill, ICTs, enterprise management strategies; 4) the ability to promote strategies oriented to Customer Experience and Customer Relationship Management.

Program
The course is arranged in 48 hours of frontal lectures and 24 hours of exercises in technical drawing

and CAD modeling. The course aims at providing knowledge on basic principles of technical drawing (execution and interpretation), on solid modeling for product representation and on new documents management techniques. The main topics are the following ones. Technical drawing: role of drawing in design/production process, standards, methods of representation, roughness, dimensions, dimensional and geometric tolerances, threads and threaded components, mechanical components.Geometric modeling: main techniques, CAD systems, solid modeling of parts and assemblies, digital drawing. Document management: evolution of traditional and digital documents management, data bases management, evolution of management MRP/ERP and PDM/PLM/cPLM systems, main functionalities, architectures, impact on extended enterprise, collaborative product development systems and workflow management.

Development of the course and examination
LEARNING EVALUATION METHODS
The evaluation of the student learning is performer through an oral exam to assess the matured competences on the course topics and a graphic test to assess the student skill about technical drawing.

LEARNING EVALUATION CRITERIA
TThe student learning is assessed through the verification of the results achieved during the graphic test and the oral exam. In particular, the graphic test allows the teacher to evaluate the ability of the student to create technical drawings and interpret them with a focus on international standards. Criteria for the oral exam are: knowledge of the course topics, ability of analysis and synthesis and to apply matured competences in different domains.

LEARNING MEASUREMENT CRITERIA
In both tests (graphical and oral), the student has to demonstrate to be able to independently use the basis of mechanical drawing to represent parts and assemblies and to know and create relations among the main approaches and tools for Product Lifecycle Management (documents and processes). In particular, in the oral exam the student has to demonstrate abilities in illustrating and summing up ideas and concepts learned during lessons.

FINAL MARK ALLOCATION CRITERIA
The maximum score is 30/30 and laude. It is achieved by students that demonstrate competence and skill in product lifecycle management and in mechanical drawing. The minimum scorre is 18/30 and is assigned to students that only have an enough knowledge of teached tools and methods.

Recommended reading
Levy Gabriele: La logistica nei sistemi ERP. Dalla distinta base alla produzione. Franco Angeli Edizioni, 2013 Saaksvuori, Antti, Immonen, Anselmi: Product Lifecycle Management, Sprinter, 2004 Langfelder, M., 2004, Spazio PDM/PLM. Il PDM/PLM come strumento di interoperabilità , a cura di Sistemi e impresa F. MANFE , R. POZZA, G. SCARATO: Disegno Meccanico , Vol 1-2-3, Principato Editore, Milano. E. Chirone, S. Tornincasa,"Disegno Tecnico Industriale", Vol. 1-2, Edizione il Capitello, Torino. Manuali M1: Norme per il Disegno Tecnico , Vol I. e Vol. II, UNI., Milano.

Disegno Meccanico (A/L)

Ferruccio Mandorli

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
the course allows the students to acquire the necessary knowledge in order to read and execute mechanical drawings of components, groups and assemblies according to the technical drawing standards. These skills, which will be integrated with notions acquired in the course of metallurgy, machine design, applied mechanics and mechanic technology courses, will offer the student the possibility to become aware of the multidisciplinary nature of engineering, thanks also to specific references to aspects specifically related with production systems and technologies, the design of machineries and mechanical systems. The students will also acquire the ability to use the appropriate technical language of mechanical drawing
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
For the purpose of addressing the design and productive issues through the implementation of the acquired skills, the student will have to be able to summarise and represent the results of the design activity using appropriate and updated methods, techniques and tools. This ability will be acquired through a series of professional skills such as: the ability to execute, according to the standards, dimensioned sketches of components and simple assemblies, the ability to read mechanical drawings of components, groups or assemblies interpreting in a correct and comprehensive way the orthogonal views, the dimension indications, the dimensional and geometrical tolerance indications, the rugosity indications and the indications listed in the legend box and bill of components.
TRANSVERSAL SKILLS:
In their professional activity, especially in the industrial sector, engineers, need to communicate information, ideas, problems and solutions to other technical interlocutors; a significant part of this information is graphic information and it needs the application of rigorous methods for its representation. The objective of the practical exercises is to learn to execute freehand sketches and to develop technical communication skills.

Program
Role of mechanical drawing in the desing/prodcution process, regulation and standardization, representation methods, orthogonal projections, sections, notes on processes and materials, roughness, dimensioning, dimensional tolerances, threading and threaded entities, connections, guides and joints, mechanical transmissions.

Development of the course and examination
LEARNING EVALUATION METHODS
The evaluation of the level of understanding of the students is done with a written and an oral exam: the written exam is a graphic test eventually integrated with additional questions; the objective of the graphic test is to make the sketch of a mechanical component that is part of a larger assembly

drawing, given as reference. During the oral examination, the student will be asked to answer to questions related to the graphic test or about some of the topics of the course.

LEARNING EVALUATION CRITERIA

The mark of the written exam is determined by taking into account the following criteria: coherence of the drawing in respect to the assigned test; correctness of the geometric representation as well as the dimensional specifications. The mark of the oral exam is determined by taking into account the following criteria: knowledge about the standards; competency in the use and interpretation of the mechanical drawing rules. In order to pass the exam, the student must demonstrate that he/she learned the syntactic and semantic rules that define the graphic language of the mechanical drawing and that he/she has developed the competency required to correctly draw and read the mechanical drawing of a component or a small assembly.

LEARNING MEASUREMENT CRITERIA

The grading scale is from 1 to 30. In order to get the minimum sufficient mark to pass the exam (i.e. 18/30), the student must get at least 18/30 for the written exam and he/she must answer in a sufficient way during the oral examination, in order to demonstrate that he/she has acquired a sufficient capability in drawing and reading mechanical drawings of simple components and assembly. The maximum mark (i.e. 30/30 cum laude) can be obtained by performing a very accurate written exam and by demonstrating a deep knowledge of the topics of the course.

FINAL MARK ALLOCATION CRITERIA

The final mark is computed starting from the mark of the written exam and by adding or subtracting a maximum of 4 points, depending of the answers provided during the oral exam.

Recommended reading

E. Chirone, S. Tornincasa: "Disegno Tecnico Industriale", Vol 1-2, Edizioni il Capitello. M. Carfagni, L. Governi, R. Furferi, Y. Volpe: "Esercizi di disegno meccanico", Zanichelli. G. Manfè, R. Pozza, G. Scarato: "Disegno Meccanico", Vol 2 e 3, Principato Editore. Norme ISO, EN, UNI per il Disegno Tecnico. Documents handed out during the course and material available on the eLearning platform (https://lms.univpm.it)

Disegno Meccanico (M/Z)

Michele Germani

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
the course allows the students to acquire the necessary knowledge in order to read and execute mechanical drawings of components, groups and assemblies according to the technical drawing standards. These skills, which will be integrated with notions acquired in the course of metallurgy, machine design, applied mechanics and mechanic technology courses, will offer the student the possibility to become aware of the multidisciplinary nature of engineering, thanks also to specific references to aspects specifically related with production systems and technologies, the design of machineries and mechanical systems. The students will also acquire the ability to use the appropriate technical language of mechanical drawing
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
For the purpose of addressing the design and productive issues through the implementation of the acquired skills, the student will have to be able to summarise and represent the results of the design activity using appropriate and updated methods, techniques and tools. This ability will be acquired through a series of professional skills such as: the ability to execute, according to the standards, dimensioned sketches of components and simple assemblies, the ability to read mechanical drawings of components, groups or assemblies interpreting in a correct and comprehensive way the orthogonal views, the dimension indications, the dimensional and geometrical tolerance indications, the rugosity indications and the indications listed in the legend box and bill of components.
TRANSVERSAL SKILLS:
In their professional activity, especially in the industrial sector, engineers, need to communicate information, ideas, problems and solutions to other technical interlocutors; a significant part of this information is graphic information and it needs the application of rigorous methods for its representation. The objective of the practical exercises is to learn to execute freehand sketches and to develop technical communication skills.

Program
Role of mechanical drawing in the desing/prodcution process, regulation and standardization, representation methods, orthogonal projections, sections, notes on processes and materials, roughness, dimensioning, dimensional tolerances, threading and threaded entities, connections, guides and joints, mechanical transmissions.

Development of the course and examination
LEARNING EVALUATION METHODS
The evaluation of the level of understanding of the students is done with a written and an oral exam: the written exam is a graphic test eventually integrated with additional questions; the objective of the graphic test is to make the sketch of a mechanical component that is part of a larger assembly

drawing, given as reference. During the oral examination, the student will be asked to answer to questions related to the graphic test or about some of the topics of the course. The written exam is preparatory for the oral exam and the oral exam must be given in the same session of the written one. In case of fail during the oral exam, the student will be requested to repeat also the written exam.

LEARNING EVALUATION CRITERIA
In order to pass the exam, the student must demonstrate that he/she learned the syntactic and semantic rules that define the graphic language of the mechanical drawing and that he/she has developed the competency required to correctly draw and read the mechanical drawing of a component or a small assembly.

LEARNING MEASUREMENT CRITERIA
The mark of the written exam is determined by taking into account the following criteria: coherence of the drawing in respect to the assigned test; correctness of the geometric representation as well as the dimensional specifications. The mark of the oral exam is determined by taking into account the following criteria: knowledge about the standards; competency in the use and interpretation of the mechanical drawing rules.

FINAL MARK ALLOCATION CRITERIA
In order to get the minimum mark (i.e. 18/30), the student must get at least 18/30 for the written exam and he/she must answer in a sufficient way during the oral examination, in order to demonstrate that he/she has acquired a sufficient capability in drawing and reading mechanical drawings of simple components and assembly. The maximum mark (i.e. 30/30 cum laude) can be obtained by performing a very accurate written exam and by demonstrating a deep knowledge of the topics of the course.

Recommended reading
E. Chirone, S. Tornincasa: Disegno Tecnico Industriale , Vol 1-2, Edizioni il Capitello. M. Carfagni, L. Governi, R. Furferi, Y. Volpe: Esercizi di disegno meccanico , Zanichelli. G. Manfè, R. Pozza, G. Scarato: Disegno Meccanico , Vol 2 e 3, Principato Editore. Norme ISO, EN, UNI per il Disegno Tecnico. Documents handed out during the course and material available on the eLearning platform (http://moodle.univpm.it)

Disegno Tecnico e Rilievo degli Edifici

Federica Fiori

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course allows the students acquiring knowledge on the drawing of buildings and more advanced knowledge about traditional survey methods. These competences give to the students a scientific language and a technical one, in order to improve the student s skills in the knowledge-basis of representation. This is useful to comprehend thereafter the engineering courses. The teaching of technical drawing, cooperating with architectural survey, wants to show a comprehensive framework of most common representations and tools of survey, starting from the traditional to the instrumental one.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to approach design issues, the student will have skills in analysis and lecture of elements of contemporary and historical architecture, moreover the student will use current tools of drawing and will apply several kind of graphical representation. These capacities will develop professional skills, as follow: 1. the capacity of representing design and technical drawings at various scales and for various steps of project 2. the capacity of planning a traditional survey or an instrumental one, applying operational choices based on the state of art 3. the capacity of developing a complete set of drawings with correct graphical norms and collaborating each other, allowing project management.
TRANSVERSAL SKILLS:
The development of a traditional survey, in a working group, with its graphical elaborations and a report, will contribute to improve the level of autonomy, the communicative skills and the ability of self-learning and to lead to conclusions.

Program
Contents (Lessons and lectures - 51 hours) The fundamental problem of graphic representation - Fundamental geometrical entities - The concept of point and straight line to infinity - The geometrical operation of projection and section - Representation methods - Orthogonal projections - Preliminary remarks - The reference system - Representation of the point - Representation of the straight line - Representation of the piane - Conditions of belonging - Conditions of parallelism - Conditions of perpendicularity - Transformation of projections - Representation of solids - representation of geometrical elements in oblique axonometry - Conditions of belonging - Conditions of parallelism - Oblique axonometry - Orthogonal axonometry - Perspective - Mathematical basis of a CAD 2D system - Basis of BIM - Digitalisation - Identification -Choice of geometrical elements - Graphics primitive - Modifications and construction in CAD systems - CAD drawing techniques. General concepts and theoretical foundations of architectural surveying; an outline of measurement theory; surveying methods: direct, instrumental, photogrammetry, automatic. The graphic instrument for programmation of the construction process, management of work s groups by various techniciens. Exercises (21 hours) Graphical applications

Development of the course and examination

LEARNING EVALUATION METHODS
- oral or paper examination about issues treated in the course with graphical applications - presentation, with drawings, of a survey project concerning a house, chosen from the student and agreed by professor The project might be carried out in a students team, composed from 2 to 4 units. If a test has negative result, the student can repeat it, maintaining the previous

LEARNING EVALUATION CRITERIA
The student must demonstrate, through the two tests above, knowledge of architectural drawing and survey procedures. He must also to be autonoumous to choose graphical norms, level of detail and representation scales, concerning several project phases. The student must know reference elements of main representation systems and resolve descriptive geometry problems through graphical applications.

LEARNING MEASUREMENT CRITERIA
The vote will be attributed adding the evaluation of the oral examination and that of the project. The project will have maximum 10 points. Oral or paper examination consists in 2/3 queries and have maximum 20 points.

FINAL MARK ALLOCATION CRITERIA
The final evaluation will be given thirty. Laude will be given to students who have the highest rating and demonstrate full knowledge of the subject.

Recommended reading
- M. Docci , "Teoria e pratica del disegno", Laterza P. Clini, Architettura in CAD , Pitagora editrice, Bologna, 2008 P. Clini, Il rilievo dell'architettura , Alinea, 2008 M. Docci, D. Maestri, "Manuale del rilevamento architettonico e urbano", Laterza, 2009 Brusaporci, Stefano, ed. Handbook of Research on Emerging Digital Tools for Architectural Surveying, Modeling, and Representation. IGI Global, 2015. Courses slides available on moodle: https://lms.univpm.it/enrol/index.php?id=23

Dispositivi Elettronici

Mauro Ballicchia

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course provides a thorough knowledge and understanding on the operating principles of the main solid-state devices in order to apply it to design of electronic circuits, deepening in particular some design techniques typical of CMOS radio-frequency integrated circuits. Starting from the basic principles of the semiconductor physics the course will introduce the equations of semiconductors both in equilibrium and out-of-equilibrium. This knowledge will be used to describe the operating principles of the main solid-state devices, in all the operating regions, and introduce the fundamental knowledge on sub-micrometer and nanometer technologies, the device scaling and its influence on the performance of the devices. The course provides also a knowledge and understanding of the high-frequency behavior and the noise models of the devices that will be applied by introducing the main design techniques of radio-frequency integrated circuits.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The course allows to apply the knowledge of the semiconductor theory to analyze and model the electrical behaviour of the main semiconductor devices until the nanometer scale. The skill to model the electrical behavior of the electronic devices is applied in the basic design techniques of radio-frequency integrated circuits, in order to provide the student the applying knowledge about design problems with conflicting constraints.
TRANSVERSAL SKILLS:
The course includes multidisciplinary contents, since, starting from the basic knowledge of classical and modern physics, introduces the semiconductor physics in order to analyze the behavior of semiconductor devices and extract both analytical and circuit model to be used in the design of electronic circuits. This aims to allow the students to develop transversal skills, in order to improve the ability of making judgements in the analysis of the emerging micro and nano-electronic technologies, that are continuously evolving, and contemporary makes the students able to work with expert of different disciplinary area. Moreover interdisciplinarity contributes also to improve learning skills, by harmonizing the contents in a unitary vision, and providing, at the same time, the basic elements for subsequent courses, that are more specialized and application oriented.

Program
Recall of quantum mechanics. Kronig-Penney model. Effective mass of electrons and holes in semiconductors. Statistical mechanics, carrier concentration at thermal equilibrium, non-equilibrium phenomena in semiconductors: carrier transport and Generation-Recombination. Drift-Diffusion model. PN Junction and MOSFET: physical operation, DC and high-frequency device modelling. Noise sources. Noise in linear two-ports. MOSFET noise. Submicron and nanometer technologies: submicron effects in MOSFET and device scaling. Fundamentals of radio-frequency integrated circuit design: design of amplifiers by scattering parameters, design of Low-Noise Amplifiers (LNA).

Varactors, voltage-controlled oscillators and mixers.

Development of the course and examination
LEARNING EVALUATION METHODS
The examination consists of an oral test, structured into three questions regarding the main topics covered by the course, that are: the physics of semiconductors, the physical operation and the models of semiconductor devices, the basic design techniques for radio-frequency integrated circuits in submicron CMOS technologies. If necessary, the questions whose answer requires the execution of short calculations, will be carried out in written form during the oral test.

LEARNING EVALUATION CRITERIA
The student, during the oral examination, must demonstrate, through the discussion of the questions posed by the teacher, to possess the knowledge and the analytical tools necessary to describe the physical operation of semiconductor devices, to be able to apply them to derive the device models in all the operating conditions and to analyze the scaling issues in modern submicrometer and nanometer technologies. The student must also demonstrate to know and be able to use device models and possess the methodological skills to design basic radio-frequency circuits. In order to pass the oral test with a positive evaluation, the student must demonstrate to have well understood the contents of the course, that must be presented in a sufficiently correct manner with the use of an adequate technical and scientific terminology. The highest mark is achieved by demonstrating an in-depth knowledge of the contents of the course, that must be presented with a complete mastery of the technical-scientific language.

LEARNING MEASUREMENT CRITERIA
For each question, posed during the oral test, it is assigned a mark between zero and thirty. The final mark, that is expressed in thirtieths, is the average of the marks obtained in the questions.

FINAL MARK ALLOCATION CRITERIA
In order that the final outcome of the evaluation is positive, the student must achieve the pass mark, equal to eighteen points, in each of the questions, which corresponds to possess an overall knowledge of the contents of the course. The highest mark will be achieved by demonstrating an in-depth knowledge of the contents. The honours will be given to the students who, having achieved the highest mark, have demonstrated a complete mastery of the subject and a particular brilliance of exposition.

Recommended reading
S.M. Sze, K. K. Ng , Physics of Semiconductor Devices 3rd edition , John Wiley and Sons, Inc. 2007. G. Ghione, Dispositivi per la Microelettronica , McGraw-Hill R.S. Muller, T.I. Kamins, Device Electronics for Integrated Circuits , John Wiley and Sons, Inc. 2003. T.H. Lee, The Design of CMOS Radio-Frequency Integrated Circuits , Cambridge University Press, 2004. G.D. Vendelin, A.M. Pavio, U.L. Rhode, Microwave Circuit Design using Linear and Nonlinear Techniques , John Wiley and Sons, Inc. 2005, 1990.

Dynamical Modelling of Movement

Laurence Cheze

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
none

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
Aim of the course is the analysis of the dynamics of systems consisting in articulated rigid bodies, and its use in human movement describing the specificities of these concepts in biomechanics. In particular, focus is on the inertial body parameters estimations, and on the computation of joint moments using an inverse dynamics approach. Musculoskeletal modeling is also presented
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
By this mandatory course, the students learn how to establish the laws of motion linking the movement of a multi-body system (the musculoskeletal system) and the causes of this movement (mechanical actions). They are able to choose and apply the relevant methods to quantify the joints loads in different situations, from the determination of body segment inertial parameters to the calculation of the joints net moments. The examples are mostly in the domain of human movement analysis (sport gestures,) . The students are aware of measurement errors and to the main hypotheses to assume to establish the movement equations, so that they keep a critical mind when they have to interpret their results for example in a clinical context.
TRANSVERSAL SKILLS:
Capabilities of: synthesis, autonomy and clarity. Read a document, understand an interlocutor expressing himself, and speak in English. Work in an international context.

Program
. Dynamics of a material point a. Some basic concepts (reference frame, mass, linear momentum, angular momentum) b. Newton s first law of inertia c. Newton s second law or Fundamental Principle of Dynamics d. Newton s third law or Action-Reaction law e. Some classical forces (gravitational force, friction force, spring force) II. Work, kinetic energy, kinetic moment and related theorems a. Work and Power b. Kinetic energy and work-energy theorem c. Conservative forces and potential energy d. Conservation of total energy e. Angular momentum theorem III. Kinetics of a rigid body a. Introduction b. Mass distribution c. Centre of mass d. Kinetic energy associated to the movement of a solid e. Kinetic vectorial quantities associated to the movement of a solid f. Koenig s theorems for the kinetic energy and the angular momentum g. Kinetics of the specific movement of a solid around a fixed point h. Matrix of the inertia tensor in any direct orthonormal basis i. Application of the Koenig s theorems for kinetic calculations j. Time derivative of the linear and angular momentums k. Application in human movement : Inertial body segment parameters evaluation IV. Rigid multi-body dynamics a. Introduction b. Fundamental Principle of Dynamics c. Kinetic energy theorem d. Energy conservation theorem e. Joint modelling f. Application in human movement i. External forces measurement devices ii. Inverse dynamics method to compute net joint moments V. Lagrange s equations of motion a. Generalized coordinates and kinematical constraints b. Generalized forces and virtual work c. Lagrange s equations of motion VI.

Musculoskeletal modelling a. Musculo-skeletal models i. Muscle contraction dynamics model ii. Muscle-tendon dynamics model iii. Skeletal dynamics model b. Prediction of mucle-tendon and joint reaction forces i. Static optimization ii. EMG to force iii. Forward dynamics assisted data tracking The course notes will be available for students in PDF format. New concepts will be regularly applied on exercises, mostly related to human movement.

Development of the course and examination

LEARNING EVALUATION METHODS

The assessment of student learning consists of a two written tests, composed of two or three exercises on topics covered in the course, to be completed in 120 minutes.

LEARNING EVALUATION CRITERIA

To successfully pass the examination, the student must demonstrate to have well understood the concepts presented in the course and that he/she is able to apply these concepts in typical concrete situations.

LEARNING MEASUREMENT CRITERIA

A score between zero and thirty is assigned for each written test. The overall grade is the average of the scores obtained in the two tests, with rounding to the entire excess.

FINAL MARK ALLOCATION CRITERIA

The student must achieve at least the sufficiency, equal to 18/30, in the overall grade. The highest rating is achieved by demonstrating a thorough understanding of the course content in the tests. Laudem is given to students who, having done all the tests so correctly, have demonstrated a particular brilliance in the exposition and in the preparation of the written tests.

Recommended reading

Vladimir M. Zatsiorsky: Kinetics of human motion , Human Kinetics (2002) Aydin Tozeren, Human body dynamics : Classical mechanics and human movement Springer (2000) Arthur Chapman, Biomechanical analysis of fundamental human movements Human Kinetics (2008) Masud Chaichian, Mechanics : An intensive course Springer (2012)

Economia dei Sistemi Industriali

Alessandra Micozzi

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course will enables students to acquire knowledge related to firms strategic choices and the factors affecting the competitive advantage of firms. Specific attention is paid to make or buy decisions, the management of the supply chain and the management of innovation. By integrating the knowledge gained in other courses, will increase students knowledge in understanding the strategic choices of firms in the organization of production, innovation and the interaction within other firms within the production chain. The course will also provide students with basic knowledge about the internationalization processes of firms and the role of these processes in the context of the business growth strategies.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
After completing the course the student will be able to evaluate corporate decisions about make or buy choice and the management of contractual relations within the supply chain. Students will also acquire several specific skills, such as: 1. the ability to evaluate the cost and benefits of vertical integration choices taking into consideration both production and transaction costs; 2. the ability to assess the costs and benefits of different forms of internationalization according to the company's strategic decisions; 3. the ability to evaluate costs and benefits of innovative projects.
TRANSVERSAL SKILLS:
During the course students are required to solve a variety of business issues, with reference to make or buy decisions and innovation projects. In addition, students are required, in team, to write a business plan for a new venture. They are therefore required to present and discuss the results of their work in class. These activities will contribute to improve independent judgment, communication skills and autonomous learning.

Program
Industry dynamics and competitive strategy. Entry and exit decisions. The vertical boundaries of firms and the make or buy decisions. The horizontal boundaries of firms: growth strategies and diversification. The internationalization processes. Strategic positioning and competitive advantage. Innovation and differentiation. Management of innovation

Development of the course and examination
LEARNING EVALUATION METHODS
The assessment of students' learning is made by: - A written test, consisting of five/six open questions about the topics covered in the course. - An oral part, consisting in the discussion of the results of the written test and further questions on the topics covered in the course. Students cannot access the oral part of the exam if they have not passed the written test.

LEARNING EVALUATION CRITERIA
To successfully pass the final assessment, students must demonstrate to know the concepts and models illustrated in the course. Students must also demonstrate the ability to solve exercises related the main topics of the course.

LEARNING MEASUREMENT CRITERIA
A score is assigned to each question. The sum of the points awarded to the questions is equal to thirty. Scores will be based on the following criteria: a) the completeness and accuracy of the answer b) the development of arguments, c) the use of the appropriate terminology. The result obtained in the written test can be increased or decreased in the oral test

FINAL MARK ALLOCATION CRITERIA
he outcome of the evaluation is positive when the student reach at least eighteen points out of thirthy. The highest rating is achieved by demonstrating a thorough knowledge of the content of the course

Recommended reading
Besanko D., Dranove D., Shanley M. S. Schaefer - Economics of strategy 6th Edition, Wiley, 2012

Economia dell'Impresa (BIO+MECC)

Francesca Micozzi

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
At the end of the course students will be able to apply the methodology used in the main corporate decisions, such as production capacity, production volumes and investment projects. The course will enable students to understand the principles underlying the evaluation of product costs and the methodology to calculate costs and benefits of new projects. The course will also provide students with basic knowledge about the different forms of market structures and about the models explaining the behavior of firms in different market situations.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
At the end of the course students will be able to apply the methodology used for the main corporate decisions. Students will acquire several specific skills, such as: 1. the ability to determine the cost and revenue functions in different decision-making contexts; 2. the ability to examine the financial statements for the assessment of firm s performance; 3. the ability to apply the appropriate methodology for the economic and financial evaluation of investment projects.
TRANSVERSAL SKILLS:
During the course students are required to work in team to solve a variety of business cases, such as the introduction of new products or the financial evaluation of investments. The teams are required to present and discuss the results of their work in class. These activities will contribute to improve the degree of independent judgment, communication skills and the ability of autonomous learning.

Program
The programe of the subject is divided in three parts: 1)Organization and behaviour of firms: basic concepts of microeconomics (cost functions, markets, prices); firms institutional and organizational forms; scale and scope economies. 2)Principles of accounting; financial analysis; capital budgeting 3)Market structures: perfect competition, monopoly, imperfect competition, oligopoly; industry analysis.

Development of the course and examination
LEARNING EVALUATION METHODS
The final exam is based on a written and an oral part.

LEARNING EVALUATION CRITERIA
The students must be able to do microeconomics exercises, to develop a market analysis and to analyse a balance sheet

LEARNING MEASUREMENT CRITERIA

The answers given during the exam must be clear and complete

FINAL MARK ALLOCATION CRITERIA
The mark is the average between oral and written exam.

Recommended reading
Mankiw, Taylor, Ashwin - Principi di economia per l'impresa - Zanichelli, 2015 Anthony R.N. et al. - Il bilancio. Analisi economiche per le decisioni e la comunicazione della performance - McGraw-Hill (quattordicesima edizione)

Economia dell'Impresa (GEST)

Donato Iacobucci

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course will enables students to acquire basic knowledge about corporate governance and the principles at the basis of major corporate decisions, such as production capacity, production volumes and investment projects. By integrating the knowledge gained from other courses of economics and business organization the course will increase the student's knowledge in the field of theories of models used in firm s management. The course will also provide students with basic knowledge about the main types of markets and forms of competition and about the models explaining the behavior of firms within the different market contexts.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
At the end of the course students will be able to correctly interpret the principles underlying the main corporate decisions. Students will acquire several specific skills, such as: 1. the ability to determine the cost and revenue functions in different decision-making contexts; 2. the ability to examine the financial statements for the assessment of firm s performance; 3. the ability to apply the appropriate methodology for the economic and financial evaluation of investment projects.
TRANSVERSAL SKILLS:
During the course students are required to work in team solve a variety of business cases, referring to the entry in a market or the financial evaluation of investments. The teams are therefore required to present and discuss the results of their work in class. These activities will contribute to improve the degree of independent judgment, communication skills, and the ability of autonomous learning.

Program
The course is organized in three parts: 1) Organization and behaviour of firms: firms institutional and organizational forms, production funcions, cost functions, scale and scope economies. 2) Supply and demand functions, markets; elasticity of demand and supply; market failures; financial markets. - Firms strategy and market structures: firm's strategcy and pricing policy, perfect competition, monopoly, imperfect competition, oligopoly; industry analysis.

Development of the course and examination
LEARNING EVALUATION METHODS
The assessment of students' learning is attained by: 1) A written test, consisting of two/three open questions about the topics covered in the course and in the solution of two/three exercises. The duration of the test is about two hours. 2) An oral part, consisting in the discussion of the results of the written test and further questions on the topics covered in the course. Students cannot access the oral part of the exam if they have not passed the written test.

LEARNING EVALUATION CRITERIA

To successfully pass the final assessment, the student must demonstrate to know the concepts and models illustrated during the course.The student must also demonstrate the ability to solve simple exercises about business decisions.

LEARNING MEASUREMENT CRITERIA
A score is assigned to each of the questions and exercises. The sum of the points awarded to questions and exercises is equal to thirty. Scores will be based on the following criteria: a) the completeness and accuracy of the answer b) the development of arguments, c) the use of the appropriate terminology. The result obtained in the written test can be increased or decreased in the oral test by no more than three points.

FINAL MARK ALLOCATION CRITERIA
The outcome of the evaluation is positive when the student reach at least eighteen points out of thirthy. The highest rating is achieved by demonstrating a thorough knowledge of the content of the course.

Recommended reading
N. Gregory Mankiw, Mark P. Taylor, Andrew Ashwin - Business economics - Cengage Learning EMEA, 2013, Chapters 1-15

Economia dell'Impresa (INF)

Donato Iacobucci

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course will enables students to acquire basic knowledge about corporate governance and the principles at the basis of major corporate decisions, such as production capacity, production volumes and investment projects. The course will enable students to understand the principles underlying the formation of income statement and the balance sheet and the analytical tools to analyze the two documents. The course will also provide students with basic knowledge about the main types of markets and forms of competition and about the models explaining the methodology to evaluate entry decisions and investment projects.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
At the end of the course students will be able to correctly interpret the principles underlying the main corporate decisions. Students will acquire several specific skills, such as: 1. the ability to determine the cost and revenue functions in different decision-making contexts; 2. the ability to examine the financial statements for the assessment of firm s performance; 3. the ability to apply the appropriate methodology for the economic and financial evaluation of investment projects.
TRANSVERSAL SKILLS:
During the course students are required to work in team solve a variety of business cases, referring to the entry in a market or the financial evaluation of investments. The teams are required to present and discuss the results of their work in class. These activities will contribute to improve the degree of independent judgment, communication skills, and the ability of autonomous learning.

Program
The course is organized in three parts: 1) Organization and behaviour of firms: basic concepts of microeconomics, cost functions, demand functions, markets, prices, scale and scope economies; firms institutional and organizational forms. 2) Financial analysis: income statement and balance sheet; risk and opportunity cost of capital; investmente evaluation; - Market structures: perfect competition, monopoly, imperfect competition, oligopoly; industry analysis.

Development of the course and examination
LEARNING EVALUATION METHODS
The assessment of students' learning is attained by: 1) A written test, consisting of two/three open questions about the topics covered in the course and in the solution of two/three exercises. The duration of the test is about two hours. 2) An oral part, consisting in the discussion of the results of the written test and further questions on the topics covered in the course. Students cannot access the oral part of the exam if they have not passed the written test.

LEARNING EVALUATION CRITERIA

To successfully pass the final assessment, the student must demonstrate to know the concepts and models illustrated in the course.The student must also demonstrate the ability to solve simple exercises about business decisions

LEARNING MEASUREMENT CRITERIA
A score is assigned to each of the questions and exercises. The sum of the points awarded to questions and exercises is equal to thirty. Scores will be based on the following criteria: a) the completeness and accuracy of the answer b) the development of arguments, c) the use of the appropriate terminology. The result obtained in the written test can be increased or decreased in the oral test by no more than three points.

FINAL MARK ALLOCATION CRITERIA
The outcome of the evaluation is positive when the student reach at least eighteen points out of thirthy. The highest rating is achieved by demonstrating a thorough knowledge of the content of the course

Recommended reading
N. Gregory Mankiw, Mark P. Taylor, Andrew Ashwin - Business economics - Cengage Learning EMEA, 2013, Chapters 1-15

Economia e Organizzazione Aziendale (GEST)

Diego D'Adda

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course will enable the students to acquire basic knowledge of business economics and some aspects about the organization of firms. This knowledge will be fundamental prerequisites for subsequent courses in economic and management disciplines that students will take. The topics the course will cover are the external accounting and cost accounting, the evaluation criteria of decisions in the short and long term and will introduce concepts and models related to strategy and business organization.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will learn the main features of a firm, how to analyze the economic and operating impact of internal and external flows affecting the company and how to assess the economic convenience of the typical choices a firm faces in the short and in the long run. This will reflect in the acquisition of a number of skills, such as 1) the ability to analyze a company from information found (for example in the balance sheet); 2) the ability to register how a specific transaction involving the company in a certain period of time will translate in a book entry and then in an economic / financial result; 3) the ability to use appropriate costing techniques in order to estimate the cost of a product / service; 4) the ability to assess the economic convenience of a decision, be it in the short term or long term oriented (e.g. an investment); 5) the ability to understand the competitive environment in which the firm operates and the strategy it pursues.
TRANSVERSAL SKILLS:
The students will be asked to perform an analysis of existing firms. This task will be performed in groups and will lead to develop a report, will help the student in improving his judgment skills, communication skills thanks to the teamwork and his ability to learn and to draw conclusions.

Program
he firm: introduction External Accounting: Balance Sheet Internal Accounting: Cost Accounting Short term Decisions Long-term Decisions: Investment Evaluation Criteria Strategy and organization

Development of the course and examination
LEARNING EVALUATION METHODS
written examination. Moreover, students aregiven the possibility to complete group assignments that can increment the final mark.

LEARNING EVALUATION CRITERIA
Studens should be able to grasp theoric knowledge provided in the lessons, to make and understand a balance sheet, to evaluate an invesment, to apply the principal cost accouning

mehods, to evaluate short term decisions.

LEARNING MEASUREMENT CRITERIA
Final marks over 30 points (18: pass - 30 cum laude: highest)

FINAL MARK ALLOCATION CRITERIA
Sum of the points obtained by answering written questions, re-scaled plus the eventual incremental points of the assignments.

Recommended reading
Giudici, G., 2002, Gestire le Risorse dell'Impresa, Maggioli Editore

Electricial and Electromagnetic Safety and Interactions in Biomedical Devices

Franco Moglie

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
Electric circuits, transmission lines, the electromagnetic propagation.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The student will be able to know, understand and analyze the three main risks of the biomedical area: direct contact with live parts, biological effects of electromagnetic fields and immunity of biomedical equipment to electromagnetic interference. In addition, the student will know and will be able to use the techniques of measurement and control in accordance with the technical regulations
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
This free-choice course will give to the student the fundamental knowledge related to the interaction of electromagnetic waves with biological matter. It will also give to the student the basic elements to design and operate with biomedical devices, in compliance with safety requirements and protection against electromagnetic interference as requested by the European and national regulations.
TRANSVERSAL SKILLS:
This multidisciplinary course will improve the autonomy of the student from both judgement and learning capacity point of views It will improve also its capacity of synthesis and its clarity of exposition

Program
Class lectures (42 hours). Review of electric circuits, mathematics of the decibel, Fourier series and of the electromagnetic fields. Electrical safety: hazard recognition, effects of electricity on the human body, electrical hazard protections, work practices. Electrical safety of medical equipment: physiological effects of electricity, body and skin resistances, macroshock and microshock, codes and standards, classification of medical equipments, equipment design, grounding, ground fault interrupters, isolated power system and its monitoring. The IEC 60601 standard. Non-ionizing radiation. The electromagnetic spectrum. Full wave electromagnetic simulators: the finite-difference time-domain. Dielectric properties of tissues. Laser awareness. Exposure to shortwave and mediumwave broadcasting stations. Magnet awareness. Radiated and conducted susceptibility, electrostatic discharge (ESD). Laboratory practice (6 hours). Measurements of electromagnetic field at low- and radio- frequency. TEM cells and reverberation chambers. Field probes and spectrum analyzer. Laboratory practice of radiated and conducted susceptibility, and ESD.

Development of the course and examination
LEARNING EVALUATION METHODS
An oral exam will evaluate the student skill. During the exam, two or more topics developed during the course will be discussed.

LEARNING EVALUATION CRITERIA
To obtain a positive evaluation, the student must demonstrate that has understood the concepts

presented in the course, and must demonstrate that has completely understood the electrical safety of biomedical devices and the interactions between electromagnetic field and biomedical devices.

LEARNING MEASUREMENT CRITERIA
The vote is an average of the each response weighted according to the complexity of the question.

FINAL MARK ALLOCATION CRITERIA
The evaluation is positive when the student obtains the sufficiency, i.e. 18/30 points. The highest rating is achieved by demonstrating a very good understanding of the course content. Praise is given to students who have demonstrated an excellent understanding of all the discussed topics.

Recommended reading
Lecture notes available on the moodle website.

Elementi di Controlli Automatici (ELE+BIO)

Federica Verdini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Algebra of matrices, Laplace Transform, coordinate transformations on linear vector spaces

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
Learn: 1 - Elements of analysis of LTI systems with state and synthesis with reaction to the state; 2 - the classical theory of feedback control, SISO, continuous-time. Acquire skills of analysis and synthesis in the frequency domain, complex variable, time also with the use of MATLAB
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The course will provide the basic knowledge of the foundamentals of analysis of linear and stationary systems with the state - The classical theory of control feedback, single-input-single-output (SISO), continuous-time. The course will allow to acquire skills of analysis and synthesis in the frequency domain and of the complex variable s, for time-continous SISO systems also with use of MATLAB. Students will be able the use Matlab tools specially dedicated to control systems.
TRANSVERSAL SKILLS:
The student should be able to critically evaluate different practical solutions in order to identify the most appropriate objectives to be pursued.

Program
Theory lessons (48 hours) The course will provide the basic knowledge of the foundamentals of analysis of linear and stationary systems with the state, the classical theory of control feedback, single-input-single-output (SISO), continuous-time. 1 - Elements of analysis of LTI systems with state and synthesis with reaction to the state; - Definition of dynamic systems regular, time invariant, linear; - Natural (impulse) response decomposition in natural modes; - Dynamic response calculation via Laplace transform; - Stability: definition and conditions; - Response in free and forced conditions; - Steady-state and transient response; - Frequency response; - Structural properties of a dynamic system; - Eigen-values allocation design techniques. 2 - Frequency response analysis and design ; Root locus design. - Transfer function analysis; - Nyquist and Routh criteria; - Steady-state behaviour under polynomial and sinusoidal inputs; - Transient behaviour; - Effects of parameters incertitude; - Frequency domain design of servo-systems; - Root locus design of servo-systems; - Industrial regulators characters and tuning Pratical lessons (24 hours) The course will allow to acquire skills of analysis and synthesis for time-continous SISO systems in the frequency domain, the complex variable s and in the time domain also with use of MATLAB. Infact students will be able the use Matlab tools specially dedicated to control systems.

Development of the course and examination
LEARNING EVALUATION METHODS
it consists in three questions. One of the three questions will be answered in writing, because it concerns the solution of control design and analysis problems. Solution is here meant as the correct

determination of the numerical values required by the question. Two questions will be answered orally.A rate greather than (or equal to) 4, after the first question is required to support the oral questions

LEARNING EVALUATION CRITERIA
the students have to reach the ability to explain the learned theoretical aspects and to gain a level of competence to use the skills learned.The student should be able to critically evaluate different practical solutions in order to identify the most appropriate objectives to be pursued.

LEARNING MEASUREMENT CRITERIA
The final vote will be given 30/30. Each of the three questions will be assessed from 0 to 10.Il final grade will be the sum of the votes.

FINAL MARK ALLOCATION CRITERIA
A rating of 0 in question involves the repetition of the examination. An evaluation of 10 corresponds to demonstrate full knowledge of the matter. The attribution of praise is a full demonstration of mastery of the topics.

Recommended reading
Rinaldi, Picardi I sitemi lineari: teoria , modelli, applicazioni Città Studi Edizioni;Ruberti, Isidori, Teoria dei Sistemi Bollati-Boringhieri;sidori, Sistemi di controllo Siderea Ruberti,Isidori Teoria della stabilità . Siderea;Franklin, et al Feedback control of Dynamic systems ,Addison-Wesley, 2002,EdiSES K.J.;Shinners : Modern control system theory and applications , Addison Wesley

Elementi di Elettronica (ELE+BIO)

Massimo Conti

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
knowledge of the basic elements of electromagnetism and of the kirchhoff laws

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course provides the knowledge and the understanding of the basic concepts of logic networks, and analog and digital electronics.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The students will apply the knowledge and will be able to analyze simple analog and digital circuits and design basic digital systems.
TRANSVERSAL SKILLS:
The course content and teaching methodologies highlight the connections with other subjects in the field of electronics. The student will describe in written and oral way the contents of the course, helping to improve communication skills.

Program
- Number systems and code. - Boolean algebra - Combinatorial Networks - Sequential Networks - Semiconductor devices: Diode, MOSC, MOSFET, BJT - Basic digital circuits - Analysis of electronic circuits with diodes and transistors. - OpAmp

Development of the course and examination
LEARNING EVALUATION METHODS
The exam consists of a written test and an oral test on the course topics. The oral examination must be taken in the same appeal of the written test.

LEARNING EVALUATION CRITERIA
The student must demonstrate, through a written and oral exam, that he has understood the basic concepts of logic circuits and analog and digital electronics, that he is able to analyze simple analog and digital electronic circuits. The student must demonstrate a comprehensive knowledge of the contents of the course, properly exposed with the use of proper technical terminology.

LEARNING MEASUREMENT CRITERIA
To the written test is given a score between zero and 30. The written test consists of more than one exercises, to each exercise is assigned a score depending on the complexity of the exercise.

FINAL MARK ALLOCATION CRITERIA
The mark of the written examination is taken as an indication to the final mark. It is recommended to repeat the written examination, if the student with a personal self-evaluation, believes he can aspire to a final mark much higher than that achieved in the written examination. By evaluating the oral exam the teacher defines the final score. In case of failure of the oral exam, the student must

normally repeat the written test.

Recommended reading

- documents available on moodle and on the professor website - C.Turchetti, M.Conti, Elementi di Elettronica , Pitagora - Simone Orcioni, Elettronica Analogica. Dispense del corso. seconda edizione, Pitagora Editrice, 2011 - Jaeger, Blalock, Microelettronica: 1 elettronica analogica , Mc Graw-Hill (seconda edizione) - Jaeger, Blalock, Microelettronica: 3 elettronica digitale , Mc Graw-Hill (seconda edizione)

Elementi di Elettronica (INF)

Paolo Crippa

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course objective is to provide students with the basic concepts of logic circuits and analog and digital electronics, to provide the skills needed to analyze simple analog and digital circuits, to provide basic skills for the design of digital systems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student must achieve the analysis and design skills in logical networks, and basic analog and digital electronic circuits. This ability will lead to a series of professional skills, such as: 1. the ability to appropriately choose both analog and digital discrete electronic components; 2. optimize combinational and sequential networks; 3. simulate elementary analog and digital circuits and discuss the results, 4. design elementary digital circuits
TRANSVERSAL SKILLS:
The student through the solution and the design of elementary analog and digital circuits will be able to integrate the skills achieved in this course and in the other ones to refine and develop his competence in basic electronics. The student by teamworking will acquire critical dialogue, organization, and design-oriented collaboration skills, and in general, he will improve his autonomous discernment as well as his communication ability.

Program
Contents (lectures, 72 hours) - Number systems and codes. - Binary functions: AND, OR, NOT, NAND, NOR, XOR, XNOR; full-adder. - Boolean algebra. - Combinatorial networks: logic circuits, algebraic representation, sum of products, product of sums, minterms, maxterms, canonical sum and product, synthesis of combinatorial circuits. Programmable Logic Array (PLA); Karnaugh maps. The Quine-McCluskey algorithm. NAND, NOR implementations. - Integrated circuits, logic families. Design of combinatorial circuits: analysis and synthesis. Code converters. Coders and decoders. Multiplexers and demultiplexers. Implementation of combinatorial circuits by using decoders and multiplexers. Half-adder and full-adder, carry lookahead adder. Multipliers. - Sequential networks. SR, S'R' and D latch. Flip-flops: SR, JK, D, T. State machines, Moore and Mealy models. Analysis and design of sequential circuits. Registers and shift-registers. Counters. - Analog and digital signal representation. Linear and non-linear devices. Non-linear circuit analysis. Ideal amplifiers, voltage and current gain, input and output impedance, frequency response. - The operational amplifier. The ideal Op-Amp. Circuits with Op-Amps. - Fundamentals of solid-state electronics. The p-n junction. - The diode: DC characteristic, Shockley model, piecewise linear models. Circuits with diodes. Diode logic. - The MOS transistor (MOSFET): n- and p-channel MOSFET, behavior, model, I-V characteristics. - The bipolar junction transistor (BJT): behavior, model, I-V characteristics. - Single transistor amplifiers with BJT and with MOSFET: biasing circuits, basic configurations. - Analysis of electronic circuits with diodes, MOSFETs, and BJTs: linearization, DC and AC behavior. - Inverter:

characteristics and noise margin. DC analysis, power consumption, transient analysis, rise and fall time, propagation delay. The NMOS inverter with resistive load and with active load. The CMOS inverter. - NMOS, pseudo-NMOS and CMOS random logic. PLA.

Development of the course and examination

LEARNING EVALUATION METHODS

The student learning evaluation is based on two tests: - a written test consisting in the solution of exercises related to topics covered in the course. It takes two hours; - an oral test consisting in the discussion of one or more topics covered in the course. When necessary, the questions, whose answers also require short calculations or simple circuit drawings, will be carried out in writing during the oral test. The written test is preliminary to the oral test, to access to which the student must have obtained at least 16/30 in the written test. The oral test should be performed in the same call of the written test. In case of failure of the oral test, the student must also repeat the written test.

LEARNING EVALUATION CRITERIA

In the written test the student must demonstrate that he has well learned the basic concepts and tools of logical networks and that he has acquired the ability to analyze and solve simple digital and analog electronic circuits. In the oral test the student must demonstrate to have an overall knowledge of basic analog and digital electronics and the ability to design combinational and sequential logic circuits.

LEARNING MEASUREMENT CRITERIA

The written test is graded according to a scale ranging from 0/30 to 30/30. The mark is obtained by summing the marks obtained by solving the proposed exercises weighted according to their typology and complexity. The oral test is graded according to a scale ranging from 0/30 to 30/30.

FINAL MARK ALLOCATION CRITERIA

The final mark, on a 30-point scale, is given by the mark obtained in the oral test that takes into account the results obtained in the written test. The highest mark is achieved by demonstrating a thorough knowledge of the course contents during the two tests. The cum laude will be awarded to the students who, having successfully passed both tests, have also demonstrated a particular skill in performing the oral test and the written exercises.

Recommended reading

- C. Turchetti, M. Conti, Elementi di Elettronica , Pitagora. - A. S. Sedra, K. C. Smith, Circuiti per la Microelettronica , EdiSES. - M. M. Mano, C. R. Kime, Reti Logiche , Pearson Education Italia (Addison Wesley). - R. C. Jaeger, T. N. Blalock, Microelettronica: 1 elettronica analogica , McGraw-Hill (2° Ed.). - R. C. Jaeger, T. N. Blalock, Microelettronica: 3 elettronica digitale , McGraw-Hill (2° Ed.). - J. Millman, A. Grabel, P. Terreni, Elettronica di Millman , McGraw-Hill, (4° Ed.). - P. U. Calzolari, S. Graffi, Elementi di Elettronica , Zanichelli. - F. Fummi, M. G. Sami, C. Silvano, Progettazione Digitale , McGraw-Hill. - J. F. Wakerly, Digital Design , Prentice Hall. - R. S. Muller, T. I. Kamins, Device Electronics for Integrated Circuits, 2nd Ed., John Wiley & Sons. - Lecture notes avalaible on the course istitutional web site (Moodle).

Elementi di Informatica (BIO+EL)

Christian Morbidoni

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
This course aims to provide students with the following knowledge: 1) High-level architecture and functioning of a computer 2) Basic concepts of information coding, with particular reference to binary encodings of numerical values and to low level text encodings (ASCII, UNICODE) 3) Basic concepts and main constructs of imperative programming languages 4) C programming language: expressions, control statements, primitive and derived data structures, pointers, linked lists 5) The main sorting algorithms, their caracteristics and their implementation in C
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will develop the ability to: 1) Solve problems and implement simple algorithms using the C language 2) Analyze the correctness of a C program and be able to compile, run, and debug a C program 3) Become familiar with domain terminology
TRANSVERSAL SKILLS:
The skills gained in this course aims to provide students with the tools needed to: 1) Deepen the knowledge of the hardware of a computer 2) Become familiar and deepen the semantics and syntax of other high-level programming languages

Program
The main goal of this course is to provide students with the basic knowledge to understand how the computer works and to program using the C language. Topics: Introduction to computer science; Computing systems and architecture; Programming basics, controls and data structures; The C language: expressions, variables, functions, pointers, instructions, structured data tyoes, I/O; Basic data structures: Arrays, linked lists, stacks, queues, trees. Basic sorting and search algorithms and their implementation in C.

Development of the course and examination
LEARNING EVALUATION METHODS
The exam consists of two parts: a written test, where students will have to solve problems programmin in C, and a spoken test where stundets will discuss their written test results and will aswer to other questions regarding the course topics. To be admitted to the spoken test, the student will have to score 18 at the written test. If failed, both tests will have to be repeated.

LEARNING EVALUATION CRITERIA
To pass the exam students will have to demonstrate their understanding of the topics and to be able to program in C and possibly other languages presented in class.

LEARNING MEASUREMENT CRITERIA

A rate between 0 and 30 is assigned to each test (written and spoken). The final evaluation is the average rate.

FINAL MARK ALLOCATION CRITERIA
To pass the exam students have to rate at least 18 in both the tests (spoken and written).

Recommended reading
P. Zingaretti, E. Frontoni, Informatica: tematiche generali, Ed. Simple (www.stampalibri.it), 2006 ; Linguaggio C - Guida alla programmazione 4/ed, McGraw-Hill, 2009

Elettromagnetismo per la Trasmissione dell'Informazione

Marco Farina

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
It is assumed that the student be familiar with vector algebra and some basics of Mathematical Analysis, as well as knowledge of main properties of complex numbers. The student is also required to have solid basis in Physics

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
This course introduces students to the knowledge of the principles of electromagnetic theory and to the understanding of the applications of electromagnetic theory, with particular emphasis on common concepts in Telecommunications and Computer Science. This knowledge, complemented by notions acquired in physics courses, will be a highly multidisciplinary compendium comprising the study in-depth of wave and propagation phenomena, their modeling, and their use in Engineering. The aim is to provide knowledge, understanding and tools that can also be utilized in areas other than electromagnetics itself, wherever wave phenomena are fundamental.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The course provides applying knowledge of electromagnetics theory -and more in general of field and propagation theory- to concrete design problems, in particular to optimizing transmission of signals through matching techniques, to the selection of the most suitable propagation structure (guided or not) in the framework of the system being designed, and to the development of simulation and modeling programs by numerical techniques.
TRANSVERSAL SKILLS:
The highly interdisciplinary nature of the course induces students to link concepts from very different disciplines of Engineering, thereby improving their ability to learn independently. Moreover, the course provides communication skills and capacity to work in a team with professionals and technical people from different disciplinary areas.

Program
Electrostatics and Magnetostatics in differential equations: numeraical and analytical solution techniques; Electrodynamics and Maxwell's equations; transmission lines and waveguide propagation; metal and dielectric waveguides; ABCD and S matrices; design of matching circuits; radiation phenomena: free propagation and antennas. Exercises and laboratory (16 hours): electromagnetics problems; design of single stub, double stub, lumped matching circuits; use of design programs; control of an electromagnetic system of microscopy

Development of the course and examination
LEARNING EVALUATION METHODS
Assessment of student learning is performed through two tests: a written test and an oral test. Students must pass the written test with a mark of at least 18/30 in order to attend the oral test. The oral exam can be done on the same day of the written test or, alternatively, in the subsequent days , or on further dates agreed with the teacher , within one year from the positive written test. In case of

fail in the oral test, it is not necessary to repeat the written test. Not passing an exam does not affect the registration to the following exam. Possible exceptions to this rule will be explicitly stated during the exam. Submitting a test does not invalidate existing written tests (during the oral exam, the student must indicate which one of the documents should be evaluated). The written test usually consists of 5 exercises, each worth 6/30, to be carried out in two hours. The students keep a personal copy of the test being performed after the delivery of the elaborate. At the end of the test, the teacher makes available the solution on the official moodle website, according to which students can proceed to their own evaluation, or to a preliminary assessment of the achievement of sufficiency. Only those who have reached 18/30 in the self-evaluation may undergo oral test. The oral exam consists of two parts: the first discusses the written test and verifies the validity of the self-evaluation, and in the second we proceed to the discussion of some of the topics covered during the course. The number of topics is not fixed, but is a function of the behavior in the oral examination.

LEARNING EVALUATION CRITERIA

In order to successfully pass the exam, the student must demonstrate mastery of the concepts introduced in the course; the written test is aimed to verify the ability to solve problems by the methods introduced during the course. In the oral examination, the student must demonstrate that he/she is are able to introduce, to derive, to argue, show and to link relationships and theories related to electromagnetism and its applications, with particular emphasis on applications in the domain of information

LEARNING MEASUREMENT CRITERIA

The exam is performed in order to assess: 1) the efforts made by the student in the preparation of the exam 2) what the student has learned, and what actually understood 3) student's ability to develop its own considerations and criticisms of the concepts studied and the skills to use them independently, applying to issues not explicitly covered in the course 4) the possible impact of particular personal circumstances (emotional, communication and learning problems)..

FINAL MARK ALLOCATION CRITERIA

averages between the results of the written test and of the oral test are NOT made, since the two tests measure two different aspects (applicative in the written test and theoretical in the oral test). While in theory one can aspire to the highest final mark starting with a written test just sufficient , the oral exam is highly dependent on the evaluation obtained in the written test; the oral exam is devoted , in this case, to determine the causes that have produced errors in the written test . The final assessment is therefore based on the application of the measurement criteria described in the Learning Measurement Criteria to the whole set of the written and oral test. The use of the learning measurement criterion 1) enables to establish a rating between 0 and 20; criterion 2) , obviously if criterion 1) is satisfied, allows to rate the student between 20 and 28), while criterion 3) allows to assign marks between 28 and 30. All ratings are weighted by the criterion 4), according to which the duration of the examination may vary greatly. Those who have been shown to meet the criteria 3) , and who show a very clear mastery of the concepts , can get laude mark.

Recommended reading

-Ramo-Whinnery-Van Duzer, Fields and Waves in Communication Electronics, Wiley -R. Feynman, The Feynman Lectures on Physics , - elettromagnetics and matter (vol 2), Zanichelli;

Elettronica Analogica

Simone Orcioni

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Circuit Theory: Kirchhoff's Laws; nodal analysis; Substitution, Thevenin's and Norton's theorems; two-port netowork; Laplace transform. Mathematics: complex number, derivative, integral, first order differential equations, Fourier series.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course objective is to gain insights into one of the sectors that characterize Electronics: analog circuits. The course, integrating the basic knowledge acquired on the circuit theory from previous courses, has the main objective to increase knowledge of analog circuits based on non-linear devices such as diode, bipolar junction transistors and field-effect transistor. This objective is expressed in knowing and understanding the basis for the analysis and design of basic analog circuit blocks: a single stage amplifier, with feedback amplifiers, operational amplifiers, oscillators.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The acquired knowledge will be tested through the analysis of analog circuits, the design of the fundamental analog circuit blocks and laboratory activities.
TRANSVERSAL SKILLS:
The laboratory group activities allow to stimulate the ability to work in teams, to apply their knowledge in a real context and integrate the knowledge gained in other courses.

Program
Content (class, 64 hours) Introduction. Non-linear circuit analysis: linearization, DC analysis, AC analysis. Elements of circuit theory: linear active and passive components, voltage division and current division, amplifier representations. Operational amplifier: The ideal Op-Amp. Basic circuits with the op-amp. Frequency behavior. The diode: DC characteristic, piecewise linear model, small-signal model. Zener diode. Circuits with diodes: limiting, rectifiers, and peak holders. BJT: Qualitative behavior of the BJT. I-V characteristics. Biasing circuits. Single transistor amplifiers with BJT: Common emitter, common emitter with emitter resistance, common base, and common collector: AC and DC behaviors. MOSFET: Qualitative behavior of the MOSFET: threshold voltage, channel length modulation and body effect. I-V characteristics. Biasing circuits. Single transistor amplifiers with MOSFET: Common source, common gate, and common drain: AC and DC behaviors Frequency behavior: Single stage amplifiers analyzed with the time constant method. Multistage and differential amplifiers: DC analysis. Small-signal analysis: differential gain, common mode gain, CMRR. Differential amplifier with active load. Multistage amplifiers. Current mirrors with MOSFETs and BJTs: Mirror with emitter resistances, Wilson's mirror, modified Wilson's mirror, and cascode mirror. Feedback: Negative feedback properties. The four feedback topologies: series-series, shunt-shunt, series-shunt, shunt-series. The stability. Power stages: Class A, B, and AB power stages. Oscillators: Sinusoidal oscillator. Describing function method. Characteristic function method. Colpitts oscillators. Quartz oscillators. Multivibrators. Class and Lab exercises (10 hours) Class training for the written test. Lab experiment on amplifiers with OP-Amp: Unit Gain

Amplifier, Non-inverting Amplifier, Inverting Amplifier, Integrator. Lab experiment on astable multivibrators.

Development of the course and examination

LEARNING EVALUATION METHODS

The evaluation of the student's learning consists of two parts: - A written test, consisting in the solution of a circuit, to be completed in two hours; the exercise will be divided into parts whose solution may be propaedeutic for the next; - An oral, consisting in the discussion of one or more topics covered in the course; during the oral exam the solution of simple exercises may also be required. The written test is propaedeutic for the oral exam, to access to which students must pass the access threshold. The oral exam must be sustained in the same exam session of the written test. In case of failure of the oral exam, the student must also repeat the written test.

LEARNING EVALUATION CRITERIA

The evaluation of learning can be considered as positive if the student demonstrates the ability to analyze, solve and understand the usefulness of the circuits studied during the course (for example: single transistor amplifiers, operational amplifiers, multistage amplifiers with feedback, oscillators). Furthermore he must demonstrate an understanding of the methods of analysis of the circuit performances (eg analysis in DC and AC, analysis in the Laplace domain or in the frequency domain, method of the time constants). All this can not be achieved without the knowledge of the operation of the devices presented during the course, neither the previous requirements.

LEARNING MEASUREMENT CRITERIA

For each of the tests is assigned a score out of thirty. The ability to analyze and solve circuits will be assessed through the written test. The threshold for access to the oral test is fixed at fifteen thirtieths. Knowledge and understanding of the topics covered in the course will be evaluated through oral examination.

FINAL MARK ALLOCATION CRITERIA

In order that the overall outcome of the evaluation is positive, the student must achieve a rating of not severely inadequate oral test and at least sufficiency in the average of the two tests, written and oral. The final grade is given by the average of the written and the oral test. The written test is given by the weighted average of the ratings of the individual parts. Praise is given to students who, having done all the tests so correctly, have demonstrated a particular brightness in the oral and in

Recommended reading

Simone Orcioni, Elettronica Analogica. Dispense del corso. Terza edizione, Pitagora Editrice, 2014. A. Sedra, K. Smith, Microelectronic Circuits , Oxford University Press.

Elettronica Digitale

Giorgio Biagetti

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
knowing how to analyze linear and non-linear electronic circuits, behavior of semiconductor devices, boolean algebra, mathematical analysis.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The students will start to know and understand the behaviour and the inner workings of digital electronic circuits (logic gates, arithmetic, addressing, and sequential circuits, memories), as well as the basis of their design, either with discrete components, with integrated circuits, and by means of programmable systems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Students must be able to design digital electronic circuits, both by chosing discrete components from available commercial offerings, and in integrated circuit form, by drafting layouts of simple circuits. The student must also be able to apply the acquired knowledge to understand the most commonly employed electronic buses, and to analyze/simulate programmable systems described in languages such as VHDL.
TRANSVERSAL SKILLS:
The solution of real-world design problems stimulates the student's ability to integrate knowledge acquired in this and in the preceding courses, so as to reach a complete and rational design solution based on the available scientific literature and the device data sheets.

Program
Elementary CMOS logic gates: NMOS and CMOS inverters. DC and transient characteristics. Design criteria. Power dissipation. CMOS buffers. Complex CMOS logic gates: NAND, NOR. DC characteristics, design formulas. CMOS transient: RC approximation, Elmore method. Mirror circuits: XOR and XNOR gates. Transmission Gates: nFET and pFET switch, clock feedthrough, CMOS switch. XOR and XNOR gates. Tristate and open-drain gates. Elementary BJT logic gates. RTL, DTL and TTL inverters. Transfer characteristics. NAND and NOR TTL gates. TTL-CMOS interfaces. BiCMOS inverter. Combinatorial circuits: binary decoders. multiplexer, demultiplexer. PLD: logic array, AND and OR. PLA. Wired-and logic. Arithmetic circuits: adders, subtracters, multipliers, comparators, shifters. Sequential circuits: bi-stable circuits, latches and flip-flops. Master/Slave configuration. Finite state systems (FSS): design and minimization of the number of states. Programmable devices: CPLD and FPGA architecture and design methods. Elements of VHDL. Memories: organization, decoder, basic memory cell, sense amplifier. CMOS static RAM: 6 transistor cell. Dynamic RAM: 1 transistor cell. Non-volatile memories: FLASH and EEPROM. Memory interfaces: parallel (SRAM, DRAM, NAND) and serial (SPI, I2C) buses. Design guidelines: synchronous circuits, clock buffering, synchronizers, reset, test circuits and interfaces.

Development of the course and examination
LEARNING EVALUATION METHODS

The evaluation method comprises two tests: - a two-hour written paper, which proposes five relatively short exercises to be solved. The exercises may deal with both design and analysis problems related to the circuits and the topics covered during the lectures; - an oral test, which includes the discussion of the written paper and of some of the other topics dealt with in the course. If necessary, the level of knowledge of the essential prerequisites for mastering the subject may also be tested. Passing the written test with at least half of the maximum mark is considered a propaedeutic step in facing the oral test. The oral test must be undertaken during the same exam session as the written test. If the oral test is failed, the student is then required to repeat the written paper as well.

LEARNING EVALUATION CRITERIA

The two tests aim at evaluating both the completeness of the knowledge acquired by the student on the subject and the topics covered during the course, and the student's ability of applying the acquired knowledge to the solution of engineering problems regarding the design and the analysis of digital circuits.

LEARNING MEASUREMENT CRITERIA

Each exercise in the written paper is assigned a predetermined, although variable, maximum mark, typically ranging from 4 to 8 according to the exercise difficulty. The sum of the maximum marks of all of the exercises exceeds 30 by about 10%-15%, though the maximum mark assigned to the whole written paper is still limited to 30. For the exercises that require numerical results, half of the available marks will be assigned according to the correctness of the numerical results, the other half according to the correctness and completeness of the solution procedure adopted by the student. The final mark of the written test will be the sum of the marks obtained in the individual exercises, limited to 30 if the sum exceeds this threshold. The oral test will directly be evaluated with a mark from 0 to 30.

FINAL MARK ALLOCATION CRITERIA

Since the oral test includes the discussion of the written paper, the final mark will be the mark obtained in the oral test. Honors will be granted to students that, having obtained the maximum mark in the oral test, have also demonstrated an excellent mastering of the subject and the ability of facing problems even if not directly discussed during the lectures. The mark obtained in the written paper is only used as a preliminary evaluation that can be used by the student to assess their preparation, and as a starting point to direct the beginning of the oral test.

Recommended reading

Travis N. Blalock, Richard C. Jaeger, Microelettronica: 3. Elettronica digitale , McGraw-Hill Paolo Spirito, Elettronica Digitale , McGraw-Hill John P. Uyemura, CMOS Logic Circuit Design , Kluwer Academic Publishers Franco Fummi, Maria Giovanna Sami, Cristina Silvano, Progettazione Digitale , McGraw-Hill Lecture notes by the teacher, available through the university's moodle platform.

Elettronica Industriale

Paolo Crippa

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Knowledge of linear and nonlinear electronic circuits, semiconductor device operating principles, Boolean algebra, and logical networks.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
Know and understand the methods of analysis and design of electronic devices of interest for industrial applications, with an emphasis on the principles of operation of power semiconductor devices, power electronic systems and power circuits for the energy conversion.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student is expected to achieve the ability of analyzing, choosing, and using the semiconductor power devices, to achieve the ability of analyzing and designing the systems for the static energy conversion. More in general the student will be able to exploit the acquired knowledge to understand the operation, and to put forward the design, of electronic circuits and systems commonly used in industrial applications.
TRANSVERSAL SKILLS:
The student, through the solution and the design of real-world circuits and systems, will be able to integrate the skills acquired in this course and in the other ones to refine and develop his competence in industrial electronics. The student by teamworking will acquire critical dialogue, organization, and design-oriented collaboration skills, and in general, he will improve his autonomous discernment as well as his communication ability.

Program
Contents (lectures, 72 hours) - Introduction to industrial electronics and power electronic systems. - Electrical and magnetic circuits: basic concepts. - Power semiconductor devices. - Power switches. - AC-DC converters: - Line-frequency uncontrolled diode rectifiers. - Line-frequency phase-controlled rectifiers. - Switch-mode DC-DC converters. - Switch-mode DC-AC converters (inverters). - AC-AC converters. - Resonant converters. - Snubber circuits and drive circuits. - Industrial applications. - DC and AC drives: basics.

Development of the course and examination
LEARNING EVALUATION METHODS
The student learning evaluation is based on an oral test consisting in the discussion of one or more topics covered in the course. When necessary, the questions, whose answers also require short calculations or simple circuit drawings, will be carried out in writing during the oral test.

LEARNING EVALUATION CRITERIA
The student, during the oral test, must show he has the skills necessary for analysing and designing electronic circuits relevant for industrial applications. In particular, he has to demonstrate to know the operating principles of power semiconductor devices, power supply electronic systems, and

power circuits for the static electricity conversion.

LEARNING MEASUREMENT CRITERIA
Attribution of the final mark on a 30-point scale.

FINAL MARK ALLOCATION CRITERIA
In order to pass the exam with the minimum mark, a student must demonstrate a sufficiently complete knowledge of the course contents. The maximum mark is achieved by demonstrating, through the answers to the questions, a complete and thorough knowledge of the course contents. The cum laude will be awarded to the students who, achieving the highest mark, have also demonstrated particular mastery of the subject matter of the course.

Recommended reading
- N. Mohan, T. M. Undeland, W. P. Robbins, Elettronica di Potenza: Convertitori ed applicazioni , Hoepli, 2005. - M. H. Rashid, Elettronica di Potenza: Dispositivi e Circuiti , Vol. 1, 3° Edizione, Prentice Hall, 2007. - M. H. Rashid, Elettronica di Potenza: Applicazioni , Vol. 2, 3° Edizione, Prentice Hall, 2007. - R. W. Erickson, D. Maksimovic, Fundamentals of Power Electronics - Second Edition, Kluwer Academic Publisher, 1999. - A. M. Trzynadlowski, Introduction to Modern Power Electronics - Second Edition, John Wiley & Sons, 2010. - N. Mohan, T. M. Undeland, W. P. Robbins, Power electronics: converters, applications, and design , John Wiley & Sons, 2003. - Lecture notes avalaible on the course institutional web site (Moodle).

Elettrotecnica (BIO+ELE+EDI)

Francesco Piazza

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Basic mathematical knowledge (Math1, Math2, Linear Algebra or equivalent), basic Electromagnetic knowledge

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
To know and understand basic circuit theory concepts, applied to lumped linear time-invariant electrical circuits. In particular, to be able to analyze transient and steady state responses of these circuits, to compute powers and energies, to evaluate frequency responses and sensitivities to parameter variations.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will be able to analyse in practice continuous-time non-directional circuits with particular reference to lumped linear time-invariant electrical circuits. Therefore, he will acquire the following main skills: 1. ability to use standard circuit analysis methods (nodal, loop); 2. ability to analyse 1-, 2- or multi port sub-circuits and their interactions inside the circuit; 3. ability to compute circuit responses in the time domain, Laplace domain and frequency domain; 4. ability to compute powers and energies in circuits; 5. ability to evaluate the sensitivity of different circuit designs to component variations.
TRANSVERSAL SKILLS:
The student will acquire also the following general skills: the ability to use mathematical tools in a real world application field, the ability to model EM or non-EM phenomenon with the circuit theory approach, the ability to analyse a complex system as a set of interacting subsystems. The time constrained circuit analysis tests will contribute to make better judgements and to strengthen the ability to synthetize and communicate the obtained results. The large number of possible circuit schemes will force the student to develop better autonomous learning and analysis skills.

Program
Introduction to circuit theory, electrical circuit model, analysis of circuits without memory, external representations of circuits, transformations and equivalences, time-domain analysis of circuits with memory, transformed-domain analysis, DC/AC steady state analysis, frequency domain analysis, sensitivity to component variations, power and energy, three-phase circuits, application examples.

Development of the course and examination
LEARNING EVALUATION METHODS
The evaluation process consists of two parts (to be accomplished sequentially): Exam Part 1: written test consisting of the analysis of 2 electrical LTI circuits in transient, DC steady and AC steady states (allowed time 3 hours). Exam Part 2: Written test consisting of 4 open questions on course topics (allowed time 90 min).

LEARNING EVALUATION CRITERIA

Exam Part 1: evaluation of the completeness and correctness of the analysis, ability to apply in practice course notions and concepts. Exam Part 2: evaluation of knowledge level on course topics. To complete this part, the student must demonstrate a sufficient level of knowledge, i.e. at least 3 positive answers.

LEARNING MEASUREMENT CRITERIA

The evaluation is performed according to 30-point grading scale on each exam part. 16/30 is the minimum score to complete the fist part, 18/30 is the minimum score to complete the second part.

FINAL MARK ALLOCATION CRITERIA

The final mark up to 30/30 is computed as the average (integer rounded) of the marks obtained in the two exam parts. The minimum passing grade is 18/30. The cum laude attribution, which means a superior performance, is granted only if the student gets the maximum mark in both exam parts and demonstrates a superior level of interest and understanding on course topics.

Recommended reading

G. Martinelli, M. Salerno, Fondamenti di Elettrotecnica , 2' ed., Vol. 1 e Vol. 2, Siderea 1997

Elettrotecnica (GEST)

Simone Fiori

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
Basic understanding of linear algebra.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course allows the students to acquire basic notions about the behavior of the electrical circuits and of their applications in engineering. Such notions will enable the students to understand the fundamental physical phenomena that govern the linear circuits, with and without memory, some automated computation techniques instrumental in their analysis and the aspects related to the generation, the delivery and the utilization of the electrical energy. In addition, the course is structured in order to make the students aware of the ampler multidisciplinary context that the analysis of the electrical circuits lays within.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The students will be able to analyze reasonably complex circuits by using method of decomposition of complex problems into simpler sub-problems and by using automated computation techniques as well as to understand the more general topics covered by the course. In addition, the students will be able to asserve the instruments acquired in the course to their own creativity with the aim to deal with real-world and applied themes, either singularly or teamed up.
TRANSVERSAL SKILLS:
The discussion in the lecture room, short and frequent, of cases-study will improve the students' ability to interact and communicate, the ability to learn and to draw conclusions, the degree of general independent judgement and the awareness about the real-world problems to be faced in management engineering.

Program
The course is devoted to the study of the fundamental elements, linear, time-invariant and memoryless and to the study of basic methods to analyze electrical circuits. The course also presents applications to the generation of electrical energy and to its optimal transport. Detailed contents: Bipoles and generating functions (resistors, inductors, capacitor, indipenendent sources), 2-port nets (transformers, gyrator, nullor, Z and Y nets, driven sources). Circuit analysis based on mesh currents. Thevenin's and Norton's theorems. Numerical solution of resolving systems by the platforms WolframAlpha and MATLAB/OCTAVE. Applications to the generation and the optimal transport of electrical energy: The MTP theorem and the HV/LV transformers scheme.

Development of the course and examination
LEARNING EVALUATION METHODS
- a written test about the solution of an electrical circuit; - one or more written tests consisting in the discussion of a theoretical topic. Both tests may be taken in different exam sessions and in any order.

LEARNING EVALUATION CRITERIA
In order to pass both tests, the candidate will need to show a good understanding of the proposed problems, to propose one or more correct solutions as well as to show a good ability to explain the proposed solutions correctly and by using an adequate technical language. The maximum score will be given to those candidates that will show a deep understanding of the course's contents.

LEARNING MEASUREMENT CRITERIA
Both tests will be graded by an integer in the range 0-30. The final evaluation will be calculated as the mean value of the two. In case of non-integer mean value, the rounding will be determined after a short interview with the candidate.

FINAL MARK ALLOCATION CRITERIA
The maximum score will be given to those candidates that will show a deep understanding of the course's contents and a very good ability to explain them. The distinction mark will be given to those candidates who prove an outstanding ability.

Recommended reading
G. Martinelli e M. Salerno, Fondamenti di Elettrotecnica - Circuiti a costanti concentrate lineari e permanenti, Vol. I, Edizioni Scientifiche Siderea (Roma) G. Martinelli e M. Salerno, Fondamenti di Elettrotecnica - Circuiti a costanti concentrate lineari e permanenti, Vol. II, Edizioni Scientifiche Siderea (Roma) Additional handouts prepared by the instructor will be made available on the LMS/Moodles platform

Elettrotecnica (INF)

Simone Fiori

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
Basic understanding of linear algebra, geometry, numerical analysis and algorithmic programming.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course allows the students to acquire basic notions about the behavior of the electrical circuits, of the phenomenological models based on the electrical circuits and on the circuits for intelligent signal processing. Such contents will complete the set of notions acquired in the courses of physics, electromagnetism, calculus, geometry and programming and will enable the students to understand the fundamental equations that govern the linear and non-linear circuits, with and without memory, and some automated computation techniques instrumental in their analysis.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The students will be able to analyze reasonably complex circuits by using method of decomposition of complex problems into simpler sub-problems and by using automated computation techniques as well as to understand the more general topics covered by the course. In addition, the students will be able to asserve the instruments acquired in the course, even in a synergy with other courses such as data structures and data-processing algorithm, robotics, movement analysis to their own creativity with the aim to deal with real-world and applied themes, either singularly or teamed up.
TRANSVERSAL SKILLS:
The development of didactic projects, that are carried on within small groups, will improve the students' ability to interact and communicate, the ability to learn and to draw conclusions, the degree of general independent judgment and the awareness about the real-world problems to be faced in information and automation engineering.

Program
The course is divided in two parts. The first part is devoted to the study of the fundamental elements, linear, time-invariant and memoryless and to the study of basic methods to analyze electrical circuits. The second part is devoted to the modeling of physical phenomena and engineering processes by means of non-linear dynamical circuits and to their solution by a computer. Part I: Elementary bipoles, 2-port elements and linear, time-invariant, memoryless circuits . Bipoles and generating functions (resistors, inductors, capacitor, indipenendent sources), 2-port nets (transformers, gyrator, nullor, Z and Y nets, driven sources). Circuit analysis based on mesh currents and on node potentials. Thevenin's and Norton's theorems. Part II: Modeling of complex phenomena and processes by non-linear dynamical circuits and numerical solution techniques. Cases-study of non-linear, dynamical models and of their differential-type resolving systems (free and constrained) and numerical methods for their solution (Euler and Euler-Riemann methods). Elements of algorithmic programming in MATLAB/OCTAVE and examples of calculation of the dynamic response of non-linear dynamical systems.

Development of the course and examination

LEARNING EVALUATION METHODS
Learning evaluation methods: - a written test, to be completed in 90 minuts, about the solution of an electrical circuit; - a written test, to be completed in 30 minutes, consisting in the discussion of a theoretical topic. The theory test may be replaced, upon request, by an applied project of algorithmic programming in MATLAB/OCTAVE. Both tests may be taken in different exam sessions and in any order.

LEARNING EVALUATION CRITERIA
In order to pass both tests, the candidate will need to show a good understanding of the proposed problems, to propose one or more correct solutions as well as to show a good ability to explain the proposed solutions correctly and by using an adequate technical language. The maximum score will be given to those candidates that will show a deep understanding of the course's contents.

LEARNING MEASUREMENT CRITERIA
Both tests will be graded by an integer in the range 0-30. The final evaluation will be calculated as the mean value of the two. In case of non-integer mean value, the rounding will be determined after a short interview with the candidate.

FINAL MARK ALLOCATION CRITERIA
The maximum score will be given to those candidates that will show a deep understanding of the course's contents and a very good ability to explain them. The distinction mark will be given to those candidates who prove an outstanding ability.

Recommended reading
G. Martinelli e M. Salerno, Fondamenti di Elettrotecnica - Circuiti a costanti concentrate lineari e permanenti, Vol. I, Edizioni Scientifiche Siderea (Roma) G. Martinelli e M. Salerno, Fondamenti di Elettrotecnica - Circuiti a costanti concentrate lineari e permanenti, Vol. II, Edizioni Scientifiche Siderea (Roma) Additional handouts prepared by the instructor will be made available on the LMS/Moodles platform

Elettrotecnica Industriale

Francesco Piazza

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Basic electrical circuit theory, basic programming knowledge

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
To know, understand and analyze electrical circuits for energy applications: 3-phase networks, magnetic circuits, electrical machine (transformer, asynchronous, synchronous and DC machines), electrical systems, electrical systems for renewable energy plants. To know and understand basic computational methods for electric energy management and distribution.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will be able to analyse and design simple electrical circuits for energy applications. Therefore, he will acquire the following main skills: 1) ability to use 3-phase networks; 2) ability to analyse lumped magnetic circuits; 3) ability to select and size rotating electrical machines in simple applications; 4) ability to design electrical system for low-voltage energy distribution; 5) ability to design PV plants. These skills will be acquired also through the participation in a practical classroom project.
TRANSVERSAL SKILLS:
The participation of the student in the classroom project, which will be developed in workgroups and will end with the making of a real-world electrical prototype and the writing of a final technical report, will contribute to make better judgements, to strengthen the ability to synthetize and communicate the obtained results and to develop better autonomous learning and analysis skills.

Program
Overview of basic electrical circuits concepts: 1- and 3-phase networks Electrical AC systems under 1000V, electrical lines, electrical safety Magnetic circuits and transformers Introduction to electrical machines: Asynchronous, Synchronous, DC Introduction to renewable electrical sources and SmartGrids Introduction to energy management in SmartHome (Demand Side Management) Linux embedded systems for energy management

Development of the course and examination
LEARNING EVALUATION METHODS
The evaluation process consists of two parts, which can be passed in any order during the academic year: Exam Part 1 Written test consisting of 4 open questions on course topics (allowed time 90 min). Exam Part 2 Individual project on one assigned course topic or formal participation to the classroom project. At the end of the project development the student is requested to present and discuss the project work.

LEARNING EVALUATION CRITERIA
Exam Part 1 Evaluation of knowledge level on course topics. To pass this part the student must demonstrate a sufficient level of knowledge, i.e. at least 3 positive answers to test questions. Exam

Part 2 Evaluation of the individual project development and discussion or an active and positive role in the classroom project development. To pass this part the student must demonstrate a sufficient level of development of the assigned project and a sufficient ability to present and discuss the work done.

LEARNING MEASUREMENT CRITERIA

The evaluation is performed according to 30-point grading scale on each exam part. Mark 18/30 is the minimum score to pass each exam part.

FINAL MARK ALLOCATION CRITERIA

The final mark up to 30/30 is computed as the average (integer rounded) of the marks obtained in the two exam parts. The cum laude attribution, which means a superior performance, is granted only if the student gets the maximum mark in both exam parts and demonstrates a superior level of interest and understanding on course topics.

Recommended reading

Teacher's slides and material, Dispense sui Circuiti Magnetici, Trasformatore e Motore Asincrono Trifase (http://lms.univpm.it) M. Guarnieri, A. Stella, Principi ed Applicazioni di Elettrotecnica , Edizioni Progetto Padova, 1998-1999.

Energetica

Renato Ricci

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Basic knowledge of Calculus, Mechanics and Fluidynamics

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course allows to the students to obtain the advanced knowledge about renewable and traditional energy resources. In particular renewable resources design matter will be faced. By means of the integration of expertise gathered in the undergraduate courses (Applied Thermodynamics and Heat Transfer and Fluid Machinery) the students complete their knowledge in the energy system area. The students will obtain a deeper knowledge of energy conversion and management with particular emphasis to last developments in this specific area. The engineering multidisciplinary context will be also addressed with references connected to energy systems
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to face complex design problems in the field of energy systems the students should be able to correctly analyze the operation conditions of energy systems based on renewable resources. At the of the course the students will be able to: 1. analyze a renewable energy based plant; 2. design a renewable energy based plant.
TRANSVERSAL SKILLS:
The knowledge and the expertise aforementioned will provide an increment to students free learning abilities

Program
Energy by fossil fuels: resources availability and global energy policy. Local and regional laws and feeds. Main aspects of combustion energy plants. Solar energy: photovoltaic solar plants: Technique of design. Electricity storage systems: new devices for renewable energy plants Wind energy: principles of meteorology, main aerodynamic aspects of horizontal axis wind turbine (from actuator disk to BEM theory) and vertical axis, analysis of the main components of a wind turbine. Focus on wind turbine power control tecniques. Main rules and aspects of wind farm design. IEC61400 certification standards. Hydropower: classification of the hydraulic turbines, analysis of the fluidynamic behaviuor of the turbine. Design of the main infrastructures connected with hydraulic energy conversion, pressure losses in pipeline and in transport systems. Biomass and Biogas energy palnts: main aspects of the conversion technology and enviromental problems.

Development of the course and examination
LEARNING EVALUATION METHODS
Interactions with students during the lessons

LEARNING EVALUATION CRITERIA
Evaluation of the learning state

LEARNING MEASUREMENT CRITERIA
Problem solving skills

FINAL MARK ALLOCATION CRITERIA
Level of knowledge and analytical capacity

Recommended reading
On www.termofluido.univpm.it you'll find the lecture notes

Estimo (EA)

Raffaele Zanoli

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 90
Period 2s

Prerequisites
Basic algebra

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course deals with the economic aspects of architectural practice and allows students to gain basic knowledge of micro-economics, financial mathematics and principle of applied statistics for economics. This knowledge is needed to understand the theoretical basis of appraisal principles and methods. The course will then train students on real estate valuation techniques according to international standards, site & building valuation using the cost approach and project appraisal techniques.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Students will develop the ability to work in groups in order to produce a specific real estate appraisal report. To this end, using the available databases on the housing market (European or Italian), students will analyze the building and architectural features of real estate property to be appraised (subject) in order to demonstrate their ability to combine technological and appraisal skills to write the appraisal report on the subject. In addition, students will be required to demonstrate , individually, the ability to apply their acquired knowledge to address simple economic problems, financial and actuarial calculations, and valuation of complex real estate.
TRANSVERSAL SKILLS:
The preparation and writing of the real estate appraisal report, which will be worked out in groups, will help students to improve their degree of independence of judgment in interpreting data and information and to provide adequate reasons for the choices and the decisions taken for the evaluation. The student will learn to interact with other members of a team, learning to successfully manage the inevitable group dynamics while improving their communication skills.

Program
Contents (lectures/flipped calssrooms, 45 hours) Definitions, aims and scope of Appraisal Tools: Financial Math, Micro-economics, basic statistics. Value and appraisal of land and buildings. Economic aspects of goods and appraisal criteria. Market value appraisal and related procedures. Cost value appraisal and relate procedures. Other appraisal techniques. Market comparison approach. Income approach. Cost approach. residual techniques. Building land appraisal. Appraisal of residential and other buildings. Characteristics of the real estate market and principles of land economics. Expropriation. Practicals (45 hours) Guided practicals and tests on: Microeconomics, Finacial Math, Appraisal. Appraisal reporting.

Development of the course and examination
LEARNING EVALUATION METHODS
For attending student (blended): The assessment is based on individual and group activities conducted on the Moodle platform, on a practical appraissal report oral and / or written assesments

of learning For those not attending (e-learning): The evaluation is based on two written tests (multiple-choice tests and written test of an appraisal problem) and an oral examination.

LEARNING EVALUATION CRITERIA
The criteria for assessment of learning are based on the standards established by the Italian Property Valuation Standards Tecnoborsa (Fourth edition). Specifically, the various assessments are designed to test students' ability to: Understand the basics of microeconomics, in particular the concepts of value and price competitive market and not, cost, supply and demand; Anticipate and postpone monetary amounts, calculate depreciation; Analyze and segment the housing market; Understand the postulates and principles of valuation; Survey estate prices and features; Use real estate appraisal procedures

LEARNING MEASUREMENT CRITERIA
All tests and practicals will be given a percentage grade which will be converted in 0/30 marks. Tests will be given a mark based on the ratio of the gained points over the total theoretical points. The appraisal practical (report) will be graded using a rubric published on the LMS course site

FINAL MARK ALLOCATION CRITERIA
The final mark will be a weighed average of all assessments, based on both individual and group work. The weighting scheme is the following: Microeconomics 20%, Financaial Math 20%, Appraisal 60%, of which 40% appraisal report. Online practicals (Moodle) account for 6% of the final grade.

Recommended reading
M. Simonotti, Metodi di stima immobiliare, Dario Flaccovio Editore, Palermo, ultima ediz. and various learning materials on LMS site (Moodle). English textbooks can be provided to Erasmus students.

Fields and Waves in Biomedical Systems

Valter Mariani Primiani

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
Fundamentals of electromagnetics

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
This is an extremely interdisciplinary course, with substantial laboratory contents. Aim of the course is to introduce students to the knowledge and understanding of the role of fields and waves (quantum charge, mechanical, electromagnetic, acoustic) in biological systems, and showing how waves of different nature and energy can be used to probe and investigate bio-systems at micro and nanoscale.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The course shows how to apply knowledge of the advanced theory of fields and waves to specific design problems of diagnostic instruments, imaging tools and systems for scientific investigation of bio-systems
TRANSVERSAL SKILLS:
By focusing on interdisciplinarity, students are introduced to tools enabling team working with experts from different areas. Students will acquire elements for independently designing systems for diagnosis and scientific investigation. Since innovative points of views will be discussed, this course will help students to address fast changing working problems related to technological innovation.

Program
Signal theory principles- the use of log quantities phasors Maxwell equations boundary conditions - constitutive relationships Fundamental theorems wave equation wave propagation in free space wave propagation ion complex media guided propagation: transmission lines Radiation and wave sources Antennas and their properties Interaction with biological media Thermal and non-thermal effects specific absorption rate Exposure valuation International and national standards - Electrical properties of biological media determination of dielectric permittivity: invasive and non-invasive methods Interaction with biomedical devices interference effects Cabling conducted and radiated reduction techniques measurements of conducted and radiated waves Standards and exposure limits.

Development of the course and examination
LEARNING EVALUATION METHODS
The examination is oral and it consists in three questions about all the topics. If required, the questions that require some calculation execution will be answered in a written form during the oral examination itself. The questions that require to draw some block diagrams, electric schemes, graphics, and the execution of analytical demonstrations will be answered in a written form during the oral examination itself.

LEARNING EVALUATION CRITERIA

To obtain a positive rating, the student must prove a sufficient knowledge about the course topics. Students must explain the topics in a sufficiently corrected way using adequate technical words and phrases. The knowledge of electromagnetic field and matter intercations will be checked, together with the ability to put in relationship several topics and to analyse real practical cases. The highest score will be obtained showing a deep knowledge of the topics presented using a valuable technical language.

LEARNING MEASUREMENT CRITERIA
A score ranging from zero up to ten will be assigned to each question. The score will be given in thirtieths.

FINAL MARK ALLOCATION CRITERIA
The final score is the sum of the score of all questions. The examination is passed if the total score will be equal or greater than eighteen. The 30/30 with distinction score is reserved to those students who, in addition to a correct and complete answer to all questions, show a strong ability and autonomy in theoretical demonstrations.

Recommended reading
C. R. Paul, K. W. Whites, S. A. Nasar, Introduction to Electromagnetic Fields , McGraw-Hill, Third Edition. - DANIEL FLEISCH, A Student s Guide to Maxwell s Equations , Cambridge University Press The Edinburgh Building, Cambridge CB2 8RU, UK. - James C. Lin, Electromagnetic Fields in Biological Systems , CRC Press. - Clayton R. Paul, Introduction to Electromagnetic Compatibility , Second Edition, John Wiley & Sons.

Fisica (EDI)

Daniele Rinaldi

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
The basic concepts of CALCULUS, VECTOR ALGEBRA, LINEAR ALGEBRA

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
This course gives students the fundamentals of the experimental method, typical of each scientific subject, and the fundamental laws of classical mechanics and thermodynamics. It represents a basic link between the secondary school knowledge and the university teaching. The acquired knowledge allows students to get the necessary instruments for a scientific approach to the analysis of engineering problems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The acquired knowledge and physic methods will allow students to understand, analyse and sketch engineering problems. In particular, students will have to acquire the ability to outline complex phenomena into their essential elements and to apply the classical physics laws to describe them. To this aim, the proposed exercises are usually derived from the common experience. Such knowledge and methods can be applied to many of the university courses the student will attend and, in the following, to the problems he will face during the working career.
TRANSVERSAL SKILLS:
The methodological approach acquired and the exercises proposed during this course will contribute to improve the judgement ability, the learning skill and that of drawing conclusions.

Program
1. The scientific method. The time. The length. The mass. Fundamental quantities and units, the MKSC system of units. 2. Kinematics of a particle . 3. Dynamics of the particle. Angular momentum and torque of a force. 4. Examples of forces. Simple harmonic motion. Damped oscillations. Forced oscillations. 5. Galilei s relativity. Galileo s transformation. Covariant nature of the laws of the Classic Mechanics. 6. Non inertial frame of reference and fictitious forces 7. Work and power. Conservative forces. Potential. Equilibrium conditions. 8. Particle systems and center of mass. The cardinal equations. 9. Collisions. Elastic Collisions. 2D collisions. Inelastic collisions. 10. Rigid bodies. Dynamics of the rigid body. Statics of rigid bodies. 11. Gravitation 12.The fluids 13.First law of thermodynamics. 14.Ideal and real gases. 15.Second law of thermodynamics

Development of the course and examination
LEARNING EVALUATION METHODS
Written and Oral exam. The oral examination must be sustained in the same appeal of the written test. In case of failure of the oral exam, the student must also repeat the written test.

LEARNING EVALUATION CRITERIA
understending the principles of physics

LEARNING MEASUREMENT CRITERIA
Overcoming the written test and knowledge of the fundamental principles of physics. For each of the tests specified before it is assigned a mark between zero and thirty. The overall mark, in thirtieths, is given by the average of the marks obtained in the two tests

FINAL MARK ALLOCATION CRITERIA
The student has to overcome the written test. The student passes the examination if obtains at least the mark of eighteen points in both tests. The highest mark is achieved by demonstrating a thorough understanding of the course content in the tests. Praise is given to students who, having done all the tests correctly, have demonstrated a deep knowledge of physical concepts

Recommended reading
P. Mazzoldi, M. Nigro, C. Voci, FISICA vol. I, EDISES, Lecture notes available on the web page of the Teacher

Fisica (EL)

Oriano Francescangeli

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Good knowledge of the contents of the course of Mathematical Analysis 1.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
Knowledge. This course gives students the fundamentals of the experimental method, typical of each scientific subject, and the fundamental laws of classical mechanics and thermodynamics. It represents a basic link between the secondary school knowledge and the university teaching. The acquired knowledge allows students to get the necessary instruments for a scientific approach to the analysis of engineering problems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Ability to apply knowledge. The acquired knowledge and physic methods will allow students to understand, analyse and sketch engineering problems. In particular, students will have to acquire the ability to outline complex phenomena into their essential elements and to apply the classical physics laws to describe them. To this aim, the proposed exercises are usually derived from the common experience. Such knowledge and methods can be applied to many of the university courses the student will attend and, in the following, to the problems he will face during the working career.
TRANSVERSAL SKILLS:
Cross skills. The methodological approach acquired and the exercises proposed during this course will contribute to improve the judgement ability, the learning skill and that of drawing conclusions.

Program
The scientific method. Fundamentals of the Measure Theory. Kinematics of the the point particle. Dynamics of the the point particle. Examples of forces. Galileian relativity. Non-inertial reference systems and fictitious forces. Energy and work. Mechanics of the systems of particles. Conservation laws. Collisions. Kinematics and dynamics of rigid bodies. Gravitation. The fluid systems. Static and dynamics of fluids. Waves and Oscillations. Fundamentals of classical thermodynamics.

Development of the course and examination
LEARNING EVALUATION METHODS
The evaluation of the student's level of learning is done at the end of the course by means of a written and an oral test. The written test consists in solving various problems that cover all the topics of the course, with particular attention to the mechanics of the systems of particles and rigid bodies, the mechanics of fluids and the thermodynamics. The written text is preliminary to the oral test: to access to the latter the student must earn a passing score on the written test. The oral exam consists of the discussion of three topics covered in the course, appropriately chosen in order to test the preparation of the student on the cardinal issues. In the case of a negative outcome for the oral exam, the student must repeat also the written test.

LEARNING EVALUATION CRITERIA
In the written test students must demonstrate to have understood and assimilated in depth the physical contents of the course and to be able to use the laws of physics as a tool for the resolution of a variety of mechanical (point particle, rigid bodies and fluid systems) and thermodynamics problems. Besides the fundamental processes of formulation and modeling, particular attention will be addressed to the computational and measuring aspects connected with the resolution of the problems (calculus, measurement errors, units of measure of the of the physical quantities).

LEARNING MEASUREMENT CRITERIA
It is evaluated the level of understanding of the concepts and the degree of knowledge of the subject. Is is evaluated the independent ability of the student to set up and solve problems and to make correct use of the relevant methodologies and tools of physics.

FINAL MARK ALLOCATION CRITERIA
In the written text, each exsercize receives a mark up to the maximum reported in the text, for a maximum total score of 30 points. In the oral test, each of the three questions is graded up to a maximum of 10 points, for a maximum total score of 30 points. Because the overall outcome of the evaluation is positive, the student must achieve a minimum score of 18 in both tests. The final mark, out of thirty, is the result of an appropriate weighted average of the marks obtained in the two tests, with a ratio of weights between the written test and oral of 2: 1. The honors (laude) will be given to students who, having achieved the highest rating, have argued brilliantly both tests, demonstrating a particular mastery of the subject or a level of detail of topics higher than it is normally required.

Recommended reading
[1] C. Caciuffo, S. Melone, O. Francescangeli, Fisica Generale Vol. I, Zanichelli; [2] Mazzoldi, Nigro, Voci, Fisica, Vol. I, EdiSES ; [3] D. Halliday, R. Resnick, Meccanica, Termologia. Vol. I, CEA, sesta edizione ; [4] P.A. Tipler, Corso di Fisica, Meccanica Onde termodinamica, Zanichelli, quarta edizione; [5] La Fisica Di Feynman, Zanichelli, nuova edizione completa, Vol. 1

Fisica (GEST)

Francesco Vita

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Fundamentals of mathematics.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
This course gives students the fundamentals of the experimental method, typical of each scientific subject, and the fundamental laws of classical mechanics. It represents a basic link between the secondary school knowledge and the university teaching. The acquired knowledge allows students to get the necessary instruments for a scientific approach to the analysis of engineering problems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The acquired knowledge and physic methods will allow students to understand, analyse and sketch engineering problems. In particular, students will have to acquire the ability to outline complex phenomena into their essential elements and to apply the classical physics laws to describe them. To this aim, the proposed exercises are usually derived from the common experience. Such knowledge and methods can be applied to many of the university courses the student will attend and, in the following, to the problems he will face during the working career.
TRANSVERSAL SKILLS:
The methodological approach acquired and the exercises proposed during this course will contribute to improve the judgement ability, the learning skill and that of drawing conclusions

Program
The scientific method. Fundamentals of measurement theory. Kinematics of the point particle. Dynamics of the point particle. Examples of forces. Non-inertial frames of reference and fictitious forces. Energy and work. Mechanics of the systems of particles. Conservation laws. Collisions. Kinematics and dynamics of rigid bodies. Oscillations.

Development of the course and examination
LEARNING EVALUATION METHODS
The evaluation of the student's level of learning is done at the end of the course by means of a written test and an oral examination. The written test, preliminary to the oral exam, consists in solving various exercises (problems and/or questions); the oral examination consists in the discussion of topics of the program, regarding theoretical aspects as well as the setting up and resolution of typical problems of mechanincs.

LEARNING EVALUATION CRITERIA
In the written test the students must demonstrate: knowledge of the laws of mechanics and their correct application to the solution of problems; ability to model mechanical systems in physico-mathematical terms; skills in symbolic and numerical calculations. The oral examination evaluates: the comprehension of the laws of mechanincs, their formal derivation and proper application to specific mechanical systems; reasoning skills; clarity and expression skills.

LEARNING MEASUREMENT CRITERIA
In the written test, each exsercise (problem and/or question) can receive a maximum mark variable with the difficulty of the exercise and indicated in the text, for a maximum total score of 30 points; the test is passed with a minimum total score of 18; passing the written test is a prerequisite for the oral. The oral examination assigns up to 30 points, on the basis of the evaluation criteria mentioned above; the oral examination is passed with a minimum score of 18.

FINAL MARK ALLOCATION CRITERIA
To pass the examination with a positive mark, the students have to pass both the written test and the oral examination with a minimum score of 18. The final mark is given by the score of the oral examination; in any case, the final mark cannot differ from the score of the written test by more than 4 points (either positive or negative). The honors (laude) are given to students who, having achieved a mark of 30, demonstrate a particular mastery of the subject or a level of knowledge of the topics higher than it is normally required. In the case of a negative outcome, the student must repeat both the written test and the oral examination.

Recommended reading
(1) P. Mazzoldi, M. Nigro, C. Voci, Fisica Vol. 1, EdiSES. (2) G. Vannini, Gettys Fisica I , McGraw-Hill. (3) D. Halliday, R. Resnick, K. S. Krane, Fisica 1 , Casa Editrice Ambrosiana. (4) C. Mencuccini, V. Silvestrini, Fisica I , Liguori Editore. (5) S. Rosati, Fisica Generale 1 , Casa Editrice Ambrosiana.

Fisica 1 (MECC) (A/L)

Gianni Barucca

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Basic concepts of trigonometry, vectors and differential calculus.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
This course gives students the fundamentals of the experimental method, typical of each scientific subject, and the fundamental laws of classical mechanics and thermodynamics. It represents a basic link between the secondary school knowledge and the university teaching. The acquired knowledge allows students to get the necessary instruments for a scientific approach to the analysis of engineering problems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The acquired knowledge and physic methods will allow students to understand, analyse and sketch engineering problems. In particular, students will have to acquire the ability to outline complex phenomena into their essential elements and to apply the classical physics laws to describe them. To this aim, the proposed exercises are usually derived from the common experience. Such knowledge and methods can be applied to many of the university courses the student will attend and, in the following, to the problems he will face during the working career
TRANSVERSAL SKILLS:
The methodological approach acquired and the exercises proposed during this course will contribute to improve the judgement ability, the learning skill and that of drawing conclusions.

Program
Experimental method, physical quantities and measurements. Kinematics. Dynamics. Friction. Work and kinetic energy. Power. Potential energy. Relative motion. Center of mass. Momentum. Impulse. Elastic and inelastic collisions. Rotational motion. Rotational kinetic energy. Moment of inertia. Work and rotational kinetic energy. Torque. Angular momentum. Statics. Gravitation. Fluids. Bernoulli's theorem. Harmonic motion. Thermal Physics. States and systems. Temperature. Heat. First Law of Thermodynamics. Ideal gases. Carnot cycle.

Development of the course and examination
LEARNING EVALUATION METHODS
Learning evaluation is assessed through written and oral exams. In the written examination, students must solve problems of classical mechanics and thermodynamics using methodologies and mathematical tools discussed during lectures. In the oral examination, students must discuss their written report, explaining the fundamental concepts of classical mechanics and thermodynamics.

LEARNING EVALUATION CRITERIA
Learning evaluation consists to prove to have acquired necessary autonomy and skill to outline and solve problems concerning classical mechanics and thermodynamics by using properly the

fundamental concepts, methodologies and tools presented during lectures. Ability to schematize typically complex phenomena in their essential elements is also evaluated.

LEARNING MEASUREMENT CRITERIA
Marks are expressed on a scale of 30/30. Highest mark value (30 cum laude) is attributed to students that in both written and oral examinations demonstrated full independence to set and solve problems and complete mastery of methods, models and tools of classical physics. Lowest mark value (18) is given to students able to solve problems with sufficient knowledge of the methods, models and tools of classical mechanics and thermodynamics.

FINAL MARK ALLOCATION CRITERIA
Final mark is obtained by the arithmetic average between the marks of the written and oral exams.

Recommended reading
1. P. Mazzoldi, M. Nigro, C. Voci, "Elementi di Fisica - Meccanica - Termodinamica", Edises. 2. G. Vannini - Gettys "Fisica 1", V Edizione, McGraw-Hill 3. P. Mazzoldi, M. Nigro, C. Voci, "Fisica - Volume 1", Edises. 4. Additional material - https://lms.univpm.it/

Fisica 1 (MECC) (M/Z)

Paolo Mengucci

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Basic concepts of trigonometry, vectors and differential calculus.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
This course gives students the fundamentals of the experimental method, typical of each scientific subject, and the fundamental laws of classical mechanics and thermodynamics. It represents a basic link between the secondary school knowledge and the university teaching. The acquired knowledge allows students to get the necessary instruments for a scientific approach to the analysis of engineering problems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The acquired knowledge and physic methods will allow students to understand, analyse and sketch engineering problems. In particular, students will have to acquire the ability to outline complex phenomena into their essential elements and to apply the classical physics laws to describe them. To this aim, the proposed exercises are usually derived from the common experience. Such knowledge and methods can be applied to many of the university courses the student will attend and, in the following, to the problems he will face during the working career
TRANSVERSAL SKILLS:
The methodological approach acquired and the exercises proposed during this course will contribute to improve the judgement ability, the learning skill and that of drawing conclusions.

Program
Experimental method, physical quantities and measurements. Kinematics. Dynamics. Friction. Work and kinetic energy. Power. Potential energy. Relative motion. Center of mass. Momentum. Impulse. Elastic and inelastic collisions. Rotational motion. Rotational kinetic energy. Moment of inertia. Work and rotational kinetic energy. Torque. Angular momentum. Statics. Gravitation. Fluids. Bernoulli's theorem. Harmonic motion. Thermal Physics. States and systems. Temperature. Heat. First Law of Thermodynamics. Ideal gases. Carnot cycle.

Development of the course and examination
LEARNING EVALUATION METHODS
Learning evaluation is assessed through written and oral exams. In the written examination, students must solve problems of classical mechanics and thermodynamics using methodologies and mathematical tools discussed during lectures. In the oral examination, students must discuss their written report, explaining the fundamental concepts of classical mechanics and thermodynamics.

LEARNING EVALUATION CRITERIA
Learning evaluation consists to prove to have acquired necessary autonomy and skill to outline and solve problems concerning classical mechanics and thermodynamics by using properly the

fundamental concepts, methodologies and tools presented during lectures. Ability to schematize typically complex phenomena in their essential elements is also evaluated.

LEARNING MEASUREMENT CRITERIA
Marks are expressed on a scale of 30/30. Highest mark value (30 cum laude) is attributed to students that in both written and oral examinations demonstrated full independence to set and solve problems and complete mastery of methods, models and tools of classical physics. Lowest mark value (18) is given to students able to solve problems with sufficient knowledge of the methods, models and tools of classical mechanics and thermodynamics.

FINAL MARK ALLOCATION CRITERIA
Final mark is obtained by the arithmetic average between the marks of the written and oral exams.

Recommended reading
1. P. Mazzoldi, M. Nigro, C. Voci, "Elementi di Fisica - Meccanica - Termodinamica", Edises. 2. G. Vannini - Gettys "Fisica 1", V Edizione, McGraw-Hill 3. P. Mazzoldi, M. Nigro, C. Voci, "Fisica - Volume 1", Edises. 4. Additional material - https://lms.univpm.it/

Fisica 2 (MECC) (A/L)

Paolo Mengucci

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Basic concepts of trigonometry, vector and differential calculus. Laws of mechanics of rigid bodies and fluids.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
This course gives students the fundamentals of the experimental method, typical of each scientific subject, and the fundamental laws of electromagnetism and optics. It represents a basic link between the secondary school knowledge and the university teaching. The acquired knowledge allows students to get the necessary instruments for a scientific approach to the analysis of engineering problems
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The acquired knowledge and physic methods will allow students to understand, analyse and sketch engineering problems. In particular, students will have to acquire the ability to outline complex phenomena into their essential elements and to apply the electromagnetism and optics laws to describe them. To this aim, the proposed exercises are usually derived from the common experience. Such knowledge and methods can be applied to many of the university courses the student will attend and, in the following, to the problems he will face during the working career.
TRANSVERSAL SKILLS:
The methodological approach acquired and the exercises proposed during this course will contribute to improve the judgement ability, the learning skill and that of drawing conclusions

Program
Electric charge and Coulomb's law. Electric field. Gauss theorem. Electric potential. First Maxwell's equation. Electric dipole. Conductors and electric field. Electric capacity. Condensers. Electrostatic energy. Energy density. Dielectrics. Electric current. Current density and continuity equation. Electric resistance and Ohm's law. Direct current circuits. RC circuits. Magnetic field. Ampere's theorem. Magnetic materials. Electromagnetic induction. Energy density of the electromagnetic field. Alternating current. Electromagnetic waves. Energy and momentum of the electromagnetic waves. Laws of reflection and refraction. Interference.

Development of the course and examination
LEARNING EVALUATION METHODS
Learning evaluation is assessed through written and oral exams. In the written examination, students must solve problems of electromagnetism and optics using methodologies and mathematical tools discussed during lectures. In the oral examination, students must discuss their written report, explaining the fundamental concepts of electromagnetism and optics.

LEARNING EVALUATION CRITERIA
Learning evaluation consists to prove to have acquired necessary autonomy and skill to outline and

solve problems concerning electromagnetism and optics by using properly the fundamental concepts, methodologies and tools presented during lectures. Ability to schematize typically complex phenomena in their essential elements is also evaluated.

LEARNING MEASUREMENT CRITERIA
Marks are expressed on a scale of 30/30. Highest mark value (30 cum laude) is attributed to students that in both written and oral examinations demonstrated full independence to set and solve problems and complete mastery of methods, models and tools of electromagnetism and optics. Lowest mark value (18) is given to students able to solve problems with sufficient knowledge of the methods, models and tools of electromagnetism and optics.

FINAL MARK ALLOCATION CRITERIA
Final mark is obtained by the arithmetic average between the marks of the written and oral exams.

Recommended reading
1. P. Mazzoldi, M. Nigro, C. Voci, "Elementi di Fisica - Elettromagnetismo, Onde", EdiSes 2. P. Mazzoldi, M. Nigro, C. Voci, "Fisica - Volume 2", EdiSes. 3. C. Mencuccini, V. Silvestrini, "Fisica II", Liguori Editore. 4. Additional material - https://lms.univpm.it/

Fisica 2 (MECC) (M/Z)

Gianni Barucca

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Basic concepts of trigonometry, vector and differential calculus. Laws of mechanics of rigid bodies and fluids.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
This course gives students the fundamentals of the experimental method, typical of each scientific subject, and the fundamental laws of electromagnetism and optics. It represents a basic link between the secondary school knowledge and the university teaching. The acquired knowledge allows students to get the necessary instruments for a scientific approach to the analysis of engineering problems
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The acquired knowledge and physic methods will allow students to understand, analyse and sketch engineering problems. In particular, students will have to acquire the ability to outline complex phenomena into their essential elements and to apply the electromagnetism and optics laws to describe them. To this aim, the proposed exercises are usually derived from the common experience. Such knowledge and methods can be applied to many of the university courses the student will attend and, in the following, to the problems he will face during the working career.
TRANSVERSAL SKILLS:
The methodological approach acquired and the exercises proposed during this course will contribute to improve the judgement ability, the learning skill and that of drawing conclusions

Program
Electric charge and Coulomb's law. Electric field. Gauss theorem. Electric potential. First Maxwell's equation. Electric dipole. Conductors and electric field. Electric capacity. Condensers. Electrostatic energy. Energy density. Dielectrics. Electric current. Current density and continuity equation. Electric resistance and Ohm's law. Direct current circuits. RC circuits. Magnetic field. Ampere's theorem. Magnetic materials. Electromagnetic induction. Energy density of the electromagnetic field. Alternating current. Electromagnetic waves. Energy and momentum of the electromagnetic waves. Laws of reflection and refraction. Interference.

Development of the course and examination
LEARNING EVALUATION METHODS
Learning evaluation is assessed through written and oral exams. In the written examination, students must solve problems of electromagnetism and optics using methodologies and mathematical tools discussed during lectures. In the oral examination, students must discuss their written report, explaining the fundamental concepts of electromagnetism and optics.

LEARNING EVALUATION CRITERIA
Learning evaluation consists to prove to have acquired necessary autonomy and skill to outline and

solve problems concerning electromagnetism and optics by using properly the fundamental concepts, methodologies and tools presented during lectures. Ability to schematize typically complex phenomena in their essential elements is also evaluated.

LEARNING MEASUREMENT CRITERIA
Marks are expressed on a scale of 30/30. Highest mark value (30 cum laude) is attributed to students that in both written and oral examinations demonstrated full independence to set and solve problems and complete mastery of methods, models and tools of electromagnetism and optics. Lowest mark value (18) is given to students able to solve problems with sufficient knowledge of the methods, models and tools of electromagnetism and optics.

FINAL MARK ALLOCATION CRITERIA
Final mark is obtained by the arithmetic average between the marks of the written and oral exams.

Recommended reading
1. P. Mazzoldi, M. Nigro, C. Voci, "Elementi di Fisica - Elettromagnetismo, Onde", EdiSes 2. P. Mazzoldi, M. Nigro, C. Voci, "Fisica - Volume 2", EdiSes. 3. C. Mencuccini, V. Silvestrini, "Fisica II", Liguori Editore. 4. Additional material - https://lms.univpm.it/

Fisica dello Stato Solido

Francesco Simoni

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Knowledge of differential and integral calculus and of main concepts of mechanics and electrodynamics.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
This course allows students to get knowledge of matter structure and electronic and optical properties of solid state. This knowledge, completing the concepts learned through the courses of Fisica and Fisica Superiore, represents the necessary detailed analysis in order to understand the processes which allows electronic, optoelectronic and quantum electronic devices to work.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to apply the learned concepts to sectors of interest of information engineering, the student will have to figure out the phenomenology which governs the different technologic applications already studied in different courses and are exploited in the engineering practice. This ability will come out through learning a critical method approach to concepts to be extended in the professional activity.
TRANSVERSAL SKILLS:
The course includes subjects related to wave optics, quantum mechanics, structure and property of matter, quantum electronics, they will be studied with the aim of highlighting the need of the student to develop transversal skills in order to get a critique view and a deeper knowledge of devices related to information engineering.

Program
Basic of quantum mechanics: wave functions, Schroedinger equation, observables and operators, the harmonic oscillator, model of atom. Condensed matter: molecular interaction, liquids, solids and liquid crystals, structure of crystals. Electronic and optical properties of solids: energy bands, metals, semiconductors, insulators. Matter-radiation interaction. Light amplification and laser emission.

Development of the course and examination
LEARNING EVALUATION METHODS
oral examination; the student is asked to present the main concepts concerning some proposed topics included among the ones of the programme.

LEARNING EVALUATION CRITERIA
It is evaluated the acquisition of the main concepts related to the following topics: basic of quantum mechanics, atomic and molecular properties and condenssed states of matter, electronic and optical properties of solids, radiation-matter interaction and laser physics.

LEARNING MEASUREMENT CRITERIA

It is evaluated the degree of acquisition and understanding of the discussed topics. It is evaluated the ability of using the concepts of quantum mechanics in studying the matter properties, with special focus to electronic and optical properties.

FINAL MARK ALLOCATION CRITERIA

The maximum score, thirty cum laude, is given to students showing full acquisition of the discussed topics and ability of finding links between the different concepts. The minimum score, eighteen, is given to student showing a sufficient knowledge of the discussed topics and understanding of the main aspects of the discussed topics.

Recommended reading

Lecture notes of teacher. Other readings: J.R. Hook, H.E. Hall, Solid State Physics, John Wiley & Sons; A. Yariv, Quantum Electronics, Academic Press

Fisica Generale (EA)

Daniele Eugenio Lucchetta

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 72
Period 2s

Prerequisites
Knowledge of the basic elements of differential and integral calculus

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
This course gives students the fundamentals of the experimental method, typical of each scientific subject, and the fundamental laws of classical mechanics and thermodynamics. It represents a basic link between the secondary school knowledge and the university teaching. The acquired knowledge allows students to get the necessary instruments for a scientific approach to the analysis of engineering problems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The acquired knowledge and physic methods will allow students to understand, analyse and sketch engineering problems. In particular, students will have to acquire the ability to outline complex phenomena into their essential elements and to apply the classical physics laws to describe them. To this aim, the proposed exercises are usually derived from the common experience. Such knowledge and methods can be applied to many of the university courses the student will attend and, in the following, to the problems he will face during the working career.
TRANSVERSAL SKILLS:
The methodological approach acquired and the exercises proposed during this course will contribute to improve the judgement ability, the learning skill and that of drawing conclusions.

Program
Physical observables and scientific method. Concept of Measurement. Vectors. Cynematic of the material point. Definition of force. Principles of Dynamics. Some specific forces: gravitational force, weight, elastic force. Static and dynamic friction. Other types of reactions. Work. Work and Kinetic energy. Conservative force. Potential energy. Energy conservation. Linear Momentum. The angular momentum. Systems dynamics and the third principle of mechanics. Centre of mass. Rigid systems. Equilibrium conditions. Rotational kinetic energy. Angular momentum of a rigid system. Momentum of Inertia. Temperature and its measurement. Thermal dilation. Work and Heat. Thermodynamic transformations. First principle of thermodynamics. Internal energy. Specific heat. Ideal gases. Second principle of thermodynamics. Carnot s cycle and efficiency. Clausius integral, definition and calculation of entropy. The electric charge and the Coulomb law. Electric field. Electrostatic potential energy. Electric potential. Movement of charges in electric fields. Current and current density. Electric conductivity, relationship between J and E. Ohm s law. Joule effect.

Development of the course and examination
LEARNING EVALUATION METHODS
The evaluation will be based on both a written and an oral exam. In the written examination, students must demonstrate that they know how to approach and solve simple exercises as well as answer some questions related to the main topic's coursework using methodologies, tools,

techniques, mathematical models and knowledge acquired during the lessons. In the oral exam the student will be asked, based on their written responses, the theoretical concepts of basic physics.

LEARNING EVALUATION CRITERIA
To pass the test, the student has to prove, that he understands the theoretical concepts presented in the course and must be able to apply them in real-life situations framing and solving specific physics problems through logical deductive processes.

LEARNING MEASUREMENT CRITERIA
The student's independent ability to set and solve the problems presented, through the correct use of methods, models and tools, will be evaluated during the exam.

FINAL MARK ALLOCATION CRITERIA
The highest score will equal thirty points with honours and will be awarded to students who demonstrate, in the two tests, complete theoretical knowledge and full autonomy to set and solve problems, complete mastery of the methods, models and tools of basic physics. The minimum score is equal to eighteen points and will be awarded to students who demonstrate, in the two tests, sufficient theoretical knowledge, good autonomy to set and solve problems, sufficient command of methods, models and tools of basic physics.

Recommended reading
Fundamentals of Physics by David Halliday,Robert Resnick any edition

Fisica Generale 1 (INF)

Gianni Albertini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Basics of mathematics and algebra are assumed as previous knowledge. At the end of the course a basic knowledge of the derivatives and integrals is also assumed (either obtained through this course or in the course of Analisi Matematica or as a previo

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
This course gives students the fundamentals of the experimental method, typical of each scientific subject, and the fundamental laws of classical mechanics, thermology and part of thermodynamics. It represents a basic link between the secondary school knowledge and the university teaching. The acquired knowledge allows students to get the necessary instruments for a scientific approach to the analysis of engineering problems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The acquired knowledge and physic methods will allow students to understand, analyse and sketch engineering problems. In particular, students will have to acquire the ability to outline complex phenomena into their essential elements and to apply the classical physics laws to describe them. To this aim, the proposed exercises are usually derived from the common experience. Such knowledge and methods can be applied to many of the university courses the student will attend and, in the following, to the problems he will face during the working career.
TRANSVERSAL SKILLS:
The methodological approach acquired and the exercises proposed during this course will contribute to improve the judgement ability, the learning skill and that of drawing conclusions.

Program
The Galilean method. Error analysis. Scalar and vector quantities. Particle mechanics. Systems mechanics. Kinematics. Rectilinear, circular, harmonic motion. Relative motions. Dynamics. Constraints, elastic, weight and friction forces. Tension. Inertial and not inertial frames; real and fictitious forces. Energy and momentum. Centre of mass. Work, Energy. Conservative forces, potential energy; force and potential energy gradient. Potentials wells and barriers. Collisions. Mechanical and thermal energy. Kinematics and dynamics in rotational mechanics. Moment of a vector, of a force, of the momentum. Moment of inertia. Cardinal equations in the mechanics of systems. Equivalent sets of forces. Centre of gravity. Equilibrium of a rigid body . Precession. Fluids. General characteristics of fluids. Fundamental equation hydrostatics and some basic equations. Hydrostatics in not inertial frames. Basic equations of hydrodynamics. Viscosity. Viscous resistance; Stokes law. Surface tension. Thermology and thermodynamics: Temperature, thermal equilibrium. Zeroth principle of the Thermodynamics. Heat and heat propagation. First principle of the Thermodynamics. States and transformations. Thermodynamic work, heat and internal energy. Entalpy. Perfect and real gasses; mixtures of gasses; their basic transformations. Kinetic theory. Equipartition principle. Molar heats of a perfect gas. Maxwell distribution of speeds.

Development of the course and examination

LEARNING EVALUATION METHODS

The learning evaluation is performed by using one written and one oral tests The written examination may be replaced by two partial tests, one on the topics of the first part of the course, the other on the remaining part. Partial test are only possible until the first exam session after the course (typically by February for courses of the first semester and July for those in the second). The written test (or the two partial tests) is valid fourteen months, also for many oral tests if it is the case. The final valutation is mainly based on the oral exam.

LEARNING EVALUATION CRITERIA

The written tests give access to the oral one(s) and aim to check the ability to solve simple problems related to the course topics. The oral examinations aim to test the ability to expose a topic in a clear way, to connect different parts of the program, to use the language of Physics and the formalism of Mathematics in a way appropriate to the course level. Personal opinions, explanations, interpretations are appreciated (unless they are totally erroneous or misleading).

LEARNING MEASUREMENT CRITERIA

The examinations are considered a part of the learning process. Thus, their aim is not a simple valutation mark or a decision for passing or failing. On the contrary, they aim to suggest the parts of the program to be better understood, if it is the case, or the basics settings to be acquired. In the latter case a reworking of the entire program is usually required. Once that the preparation is satisfactory the final valutation is a mark out of 30.

FINAL MARK ALLOCATION CRITERIA

The written test gives access to the oral one(s). It aims to check the ability to solve simple problems related to the course topics. The final valutation is mainly based on the oral exam, which aims to evaluate the mastery of the course topics and the ability to explain them to other people, to connect different parts of the program, to use the language of Physics and the mathematical formalism in an appropriate way. Personal opinions, explanations, interpretations are appreciated (unless they are totally erroneous or misleading)

Recommended reading

- G.Albertini, Introduzione alla Fisica , Ed.Pitagora, Bologna - G.Albertini, Momenti (meccanica rotazionale) , Ed.Pitagora, Bologna - G.Albertini, Appunti sui fluidi , Ed.Pitagora, Bologna - G.Albertini, Gli errori sperimentali , Ed.Pitagora, Bologna - G.Albertini, Thermo , Ed.Pitagora, Bologna

Fisica Generale 2 (INF)

Gianni Albertini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Knowledge of the basic concepts, physical quantities, methods and logical/mathematical tools necessary to treat subjects of Mechanics, Experimental Errors, Fluids, thermology and thermodynamics (excluding 2nd and 3rd laws and their consequences)

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
This course gives students the fundamentals of the experimental method, typical of each scientific subject, and the fundamental laws of electromagnetism and optics. It represents a basic link between the secondary school knowledge and the university teaching. The acquired knowledge allows students to get the necessary instruments for a scientific approach to the analysis of engineering problems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The acquired knowledge and physic methods will allow students to understand, analyse and sketch engineering problems. In particular, students will have to acquire the ability to outline complex phenomena into their essential elements and to apply the Thermodynamics, Electromagnetism and Optics laws to describe them. To this aim, the proposed exercises are usually derived from the common experience. Such knowledge and methods can be applied to many of the university courses the student will attend and, in the following, to the problems he will face during the working career.
TRANSVERSAL SKILLS:
The methodological approach acquired and the exercises proposed during this course will contribute to improve the judgement ability, the learning skill and that of drawing conclusions.

Program
The Second Law of Thermodynamics. Heat Engines and refrigerating machines; Thermal efficiency and coefficient of performance (COP). Carnot cycle. Carnot theorem. Entropy. Entropic diagram. Entropy and statistic; thermodynamic probability; Entropy, order and information. Helmoltz free energy. Gibbs free energy. Absolute temperature and thermal efficiency. Third law of Thermodynamics and absolute zero Electric, gravitational and magnetic fields in vacuum. Direct current electrical circuits, resistance, capacity, power suppliers. Magnetic moment. Time varying fields. Induction, self-inductance, mutual inductance. Alternate current circuits. The oscilloscope. Electric and magnetic fields in the matter. Maxwell equations in vacuum and in the materials, with steady and time-varying fields. Oscillations and waves. Superposition, Huygens and Fourier laws. Wave speed. Bel, dB. Octaves. Beating. Phase speed and group speed. Standing waves. Doppler effect. The wake. Diffraction and diffusion. Beams. Many sources interference and diffraction. Bragg diffraction. Refraction, reflection, total reflection. Wave/particle duality. Lenses. Thin lens approximation. Linear and angular magnifying powers. Resolution power, limit of useful magnification, chromatic aberration

Development of the course and examination

LEARNING EVALUATION METHODS

The learning evaluation is performed by using one written and one oral tests The written examination may be replaced by two partial tests, one on the topics of the first part of the course, the other on the remaining part. Partial test are only possible until the first exam session after the course (typically by February for courses of the first semester and July for those in the second). The written test (or the two partial tests) is valid fourteen months, also for many oral tests if it is the case. The final valutation is mainly based on the oral exam.

LEARNING EVALUATION CRITERIA

The written tests give access to the oral one(s) and aim to check the ability to solve simple problems related to the course topics. The oral examinations aim to test the ability to expose a topic in a clear way, to connect different parts of the program, to use the language of Physics and the formalism of Mathematics in a way appropriate to the course level. Personal opinions, explanations, interpretations are appreciated (unless they are totally erroneous or misleading).

LEARNING MEASUREMENT CRITERIA

The examinations are considered a part of the learning process. Thus, their aim is not a simple valutation mark or a decision for passing or failing. On the contrary, they aim to suggest the parts of the program to be better understood, if it is the case, or the basics settings to be acquired. In the latter case a reworking of the entire program is usually required. Once that the preparation is satisfactory the final valutation is a mark out of 30.

FINAL MARK ALLOCATION CRITERIA

The written test gives access to the oral one(s). It aims to check the ability to solve simple problems related to the course topics. The final valutation is mainly based on the oral exam, which aims to evaluate the mastery of the course topics and the ability to explain them to other people, to connect different parts of the program, to use the language of Physics and the mathematical formalism in an appropriate way. Personal opinions, explanations, interpretations are appreciated (unless they are totally erroneous or misleading)

Recommended reading

- G.Albertini, Appunti di elettromagnetismo, ottica e onde nuova edizione con esercizi svolti, Ed.Pitagora, Bologna - G.Albertini, Thermo , Ed.Pitagora, Bologna

Fisica Sperimentale (BIO)

Liana Lucchetti

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Good basic knowledge of mathematics

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
This course gives students the fundamentals of the experimental method, typical of each scientific subject, and the fundamental laws of classical mechanics and thermodynamics. It represents a basic link between the secondary school knowledge and the university teaching. The acquired knowledge allows students to get the necessary instruments for a scientific approach to the analysis of engineering problems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The acquired knowledge and physic methods will allow students to understand, analyse and sketch engineering problems. In particular, students will have to acquire the ability to outline complex phenomena into their essential elements and to apply the classical physics laws to describe them. To this aim, the proposed exercises are usually derived from the common experience. Such knowledge and methods can be applied to many of the university courses the student will attend and, in the following, to the problems he will face during the working career.
TRANSVERSAL SKILLS:
The methodological approach acquired and the exercises proposed during this course will contribute to improve the judgement ability, the learning skill and that of drawing conclusions.

Program
The scientific method. Cinematic of the point particle. Dynamics of the point particle. Examples of force. Galileian relativity. Non-inertial reference systems. Energy and work. Systems of particles. Conservation laws. Collisions. Cinematic and dynamics of rigid bodies. Scalar and vector fields-Gravitation. Cinematic and dynamics of fluids. First principle of thermodynamics. Thermodynamical cicles.

Development of the course and examination
LEARNING EVALUATION METHODS
Written session passed with at least 17/30.

LEARNING EVALUATION CRITERIA
The written session evaluates the skill in problem solving, the oral one evaluates the learning of the topics.

LEARNING MEASUREMENT CRITERIA
The written session is passed with 17/30. In this case the oral session is mandatory

FINAL MARK ALLOCATION CRITERIA

The final score is in the range 18-30/30.

Recommended reading

Gettys, Keller, Skove Fisica 1 McGraw-Hill Mencuccini, Silvestrini Fisica 1 Zanichelli

Fisica Sperimentale (CA)

Liana Lucchetti

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Good basic knowledge of mathematics

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
This course gives students the fundamentals of the experimental method, typical of each scientific subject, and the fundamental laws of classical mechanics. It represents a basic link between the secondary school knowledge and the university teaching. The acquired knowledge allows students to get the necessary instruments for a scientific approach to the analysis of engineering problems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The acquired knowledge and physic methods will allow students to understand, analyse and sketch engineering problems. In particular, students will have to acquire the ability to outline complex phenomena into their essential elements and to apply the classical physics laws to describe them. To this aim, the proposed exercises are usually derived from the common experience. Such knowledge and methods can be applied to many of the university courses the student will attend and, in the following, to the problems he will face during the working career.
TRANSVERSAL SKILLS:
The methodological approach acquired and the exercises proposed during this course will contribute to improve the judgement ability, the learning skill and that of drawing conclusions.

Program
The scientific method. Cinematic of the point particle. Dynamics of the point particle. Examples of force. Galileian relativity. Non-inertial reference systems. Energy and work. Systems of particles. Conservation laws. Collisions. Cinematic and dynamics of rigid bodies. Scalar and vector fields-Gravitation. Cinematic and dynamics of fluids.

Development of the course and examination
LEARNING EVALUATION METHODS
Written session passed with at least 17/30.

LEARNING EVALUATION CRITERIA
The written session evaluates the skill in problem solving, the oral one evaluates the learning of the topics.

LEARNING MEASUREMENT CRITERIA
The written session is passed with 17/30. In this case the oral session is mandatory

FINAL MARK ALLOCATION CRITERIA
The final score is in the range 18-30/30.

Recommended reading

Gettys, Keller, Skove Fisica 1 McGraw-Hill Mencuccini, Silvestrini Fisica 1 Zanichelli

Fisica Superiore

Oriano Francescangeli

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Good knowledge of the contents of the courses of Physics and Mathematical Analysis.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
This course allows students to get basics knowledge of structure of atom, molecules, condensed matter and light-matter interaction. This knowledge, completing the concepts learned through the courses of Fisica, represents the necessary detailed analysis to enrich the knowledge of basic physical phenomena in order to bring the student to a clear view of the processes which lead to the different applications of engineering based on material properties.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to apply the learned concepts to sectors of interest of engineering, the student will have to figure out the phenomenology which governs the different technologic applications already studied in different courses and are exploited in the engineering practice. This ability will come out through learning a critical method approach to concepts and simple problems related to structure of matter, to be extended in the professional activity.
TRANSVERSAL SKILLS:
The course includes subjects related to wave optics, quantum mechanics, structure of matter, quantum electronics, they will be studied with the aim of highlighting the need of the student to develop transversal skills in order to get a critique view and a deeper knowledge of the applications of engineering based on material properties.

Program
Wave properties of light. Relativity. Photons and matter waves. Elements of quantum mechanics. Atoms, molecules, solids. Chemical bonds. Physical, optical and electro-optical properties of the condensed matter. Lasers.

Development of the course and examination
LEARNING EVALUATION METHODS
The evaluation of the student's level of learning is done at the end of the course by means of a written and an oral test. The written test consists in solving various problems that cover all the topics of the course, with particular attention to the wave-particle nature of the light, the special theory of relativity, to the principles of quantum mechanics, the atomic structure, the chemical bonds and the the physical properties of electric conductors. The written text is preliminary to the oral test: to access to the latter the student must earn a passing score on the written test. The oral exam consists of the discussion of three topics covered in the course, appropriately chosen in order to test the preparation of the student on the cardinal issues. In the case of a negative outcome for the oral exam, the student must repeat the written test.

LEARNING EVALUATION CRITERIA

In the written test students must demonstrate to have understood and assimilated in depth the physical contents of the course and to be able to use the laws of modern physics as a tool for the resolution of a variety of problems. Besides the fundamental processes of formulation and modeling, particular attention will be addressed to the computational and measuring aspects connected with the resolution of the quanto-mechanical problems.

LEARNING MEASUREMENT CRITERIA
It is evaluated the level of understanding of the concepts and the degree of knowledge of the subject. Is is evaluated the independent ability of the student to set up and solve problems and to make correct use of the relevant methodologies and tools of the modern physics.

FINAL MARK ALLOCATION CRITERIA
In the written text, each exsercize receives a mark up to the maximum reported in the text, for a maximum total score of 30 points. In the oral test, each of the three questions is graded up to a maximum of 10 points, for a maximum total score of 30 points. Because the overall outcome of the evaluation is positive, the student must achieve a minimum score of 18 in both tests. The final mark, out of thirty, is the result of the arithmetic average of the marks obtained in the two tests. The honors (laude) will be given to students who, having achieved the highest rating, have argued brilliantly both tests, demonstrating a particular mastery of the subject or a level of detail of topics higher than it is normally required.

Recommended reading
[1] P.A. Tipler, G. Mosca, Corso di Fisica, Vol. III Fisica Moderna, Zanichelli [2] D. Halliday, R. Resnick, J. Walker, Fondamenti di Fisica - Vol. III Fisica Moderna - CEA

Fisica Tecnica (EA)

Massimo Paroncini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 90
Period 1s

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The teaching allows students to acquire advanced knowledge in the analysis of problems occurring in energy conversion with particular attention being paid to the presence of thermic form. This knowledge will integrate notions acquired in Physics and Mathematics courses that will enrich knowledge in the Applied Physics sector. The student will acquire a clear awareness in the more ample multidisciplinary engineering context, with a clear recall to aspects connected to thermodynamic systems and the most significant transformations used in real applications.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to face advanced and very complex design themes, to manage the innovation and development of new products and technological processes through the application of knowledge, the student will have to interpret and analyze thermodynamic systems, heat exchangers, heat machines, refrigerators, and solar collectors. The application of the most significant transformations used in the real application of the aforementioned processes, heat transmission mechanisms for the resolution of heat transfer cases and the evaluation of the general aspects with regards to acoustic comfort, air-conditioning along with thermohygrometric and visual wellness will also be examined.
TRANSVERSAL SKILLS:
The ability to face thermodynamic and heat transfer application examples in building construction as well as acoustics and lighting, will contribute to bettering the level of autonomous judgement in general, along with communication and learning capacity, and conclusions drawn by the student.

Program
Applied Thermodynamics: first thermodynamic principle, second thermodynamic principle, perfect gas, direct cycle, inverse cycle, moist air, moist air transformations, summer and winter heating and air conditioning Heat Transmission: systems of heat transmission, thermal conduction, thermal convection, thermal radiation, combined systems of heat transmission. Thermal hygrometry in buildings: calculation of thermal requirements in buildings, hygrometric issues in buildings. Applied Acoustics: fundamental acoustic quantities, acoustic spectrum analysis, spectrum response of human hear and loudness, criterions of sound and noise evaluation, propagation and transmission of sound waves, acoustic absorption and soundproofing, closed-field propagation. Lighting Engineering: photometry, Lighting production and control systems, methods of calculation for inner lighting, day-lighting, laboratory lessons

Development of the course and examination
LEARNING EVALUATION METHODS
The evaluation consists in an oral exam where the student is asked to explain basic theory and concepts of Applied Physics, by answering the questions asked.

LEARNING EVALUATION CRITERIA
During the exam, the student must demonstrate an ability to apply, autonomously and correctly, the methodologies, models and tools presented during the lessons. Furthermore the student must, demonstrate adequate ability in judging, synthesizing and clearly presenting ideas, concepts and constructive solutions related to Applied Physics.

LEARNING MEASUREMENT CRITERIA
The exam will evaluate the student's ability to independently formulate and solve the problems posed to him or her. The student's ability to correctly apply relevant models, methodologies and tools of Applied Physics will also be evaluated.

FINAL MARK ALLOCATION CRITERIA
The maximum grade, equal to thirty points with honours will be awarded to students that show full autonomy in the formulation and solution of the problems, showing to have fully grasped the models, methodologies and tools of Applied Physics. The minimum grade of eighteen will be assigned to students that are able to solve problems posed to them with sufficient knowledge of the models, methodologies and tools of Applied Physics.

Recommended reading
Yunus A. Çengel,Termodinamica e Trasmissione del Calore, McGraw- Hill, 2013 P. Ricciardi, Elementi di Acustica e Illuminotecnica, McGraw- Hill,2013 Course notes available on the Moodle platform

Fisica Tecnica (GEST)

Francesco Corvaro

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Basic knowledge of Calculus, Mechanics, Electricity and Magnetism.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course allows students to acquire the basic knowledge related to the principles of applied thermodynamics, heat transfer and air treatment. This studies, by integrating the knowledge acquired in physics courses, will constitute a deeper base that will increase the knowledge of the thermo-mechanical sector, so that the student will acquires a better awareness of the wider multidisciplinary context of engineering, with a clear reference to the aspects connected with systems and technologies of production and energy conversion and of air-conditioning systems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to acquire the fundamental tools and the basic elements to understand the thermodynamic processes, the heat transfer mechanisms, that allow the student to address problems related to practical applications: operation mechanisms of heat exchangers, of the cooling systems. The student must be able to understand the causes of technological behaviors already analyzed in other courses that are commonly addressed in engineering practice. This ability will be used through a number of vocational skills, such as: 1. the ability to understand the various thermodynamic cycles; 2. the ability to identify the heat exchange mechanisms; 3. the ability to understand the issues associated with the humid air treatment.
TRANSVERSAL SKILLS:
The execution of shared classroom exercises, will help students to improve either the level of working independence, and the ability to communicate that also stems from the teamwork, and the ability to learn independently and to draw conclusions

Program
General information on applied thermodynamics and some elements of thermometry. Equilibrium thermodynamics. Thermodynamic diagrams. Vapor, ideal gas and incompressible substances. First thermodynamic principle for closed and open systems. Application to machine tools and engine tools and to machineries of practical usage. Second thermodynamic principle. Clausius and Kelvin postulate. Thermodynamic cycles, engines and refrigerators. Direct and inverse Carnot cycle. Entropy. Gas and vapor direct thermodynamic cycles. Simple vapor compression thermodynamic cycles. moist air. Enthalpy of moist air. Psychrometric chart. Processing and treatment of moist air. Thermal exchange systems. Thermal conduction in stationary condition. Electrical analogy and resistive model. Thermal convection. Flow range. Adimensional groups and connections of practical usage. Thermal radiance. Radiance emitted by blackbody and real surfaces. Thermal exchange between blackbody, grey body and cavities. Combined mechanisms of thermal exchange. Heat exchanger.

Development of the course and examination

LEARNING EVALUATION METHODS
The assessment of the level of learning consists of an oral exam during which the student must answer questions related to the topics covered in class. The duration of the test will be the maximum of 30 minutes.

LEARNING EVALUATION CRITERIA
To successfully pass the exam, the student must demonstrate, through the test described above, to have assimilated the concepts contained in the program

LEARNING MEASUREMENT CRITERIA
Normally the student must answer to three different questions. Each question has a maximum score of 10 points.

FINAL MARK ALLOCATION CRITERIA
The final grade will consist of the sum of points obtained by the student in each question. The Lode is given to those who, in addition to achieving the maximum score, demonstrate to master very well the subject.

Recommended reading
Yunus A. Çengel , Termodinamica e trasmissione del Calore, (Terza edizione), McGraw-Hill, 2009.

Fisica Tecnica (MECC) (A/L)

Fabio Polonara

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Basic knowledge of Calculus, Mechanics, Electricity and Magnetism.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
Students will learn the fundamentals of applied thermodynamics and heat transfer. Together with the fundamentals in mathematics and physics, this course will increase the knowledge in the fields of thermofluid-dynamics, fluid machines and energy systems giving to the student the awareness of the multidisciplinary context of engineering with particular focus on the issues related to the conversion, transmission, final use of energy and to the design of fluid machines and energy systems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Aiming at applying the fundamentals of applied physics in the industrial sector, students must be able to perform analysis of components and basic energy systems in order to assess both the energy performance of fluid machines and the best technical solutions according to the operating context. The main skills acquired in the course are: 1. ability to perform first law analyses on components and on systems operating on direct and reverse thermodynamic cycles; 2. ability to perform heat transfer analyses on simple systems operating at steady state with the method of thermal resistance.
TRANSVERSAL SKILLS:
The ability of solving numerical problems, together with the awareness of their knowledge, will improve the judgement autonomy of students, their communications skills and their learning ability.

Program
Class lectures contents (54 hours): Introduction to thermodynamics. Basics of thermometry. State thermodynamics. Thermodynamics charts. Vapours, ideal gas, incompressible substances. First law of thermodynamics for closed and open systems. Application of first law to simple system components. Second law of thermodynamics. Clausius and Kelvin postulates. Direct and reverse thermodynamic cycles. Direct and reverse Carnot cycle. Entropy. Vapour and gas direct thermodynamic cycles. Vapour compression reverse thermodynamic cycle. Psycrometrics. Heat transfer mechanisms. Steady state conduction. Electric analogy and resistive model. Thermal convection. Flow regimes. Dimensionless numbers and correlations for practical use. Thermal radiation. Black-body and real-surfaces radiation. Heat transfer between black bodies, grey bodies within cavities. Heat transfer combined mechanisms. Walls transmittance. Heat exchargers. Class exercises (18 hours): numerical exercises related to technological applications learned during the course.

Development of the course and examination
LEARNING EVALUATION METHODS
The assessment of the learning level consists of a written test divided into two parts: in the first part,

the student must solve 4 numerical exercises relating to technological applications that have been discussed in class. In the second part, the student must answer 4 questions on theoretical topics chosen amongst those discussed in class. The time available for the test as a whole is 120 minutes. After this first test, the student who has obtained a mark has to pass an oral test in which the topics covered in class will be discussed.

LEARNING EVALUATION CRITERIA
To successfully pass the exam, the student must demonstrate, through the tests described above, to have assimilated the concepts contained in the syllabus and to be able to properly solve numerical exercises related to technological applications learned during the course.

LEARNING MEASUREMENT CRITERIA
The 4 numerical exercises are evaluated with a maximum total score of 60 points out of 100 (each exercise is given a maximum score of between 10 and 20 points, with a total of 60). The 4 theoretical questions are evaluated with a maximum total score of 40 points out of 100 (each question is given a maximum score of 10).

FINAL MARK ALLOCATION CRITERIA
The vote in hundredths, obtained by adding the vote gained in any exercise and theoretical question, is converted in thirthyeths. To proceed to the oral test (in the same session or in a later session) a minimum score of 14/30 is required. The final vote is a weighted mean of the vote in the written test (weight 70) and in the oral test (weight 30). The "Lode" is given to those who, in addition to achieving the maximum score on the test, demonstrate to master very well the subject.

Recommended reading
Y.A.Çengel , Termodinamica e trasmissione del Calore, (Terza edizione), McGraw-Hill, 2009 - Cesini, Latini, Polonara, Fisica Tecnica, CittàStudi, 2016

Fisica Tecnica (MECC) (M/Z)

Francesco Corvaro

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Basic knowledge of Calculus, Mechanics, Electricity and Magnetism.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
Students will learn the fundamentals of applied thermodynamics and heat transfer. Together with the fundamentals in mathematics and physics, this course will increase the knowledge in the fields of thermofluid-dynamics, fluid machines and energy systems giving to the student the awareness of the multidisciplinary context of engineering with particular focus on the issues related to the conversion, transmission, final use of energy and to the design of fluid machines and energy systems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Aiming at applying the fundamentals of applied physics in the industrial sector, students must be able to perform analysis of components and basic energy systems in order to assess both the energy performance of fluid machines and the best technical solutions according to the operating context. The main skills acquired in the course are: 1. ability to perform first law analyses on components and on systems operating on direct and reverse thermodynamic cycles; 2. ability to perform heat transfer analyses on simple systems operating at steady state with the method of thermal resistance.
TRANSVERSAL SKILLS:
The ability of solving numerical problems, together with the awareness of their knowledge, will improve the judgement autonomy of students, their communications skills and their learning ability.

Program
Class lectures contents (54 hours): Introduction to thermodynamics. Basics of thermometry. State thermodynamics. Thermodynamics charts. Vapours, ideal gas, incompressible substances. First law of thermodynamics for closed and open systems. Application of first law to simple system components. Second law of thermodynamics. Clausius and Kelvin postulates. Direct and reverse thermodynamic cycles. Direct and reverse Carnot cycle. Entropy. Vapour and gas direct thermodynamic cycles. Vapour compression reverse thermodynamic cycle. Psycrometrics. Heat transfer mechanisms. Steady state conduction. Electric analogy and resistive model. Thermal convection. Flow regimes. Dimensionless numbers and correlations for practical use. Thermal radiation. Black-body and real-surfaces radiation. Heat transfer between black bodies, grey bodies within cavities. Heat transfer combined mechanisms. Walls transmittance. Heat exchargers. Class exercises (18 hours): numerical exercises related to technological applications learned during the course.

Development of the course and examination
LEARNING EVALUATION METHODS
The assessment of the learning level consists of a test divided into two parts: in the first part, the

student must solve 4 numerical exercises relating to technological applications that have been discussed in class. In the second part, the student must answer 4 questions on theoretical topics chosen from among those discussed in class. The time available for the test as a whole is 120 minutes. After this first test, the student who has obtained a mark (sufficient or insufficient) may apply to an optional oral test in which the topics covered in class will be discussed.

LEARNING EVALUATION CRITERIA
To successfully pass the exam, the student must demonstrate, through the tests described above, to have assimilated the concepts contained in the syllabus and to be able to properly solve numerical exercises related to technological applications learned during the course.

LEARNING MEASUREMENT CRITERIA
The 4 numerical exercises are evaluated with a maximum total score of 60 points out of 100 (each exercise is given a maximum score of between 10 and 20 points, with a total of 60). The 4 theoretical questions are evaluated with a maximum total score of 40 points out of 100 (each question is given a maximum score of 10).

FINAL MARK ALLOCATION CRITERIA
The vote in hundredths, obtained by adding the vote gained in any exercise and theoretical question, is converted in thirthyeths. To proceed to the optional oral test (in the same session or in a later session) a minimum score of 14/30 is required. The Lode is given to those who, in addition to achieving the maximum score on the test, demonstrate to master very well the subject.

Recommended reading
Yunus A. Çengel , Termodinamica e trasmissione del Calore, (Terza edizione), McGraw-Hill, 2009.

Fisica Tecnica Ambientale (CA)

Giorgio Passerini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Courses of Analisi and Fisica

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course will give training upon applied thermodynamics concerning energy production management and consumption, including new sources and techniques. The course will also give training about heat transfer theories (focusing on the options and the techniques to save energy) and general education about environmental-management standard practices.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Students will be given the knowhow and the practice to reduce energy footprints and carbon footprints, to reduce heat and energy losses and to apply environmental-management good practices also through environmental certification.
TRANSVERSAL SKILLS:
A full understanding and in-deep knowledge of energy and environmental management are nowadays an education of relevant importance. Indeed, environmental certification is the (almost-twin) sister of quality certification. Such certifications have possibly the most widespread applications on both public sector and private companies.

Program
Main Concepts of Thermodynamics; Properties of Pure Substances; The First Law of Thermodynamics for Closed Systems; The First Law of Thermodynamics for Open Systems; The Second Law of Thermodynamics; Entropy; Direct cycles and Inverse Compression Cycles; Mixtures of Gas and Vapor; Air-Treatment and Air-Conditioning. Heat Transfer in Solids; Heat Transfer by Convection in Fluids; Radiative Heat Exchange. Environmental Models for Air-Quality Management and Control; Model Classifications; Application of Models on Various Scenarios; Air quality monitoring and remediation.

Development of the course and examination
LEARNING EVALUATION METHODS
Oral Exam (three questions)

LEARNING EVALUATION CRITERIA
Evaluation of candidate's answers

LEARNING MEASUREMENT CRITERIA
score up to 10/10 for each answer

FINAL MARK ALLOCATION CRITERIA
Sum of above scores

Recommended reading

Y. Cengel, Termodinamica e trasmissione del calore Mc Graw Hill, Milano 1998-2004-2009.
Lecture notes, in Italian language.

Fisica Tecnica Ambientale (EDI)

Giovanni Di Nicola

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Basic knowledge of Mathemathics and Physics.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire basic knowledge of applied thermodynamics and heat transfer. This knowledge, by integrating the knowledge gained in the mathematics and physics courses, will allow to acquire the necessary tools for the correct interpretation of thermal phenomena and to prepare the student to the design of the plants. In this way the student will acquire a clear awareness of wider multidisciplinary context of engineering, with a clear reference to the aspects strictly connected with the systems and technologies for the production, transport and use of energy and of machines and energy systems design.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student must be able to perform analysis of components and simple thermal systems in order to assess the energy performance of thermal machines and choose the best solutions regarding the use. The student will be able to apply the acquired knowledge, recognizing the importance of environmental, economic and technological constraints and proposing a critical interpretation and theoretical modeling, integrating with other professionals working in the construction sector. This ability will be allowed through a number of professional skills, such as: 1. basic knowledge of applied thermodynamics and heat transfer; 2. ability to conduct first principle analysis on the components of machines and systems operating on inverse thermodynamic cycles; 3. ability to conduct analysis on heat transfer in simple systems operating in steady state with the electrical analogy method; 4. basic knowledge of acoustic and lighting comfort.
TRANSVERSAL SKILLS:
The course will contribute to the knowledge and understanding of mathematical methods and the physical and chemical phenomena essential for engineering disciplines. The ability to solve numerical problems will help the student to improve the general degree of independence of judgment, the communication skills that comes from the awareness of his own skills and the ability to learn independently and to draw conclusions.

Program
Contents (48 hours). Introduction to thermodynamics. State thermodynamics. Thermodynamics Charts. Vapours, ideal gas, incompressible substances. First law of thermodynamics for closed and open systems. Application of first law to simple system components. Second law of thermodynamics. Clausius and Kelvin postulates. Direct and reverse thermodynamic cycles. Direct and reverse Carnot cycle. Entropy. Vapour compression reverse thermodynamic cycle. Thermodynamic properties of gas-vapor mixtures. General definitions. The psychrometric charts. Building thermophysics. Heat and mass balances. Heat transfer mechanisms. Steady state conduction. Electric analogy and resistive model. Thermal convection. Flow regimes. Adimensional numbers and correlations for practical use. Thermal radiation. Black-body and real-surfaces

radiation. Heat transfer between black bodies, gray bodies within cavities. Heat transfer combined mechanisms. Walls transmittance. Enhanced heat transfer. Acoustic comfort. Fundamentals of sound waves. Phono adsorbance. Phono insulation. Visual comfort. Photometric parameters. Indoor lighting computational methods. Exercises (24 hours). Exercises on the laws of thermodynamics. T-s and P-h diagrams for the reverse thermodynamic cycles. Exercises on the thermodynamic properties of gas-vapor mixtures and use of the psychrometric charts. Exercises on the heat transfer mechanisms and on the electric analogy and resistive model.

Development of the course and examination

LEARNING EVALUATION METHODS

The assessment of student learning consists of a test to be completed in two hours. The test is divided in two parts: - a first part based on the solution of three exercises on topics covered in the course; - a second part based on three theoretical questions on topics covered in the course. A further oral exam will be taken, consisting in the discussion on one or more topics covered in the written test. To access the further oral exam, the student must have obtained at least sixteen points in the first test. In case of failure of the oral exam, the student must also repeat the first test.

LEARNING EVALUATION CRITERIA

To successfully pass the exam, the student must demonstrate, through the tests described above, to have understood the concepts of applied thermodynamics and heat transfer exposed during the course; to show ability to conduct first principle analysis on the components of machines and systems operating on inverse thermodynamic cycles; to show ability to conduct analysis on heat transfer in simple systems operating in steady state with the electrical analogy method; to have basic knowledge of acoustic and lighting comfort.

LEARNING MEASUREMENT CRITERIA

For each one of the tests specified before, it is assigned a score between zero and thirty. The overall grade, thirty, is the final mark of the written test or, in case of oral exam, is the average of the marks obtained in the two tests, with rounding to the entire excess.

FINAL MARK ALLOCATION CRITERIA

Because the overall outcome of the evaluation is positive, the student must achieve at least eighteen points in the average of the marks obtained in the two tests described above. The highest rating is achieved by demonstrating a thorough understanding of the course content in the tests.

Recommended reading

Lecture notes (available on-line at https://lms.univpm.it/enrol/index.php). Y. Cengel, Termodinamica e trasmissione del calore , 2° edizione, McGraw-Hill Italia, Milano, 2005.

Fluidodinamica

Andrea Crivellini

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
Fundamentals of mathematical analysis and physics

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
This course aims at giving students the basic knowledge of fluid mechanics. Together with the fundamentals in mathematics and physics, this course will increase the knowledge in the field of industrial engineering with particular focus on thermofluid-dynamics giving the student the awareness of the multidisciplinary context of engineering with particular focus on the issues related to the conversion, transmission, final use of energy and to the design of fluid machines and energy systems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Aiming at applying the fundamentals of fluid mechanics in the industrial sector, students must be able to face engineering problems by means of suitable and well-timed methodologies and techniques. The main skills acquired in the course are: 1.basic knowledge of the fluid dynamics governing equation; 2. ability to evaluate for simple systems the fluid dynamics loads; 3. Ability to perform fluid dynamics analyses on simple steady state systems using the control volume technique
TRANSVERSAL SKILLS:
The ability of solving numerical problems, together with the awareness of their knowledge, will improve the judgement autonomy of students, their communications skills and their learning ability

Program
Introduction: The field of fluid mechanics; approximation of continuous; stress on a point; definition of fluid; properties of fluids. Fluid statics. Fluid kinematics. Conservation of mass and momentum Bernoulli theorem The control volumes method Vorticity and viscosity Potential flows Analytical solution of the Navier-Stokes equations for some simple problems Conservation of energy Boundary layers An introduction to turbulent flows Viscous flows in ducts, laminar and turbulent flow regimes, distributed and minor losses Dimensional analysis and similarity.

Development of the course and examination
LEARNING EVALUATION METHODS
The assessment of the student s preparation will be performed via a written and oral examination. In the written test, the student will be asked to demonstrate the knowledge of the general criteria for the calculation of forces exchanged between a fluid, which can be in motion or at rest, and a body, using different methodologies and mathematical models explained during the course. In the oral test, the student is asked to deduce the most important physical laws governing the fluid motion, the assumptions involved and the resultant applicability limits.

LEARNING EVALUATION CRITERIA
Within the examination, the student must demonstrate the knowledge of the principal physical laws

governing the fluid motion, knowing how these laws can be prooven, and the ability to use the methodologies and the mathematical models presented during the course. In addition, the student must show a sufficient ability in the synthesis and in the link between all the different topics dealt within the course.

LEARNING MEASUREMENT CRITERIA
Grading scheme is based on a scale of 30 points. Successful completion of the examination will lead to grades ranging from 18 to 30.

FINAL MARK ALLOCATION CRITERIA
The maximum mark, which is thirty with laude, is awarded to students that demonstrate in the tests a complete autonomy in formulating and solving the problems, with an outstanding ability to use the methodologies and mathematical models proper of the fluid dynamics. The minimum mark, which is eighteen, is awarded to students that demonstrate the ability to solve the tests with sufficient knowledge of the methodologies and mathematical models proper of the fluid dynamics. The admission to the oral examination is subordinate to passing the written examination. The final grade is due to the result of the oral examination. This grade will be the sum of the grades obtained in answering two questions.

Recommended reading
All the slides used during the course can be downloaded from the moodle web page: https://lms.univpm.it. Basic reference textbook: Yunus A. Cengal John M. Ciballa,"Meccanica dei fluidi", McGraw-Hill For further investigation: David Pnulli Chaim Gutfinger, "Meccanica dei Fluidi", Zanichelli, D. C. Wilcox, Basic Fluid Mechanics, DCW Industries, Inc

Fluidodinamica Computazionale

Andrea Crivellini

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
The knowledge of the fundamentals of fluid-dynamics is highly recommended.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims at giving students the advanced knowledge about the computational fluid dynamics subject. Another aim is to integrate the fundamentals of fluid dynamics, gas dynamics and aerodynamics. The course provide advanced knowledge on fluid dynamics simulation techniques. This knowledge completes the previous engineering education enhancing the expertise in the field of mechanical engineering. Students deepen the main thermofluid dynamics phenomena becoming aware of the multidisciplinary context of engineering with particular focus on the issues related to the approach to new design problems
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to apply the acquired knowledge, students should be able to face complex design problems and to manage innovation and development of new products and new technological processes. In particular, they must be able to choose and apply the suitable analytical and modelling tools to simulate at best the behavior of plants/components of both heat transfer and propulsion systems. The final goal is to be able to predict and improve the performance of the system/components under investigation. The main skills acquired in the course are: 1. Knowledge about the numerical discretization of the fluid dynamics governing equations; 2. Knowledge about the turbulence modelling; 3. Ability to use a fluid dynamics simulation tool and the capability to critically analyse of the obtained results
TRANSVERSAL SKILLS:
The ability of solving numerical problems, together with the awareness of their knowledge, will improve the judgement autonomy of students, their communications skills and their learning ability

Program
Elements on the classification of partial differential equations; Recalls about the Navier Stokes equations and about the constitutive equation for Newtonian flows. Integral and differential forms of the equations. Conservative form. Incompressible and compressible governing equations. Boundary conditions for the Navier-Stokes equations. Discretization of a model equation, the finite differences, the finite volumes and finite elements approaches. Consistency, convergence and stability of a numerical scheme. Rate of convergence, dissipation and dispersion errors. Time integration with explicit and implicit schemes. The finite volumes approach in multi-dimensional cases, application of the method to the Euler governing equations. Approximation of volume and surface integrals. Numerical fluxes, the Riemann problem and the exact and approximated solvers. The diffusive terms for Navier-Stokes equations. The peculiarity of the incompressible case, derivation of the discrete Poisson equation for pressure. Grid generation process for fluid dynamics applications. The turbulence modelling: the Reynolds averaged Navier-Stokes equations and the closure models. Differential models with one or more differential equations. Large Eddy Simulation (LES) and Direct

Numerical Simulation (DNS) of turbulent flows. Theoretical lessons will be supported by practical exercises in a computer lab. To fully understanding the proprieties of a numerical discretization scheme simple programs for solving model equations will be used. Commercial and/or open source software will be employed for solving real fluid dynamics problems (aerodynamics, termo-fluid dynamics etc)

Development of the course and examination
LEARNING EVALUATION METHODS
The method for learning evaluation will consist in an oral interview. During this examination the candidate will be interviewed on the main proprieties of a numerical discretization scheme and about the turbulence modeling introduced during the course. It will be also considered the student s ability in using those concepts for a proper set up of a computational fluid dynamics model.

LEARNING EVALUATION CRITERIA
t will be evaluated the student s ability to autonomously formulate and set up a computational fluid dynamics simulation for a problem proposed within the examination. The ability to motivate with technical considerations the choices performed in approaching the computational fluid dynamics problem will be considered as well as the capability to critically analyse and interpret the results of the simulation. Morover, the student must demonstrate his/her knowledge of the main proprieties of a discretization scheme (for partial differential equations) as well as about the turbulence modelling. The maximum mark is awarded to students that demonstrate in the test a complete autonomy in formulating and solving the problems, with an outstanding ability to use the methodologies, the mathematical and physical models proper of the computational fluid dynamics field. The minimum mark is awarded to students that demonstrate the ability to solve the test with sufficient knowledge of the methodologies, the mathematical and physical models proper of the computational fluid dynamics field.

LEARNING MEASUREMENT CRITERIA
IGrading scheme is based on a scale of 30 points. Successful completion of the examination will lead to grades ranging from 18 to 30.

FINAL MARK ALLOCATION CRITERIA
The final grade will be the sum of the grades obtained in answering three questions. The maximum grade obtained for each question will be 10 points. The laude grade will be assigned to students who obtained 30 points as well as proved a complete understanding of all the subjects of the course.

Recommended reading
All the slides used during the course can be downloaded from the moodle web page: https://lms.univpm.it. Basic reference textbook: C. Hirsch , Numerical Computation of Internal and External Flows: The Fundamentals of Computational Fluid Dynamics , 2nd Edition, ISBN:9780750665940 For further investigation: H. Versteeg, W. Malalasekera, An Introduction to Computational Fluid Dynamics: The Finite Volume Method , 2nd Edition, Pearson, ISBN-13: 9780582218840 Anderson, J.D.Jr, "Computational Fluid Dynamics The Basics with Applications", McGraw-Hill, 1995. ISBN 0-07-001685-2. Ferziger, J.H. and M. Peric, "Computational Methods for Fluid Dynamic", Springer, 2002. ISBN 3-540-42074-6.

Fondamenti di Automatica (GEST)

Andrea Monteriu'

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Differential equations, Linear algebra, Complex numbers

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide the theory fundamentals of the dynamic systems and some interesting problems about the automatic control theory. This is achieved through a mathematical model based approach. This model is used both to evaluate the behavior of continuous-time and discrete-time systems, and to define and evaluate important aspects of the behavior of the considered dynamical system, starting from the definition and the study of certain model properties, such as stability, controllability, observability, its permanent and transient regime. The mathematical model is also studied to design state- or output-feedback laws in order to improve the stability of the overall system. Course provides an essential understanding of linear system characteristics, the fundamental aspects of the automatic control theory, and the techniques that are the bases for more advanced design methods. At the end of the course, the student knows the modeling and analysis concepts and methods for studying dynamic systems, with an emphasis on the linear time-invariant single-input, single-output, continuous-time and discrete-time systems. The student is able to apply the main analysis techniques to linear or linearizable dynamic systems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The course allows students to understand how to properly model and analyze different dynamic systems (such as electrical, mechanical, electronic, economic, environmental, management systems, etc.), with an emphasis to linear or linearizable dynamic systems. In detail, students are capable to derive the mathematical model of a real dynamic system and to describe it with a state-space or an input-output representation. Using the system model, the student is able to derive the system block diagram, identifying its input and output variables; the student is also able to study the main properties of the system such as internal and external stability, controllability, observability, transfer-function matrix, and to develop state or output feedback laws, and state observers.
TRANSVERSAL SKILLS:
The student should be capable to autonomously analyze and (critique) verify the system properties and, consequently, to assess the required actions to achieve the desired goals. Evaluation skills are also developed through the critical study of the proposed course-self-study books. The student can also evaluate her/his learning and written and oral communication skills, during the written and oral exam sessions which she/he has to attend. In addition, the course aims to stimulate interest and to develop her/his passion for using the systematic approach adopted during the course. The student who acquires this methodological approach, is definitely able to continue her/his course studies with a greater autonomy and successfully achievements

Program
The course aims to provide the theory fundamentals of the dynamic systems and some interesting problems about the automatic control theory. In detail, analysis methods of linear time-invariant

systems will be studied, in continuous-time and discrete-time, stability analysis and state- feedback and output-feedback techniques are addressed together with some methodologies to solve simple control problems. The various topics covered are as follows: - Introduction to dynamical systems - Linear Time Invariant Systems - Systems, Models and their classification - Inpunt-Output Models - State Variable Models - Non-Linear Systems Linearization - Block Diagram Algebra - Modelling of Real Physical Systems - Continuous-time and Discrete-time Systems - Time Domain Analysis of Input-Output Models - Time Domain Analysis of State Variable Models - Time-Domain Responses of Continuous and Discrete Time Model - Transient and Permanent Regime of Linear Systems - Modal Analysis - Laplace and Zeta Transforms - s-Domain Analysis - z-Domain Analysis - Internal and External Stability of Linear Systems - Lyapunov Stabilty: definitions and functions of Lyapunov stability - Structural properties: Reachability, Observability, Controllability, Detectability - State-feedback, output-feedback techniques and observers - Eigenvalue assignment - Introduction to controller design

Development of the course and examination
LEARNING EVALUATION METHODS
The student skills evaluation is based on a term-end written exam and on an oral exam. The written exam consists on the resolution of different exercises relative to the course topics. The oral assessment consists on two questions regarding the topics covered during the course. Note that, for organizational reasons, both the written and oral exam may be held on the same day. In any case, the written and oral tests must be held in the same exam session. If the overall evaluation is not sufficient, the student must repeat both the written and oral test. During the course, additional and not mandatory tests may be held, which could be taken into account for the overall skills evaluation of the student.

LEARNING EVALUATION CRITERIA
In order to successfully pass the skills evaluation, the student must demonstrate, through the written test and the oral one, to understand the concepts covered in the course regarding the analysis of dynamical systems. Moreover, the student must demonstrate to know criteria and techniques for evaluating the performance of linear systems, in both discrete and continuous time. The student knowledge is required both from a theoretical point of view, showing that the student understands all topics of the course, and from a practical point of view, showing that the student is able to solve examples and exercises on analysis of dynamical systems.

LEARNING MEASUREMENT CRITERIA
During the written and oral tests, it is evaluated the student's independent ability to set and to solve problems regarding the course topics. It is also evaluated the ability to properly and corectly apply concepts, methods and tools, developed during the course.

FINAL MARK ALLOCATION CRITERIA
The course adopts a 30-point system for final marking. To the written test and to each of the two oral questions, it is assigned a score between zero and ten. The overall grade, thirty, is the sum of these three scores. In order to obtain a positive evaluation, the student must achieve an overall score of at least eighteen. The maximum score, 30 points with distinction, is reserved to those students who have achieved the highest rating on both written test and oral test, and additionally who have shown a particular mastery of the topics covered during the course.

Recommended reading
Paolo Bolzern, Riccardo Scattolini, Nicola Schiavoni, Fondamenti di controlli automatici 4/ed , McGraw-Hill Richard C. Dorf, Robert H. Bishop, Modern Control Systems, 12th edition , Prentice Hall

Fondamenti di Automatica (INF)

Giuseppe Conte

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Linear Algebra; Calculus

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course provides students with basic concepts and methodologies of automatics. Such knowledge gives to the ability to formalize and to understand issues in analysis and, for specific aspects, in modeling and control of dynamical systems in engineering applications.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Student acquire basic techniques and the ability to apply them for: analyzing the structure and behavior of linear, time-invariant, discrete-time or continuous-time dynamical systems;- solving stae and output feedback stabilization problems; formalizing and solving simple control problems.
TRANSVERSAL SKILLS:
By carrying out individual exercises and participating in problem sessions, student develops their ability: to learn by assessing the completeness and adequacy of their preparation; to make judgements by formalizing and solving modeling, analysis and control problems; to communicate by formulating and properly describing the solutions to the problems under consideration.

Program
- Dynamical systems - Discrete time and continuous time, linear dynamical systems - System's response - Modal analysis - Steady state response. - Stability - Structural properties - State feedback, observers and output feedback. - Eigenvalues assi

Development of the course and examination
LEARNING EVALUATION METHODS
Written test consisting with 4 questions about: 1) structural analysis and canonical decomposition of a linear system, 2) analysis of the dynamics of a linear system, 3) stability and stabilization of a linear system, 4) response to given inputs of a linear system. Oral test consisting in the illustration of a specific topic or part of the program (general description, related notions and results, computational aspects).

LEARNING EVALUATION CRITERIA
Correctness and completeness in answering to questions in the written test. Correctness, completeness, and ability to organize the material of the oral dissertation

LEARNING MEASUREMENT CRITERIA
Answer to question 1-4 in the written test are evaluated as follows: 1) max 9 points 2) max 6 points 3) max 8 points 4) max 7 points according of correctness and completeness. SUFFICIENCY in the written test is equal to 18. The written test is preparatory to the oral test. SUFFICIENCY in the written test is normally required to get access to the oral test. Students may be admitted to the oral

test also if they obtain no less than 16 point, not less than half of the available points for each question and there are no serious errors in their answers. The oral test must be completed in the same session of the written test. The oral test is evaluated as follows: TOTALLY INADEQUATE: serious errors, lack of organization and gaps the student fails to correct or ameliorate using the suggestions of the examiner; INSUFFICIENT: errors, lack of organization and partial gaps the student is able to correct or ameliorate using the suggestions of the examiner; -4 to -2 points; -SUFFICIENTE: Substantial correctness, completeness and sufficiently clear presentation; -1 to +1 points; - GOOD: correct answers, good presentation and completeness; +2 to +4 points.

FINAL MARK ALLOCATION CRITERIA
TOTALLY INADEQUATE in the oral test prevents the student to pass the exam. In the other cases, the overall grade is the sum of the points obtained in the written test and the points obtained in the oral test, up to 18/30 if SUFFICIENCY in the written test was not achieved, up to 30/30 if SUFFICIENCY in the written test was achieved: the exam is passed if the sum is greater than or equal to 18. 30/30 cum Laude is for candidates who master completely the topics and are able to illustrate them clearly.

Recommended reading
- Lecture notes - Bozern, Scattolini, Schiavoni, "Fondamenti di controlli automatici", McGraw-Hill

Fondamenti di Componenti e Circuiti Ottici

Luca Pierantoni

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
Fundamentals of electromagnetic fields

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire knowledge on the origins and behavior of electromagnetic wave propagation in guiding passive dielectric structures and the physical nature of wave phenomena. These skills are integrated with the knowledge gained in the basic courses, especially in Physics, Electromagnetic Fields, Analysis and Geometry as well as Electrical and Signal Theory. These skills are aimed to provide the knowledge and understanding in order to work in systems engineering and electronics and telecommunications
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Through the application of mathematical methods and analysis of the physical, graduates will have i) the ability to select appropriate dielectric waveguides to make a connection, a function of cost, performance and power. ii) the ability to design fiber optic devices, directional couplers, planar waveguides and electro-optic devices. ability to compare the performance of components. iii) the ability to measure the optical transmission characteristics of a component.
TRANSVERSAL SKILLS:
In the study of Fundamentals of Optical Components and Circuits, the student must apply methods and knowledge learned in the basic courses, in order to achieve an activity of multidisciplinary synthesis to evaluate if a project fits to the requirements and understand the advantages and limitations of the different design alternatives.

Program
Introduction to the guided propagation at optical frequencies. Plane waves. Polarization. Oblique incidence and equivalent transmission lines. Snell's law. Total reflection and total transmission. Propagation in dielectric slabs. Exact methods and variational methods (EDC). Introduction to the propagation in optical fibers. Group velocity, dispersion and attenuation. Anisotropic materials: propagation in uniaxial crystals. Optical interferometry: coherence of the optical cources, optical interferometers. Fundamentals of the electro-optical effect, optical phase modulator.

Development of the course and examination
LEARNING EVALUATION METHODS
Oral text

LEARNING EVALUATION CRITERIA
The student must demonstrate mastery of the concepts introduced in the course. In particular, the student must demonstrate that he/she is are able to introduce, to derive, to argue, show and to link relationships and theories related to the topics of the course

LEARNING MEASUREMENT CRITERIA
The exam is performed in order to assess: 1) the efforts made by the student in the preparation, 2) what the student has learned, 3) what he has actually understood, 4) his ability to develop its own considerations and criticisms

FINAL MARK ALLOCATION CRITERIA
The final mark is the results of a weighted evaluation of the learning measurement criteria

Recommended reading
) T. Rozzi, A. Di Donato, Componenti & Circuiti Ottici , Ed. Pitagora-Bologna, 2005; ii) Notes compiled by the teacher

Fondamenti di Elettromagnetismo

Leonardo Zappelli

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
Know and understand the sources and the related electromagnetic fields, the issues and applications of electromagnetic fields due to elementary sources.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Classify the most common e.m. phenomena and be able to estimate the physical quantities involved in the most common electromagnetic phenomena.
TRANSVERSAL SKILLS:
The student wil be able to apply the e.m. knowledges to define equivalent circuits for inductive, capacitive and resistive phenomena, that can be found in Electronics and Electrical power, at low and high frequencies.

Program
electrostatics, magnetostatics, Maxwell's equations, plane waves, transmission lines.

Development of the course and examination
LEARNING EVALUATION METHODS
homework assignment, written and oral sessions

LEARNING EVALUATION CRITERIA
To know the fundamentals of electromagnetics

LEARNING MEASUREMENT CRITERIA
To solve electromagnetic problems.

FINAL MARK ALLOCATION CRITERIA
Homework assignments must be successfully solved to sit to the written final session. Homework assignments marks are not taken into account for the final mark.The final mark is allocated on the basis of the written and oral sessions.

Recommended reading
Ulaby, Fondamenti di campi elettromagnetici , McGraw-Hill

Fondamenti di Elettromagnetismo (BIO)

Paola Russo

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Vectors, derivatives of functions, differential equations, integral calculus, differential operators, coordinate systems, the basic physical concepts: forces, work, energy, power

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
Know and understand the issues and applications of electromagnetic fields also in areas of biomedical interest ; knowledge of the principles of the interaction of the electromagnetic field and the biological matter; the diagnosis and classification of the most common em phenomena; be able to estimate the physical quantities involved in electromagnetic phenomena.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The course will provide the basic principles of electromagnetic fields in order to understand the issue related to their use in biomedical applications. In order to train the ability to apply the acquired knowledge the students have to solve a certain amount of homeworks before the exam. The homeworks consist in solving electromagnetic problems submitted through an online platform.
TRANSVERSAL SKILLS:
The background of a biomedical engineer required skills useful in different engineering branch. The course provides basic electromagnetic elements for subsequent courses, more specialized and application oriented, not only related to biomedical application. Through the solution of numerical examples, the student will deepen his own ability to analyze critically the results obtained and to solve problems.

Program
Electrostatic: the charge, electric force between charges, electrostatic field, Gauss theorem in integral and differential form, electric potential, capacitors, polarization of dielectrics. Currents and circuits, electromotive force, Ohm's law and Kirchoff's laws. Magnetostatic: magnetic field, Lorentz s force, the Biot-Savart and Ampere's Law in integral and differential form, ferromagnetic, paramagnetic and diamagnetic materials, vector potential. Time-varying fields: Faraday's law in integral and differential form, Ampere-Maxwell s Law, Maxwell's equations. Phasors, time varying circuits: RL, RC, RLC, impedance, complex dielectric constant, characteristics of biological tissues. Waves: plane waves, polarization of waves, waves in lossy media, incidence on dielectric interfaces. Transmission lines in time and in phasor domain: telegrapher's equations, characteristic impedance, input impedance.

Development of the course and examination
LEARNING EVALUATION METHODS
The learning evaluation methods consist of a written test and an oral test. The oral and the written test are taken in the same exam session. In case of a negative outcome of the examination, the student must retake all tests. The written test consists in solving exercises on the topics covered during the course The oral exam consists of written examination and discussion of one or more

themes of the course program. Preliminary self-assessment test (homework) must be carried out before the exam. It is up to the student to choose the time for the solution of the homework. They consist of the online solution of problems related to the topics of electromagnetism, submitted through an online open source platforms (Homework Opensource Platform, HOP).

LEARNING EVALUATION CRITERIA

To pass the exam, the student have to demonstrate knowledge of all the topics of the course program which will be submitted. The student must demonstrate, through the trials described above, the understanding of the concepts exposed in the course on the principles of electromagnetism. The student's ability to demonstrate the basic principles of electromagnetism and his ability to link between topics as well as the ability to apply to concrete examples will be evaluated.

LEARNING MEASUREMENT CRITERIA

The final evaluation of the examination is graded from 0 to 30. The minimum score for passing the exam is 18/30. The written test is graded from 0 to 30. The minimum score on the written test required for a positive final evaluation is 18/30

FINAL MARK ALLOCATION CRITERIA

The final mark will take into account of the overall examination, both written and oral, according to the evaluation criteria described above. The highest rating is achieved by demonstrating a thorough understanding of teaching content, exposed with complete mastery of technical language. The lode will be given to students who, having answered all the questions correctly and completely, have demonstrated a particular brilliance in exposure and a particular skill and autonomy in theoretical demonstrations.

Recommended reading

Main textbook in italian : F.T. Ulaby: Fondamenti di campi elettromagnetici. McGraw-Hill. Exercise book: SCHAUM S Outline Series Electromagnetics McGraw-Hill. Alternative textbook in english: Ramo-Whinnery-Van Duzer: Fields and Waves in Communication Electronics, 3rd edition Other: Copy of the slide projected during the course downloadable from the online course on Moodle platform.

Fondamenti di Informatica (GEST)

Emanuele Frontoni

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
This course aims to provide students with the following knowledge: 1) High-level architecture and functioning of a computer; 2) Basic concepts of information coding, with particular reference to binary encodings of numerical values and to low level text encodings (ASCII, UNICODE) and image encoding; 3) Basic concepts and main constructs of imperative programming languages; 4) C programming language: expressions, control statements, primitive and derived data structures, pointers, linked lists; 5) The main sorting algorithms, their characteristics and their implementation in C
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will develop the ability to: 1) Solve problems and implement simple algorithms using the C language; 2) Analyse the correctness of a C program and be able to compile, run, and debug a C program; 3) Become familiar with domain terminology
TRANSVERSAL SKILLS:
The skills gained in this course aims to provide students with the tools needed to: 1) Deepen the knowledge of the hardware of a computer; 2) Become familiar and deepen the semantics and syntax of other high-level programming languages

Program
The main goal of this course is to provide students with the basic knowledge to understand how the computer works and to program using the C language. Topics: Introduction to computer science; Computing systems and architecture; Programming basics, controls and data structures; The C language: expressions, variables, functions, pointers, instructions, structured data tyoes, I/O; Basic data structures: Arrays, linked lists, stacks, queues, trees. Basic sorting and search algorithms and their implementation in C.

Development of the course and examination
LEARNING EVALUATION METHODS
The exam consists of two parts: a written test, where students will have to solve problems programmin in C, and a spoken test where stundets will discuss their written test results and will aswer to other questions regarding the course topics. To be admitted to the spoken test, the student will have to score 18 at the written test. If failed, both tests will have to be repeated.

LEARNING EVALUATION CRITERIA
To pass the exam students will have to demonstrate their understanding of the topics and to be able to program in C and possibly other languages presented in class.

LEARNING MEASUREMENT CRITERIA
A rate between 0 and 30 is assigned to each test (written and spoken). The final evaluation is the average rate.

FINAL MARK ALLOCATION CRITERIA
To pass the exam students have to rate at least 18 in both the tests (spoken and written).

Recommended reading
P. Zingaretti, E. Frontoni, Informatica: tematiche generali, Ed. Simple (www.stampalibri.it), 2006 ; Linguaggio C - Guida alla programmazione 4/ed, McGraw-Hill, 2009

Fondamenti di Informatica (INF)

Aldo Franco Dragoni

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to give the basics of Computer Science and digital electronic computer programming. It has two objectives: 1. consciously introduce students to the basic concepts of computer architecture and binary encoding. 2. explain how to process digital information, that is, provide the elements of digital computer programming and of programming languages using the imperative paradigm and introducing the elements of object oriented and Assembly.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
At the end of the course, students will be able to properly encode the information into digital format and making simple computational problems in the form of algorithms and translate them into programs using correct syntax of a programming language.
TRANSVERSAL SKILLS:
the ability to plan the steps to be done to solve a problem will help to develop the autonomy of judgment and computational thinking skills of students.

Program
Binary encoding of sounds (WAW, MP3), images (BMP, GIF, JPEG) and videos (MPEG2, MPEG4). Unsigned, Integers and Real Numbers (IEEE754). Arithmetic Operations in binary.Von Neumann Architecture. Functional Architecture of a microprocessor (IA-32). Storage: magnetic and optical. CD-ROM, CD-R, CD-RW, DVD. Assembly programming: operands, instructions, directives, labels, subroutines, Stack, "call" and "ret", modular programming, I/O, compilation. Imperative languages evolution and structured programming. Software, copyright and copyleft. Foundamentals of data Structure. Casting. Library functions. Assignment. Arithmentic, logical and relational operators. I/O-stream and file-stream. Conditional Instructions. Cyclic instructions. Jumping. Theorem of Bohm-Jacopini. Functions. Recursive functions. Pointers and references. Parameettrss pasinghrough values and through references. Array. Strings. Array as parameters to functions. Struct. Dynamic memory: new and delete. Lists, trees. Notions of Object Oriented Programming, Classes, Polimorphism.

Development of the course and examination
LEARNING EVALUATION METHODS
The examination is held in two tests: a test of programming in C ++ and a written test with questions about the foundations of computer science and debugging of algorithms in C ++

LEARNING EVALUATION CRITERIA
The evaluation focuses on the practice: the student must demonstrate her ability to program in C ++ according to the principles of "structured programming". Knowledge of the principles of the

digitization of information serves as a complementary evaluation.

LEARNING MEASUREMENT CRITERIA
normally, the programming test is evaluated 18/30 and the written test on theory 12/30

FINAL MARK ALLOCATION CRITERIA
for the final evaluation the scores obtained in the two tests will be added up

Recommended reading
Luis Joyanes Aguilar, "Fondamenti di programmazione in C++", The McGraw-Hill Companies. John R. Hubbard, "Programmare in C++, seconda edizione, (470 esercizi svolti)", The McGraw-Hill Companies

Fondamenti di Meccanica Teorica ed Applicata

Giacomo Palmieri

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Basic knowledge on physics, geometry and calculus

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
Giving the students the fundamentals necessary for the study of mechanical and biomechanical systems; providing the basics of kinematics, statics and dynamics of rigid and deformable bodies.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will learn the basic principles of theoretical mechanics applied to problems related to kinematics, statics and dynamics of rigid and deformable bodies systems. The student will be able to deal with problems of synthesis and analysis of the motion of mechanical and biomechanical systems, and to collaborate with mechanical engineers in the design of prototypes and devices for biomedical applications This knowledge will be acquired through lectures and exercises.
TRANSVERSAL SKILLS:
The theory and exercises of the course will help to improve the degree of autonomy, the ability to learn and to draw conclusions.

Program
The course deals with the fundamentals necessary for the study of mechanical and biomechanical systems, namely the basics of kinematics, statics and dynamics of rigid and deformable bodies. More in detail, the main topics are: - Introduction to applied mechanics, biomechanics and motion analysis. - Kinematics: degrees of freedom, constraints and kinematic pairs; mobility analysis for planar and spatial kinematic chains; kinematic analysis of planar and spatial mechanisms; examples of kinematic analysis of biological systems. - Dynamics: gravity and center of mass of bodies, elastic force, aerodinamics forces, friction and passive forces; statics of bodies and multi-body systems; statics applied to human body; inertial properties of bodies; cardinal equations of dynamics; energetic theorems; efficiency; dynamics of multibody systems; Newton-Euler formulation; Introduction to Lagrangian formulation; examples of dynamics models for human motion analysis; vibrations and models of vibrating systems; free and forced vibrations, vibration isolation and transmissibility; impulsive dynamics; impacts in biomechanics. - Introduction to structural mechanics: internal forces; stress and strain, elastic constitutive law; basics on mechanical properties of materials and biological tissues; geometrical properties of sections; tension, bending and torsion.

Development of the course and examination
LEARNING EVALUATION METHODS
The exam consists of an oral exam in which some theoretical concepts of the course are discussed. Besides the oral examination the student will be asked to solve an exercise belonging to the types of problems addressed in classroom exercises. Some optional partial written tests can be planned during the course. A positive outcome in these tests exempt the student from performing the

exercise during the oral examination. The student is entitled to present during the examination a dissertation on a topic related to biomechanics, as deepening of the issues addressed in the course.

LEARNING EVALUATION CRITERIA
In the exercise or optional written test, the student must demonstrate an understanding of the basic concepts of mechanics and apply them to practical problems. A further criterion of evaluation is the ability of calculus and the appropriate use of measurement units. In the oral examination, the student must demonstrate to master the key concepts related to the topics covered during the course and must be able to present them in a clear and appropriate terminology.

LEARNING MEASUREMENT CRITERIA
The grade is given in thirthies. The examination will be evaluated by giving equal weight to the applicative and to the theoretical part.

FINAL MARK ALLOCATION CRITERIA
It is given a separate grade to the applicative and theoretical part. Outcoming the exam is subject to a minimum grade of eighteen over thirty for both tests. The final grade will be determined by the arithmetic average of the two grades rounded to the higher entire number. In the event that the written partial tests are carried out, the grade of the applicative part is determined as the arithmetic average of the grades obtained in each partial examination. The optional dissertation will be evaluated with a score from 1 to 3 points, to be added to the final grade obtained in the examination. Students who achieve a grade of thirty for both the applicative and theoretical part will be awarded cum laude. Also students which will exceed the score of thirty by adding the additional points related to the optional dissertation will be awarded cum laude.

Recommended reading
G. Legnani, G. Palmieri, Fondamenti di meccanica e biomeccanica del movimento, Città Studi Edizioni, 2016.

Fondamenti di Microonde

Antonio Morini

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
Electromagnetics, fundamentals, Physics, Calculus, Linear Algebra.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
Knowledge of the circuit representation of a device: definition of ports. Definition and propertied of matrices modelling linear devices. Comparative analysis of waveguides. Features of linear reciprocal devices featuring 2, 3 and 4 ports. Non reciprocal devices with 2 and 3 ports.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Being able to choose waveguides in order to realize certain a connection, as a tradeoff between costs, performance and power needs. Being able to design adapters, filters, diplexers, directional couplers. Ability of comparing different microwave devices. Ability of measuring the scattering matrix of a linear multiport by a Vector Network Analyzer.
TRANSVERSAL SKILLS:
The study of Microwaves requires the student to exploit methods and notions acquired from basic lectures, in particular Physics, Electromagnetic Fields, Calculus, Linear Algebra, as well as Circuit Theory and Signal Theory. Indeed, it is a multidisciplinary activity, deeply stimulating the synthesis ability, which is a paradigm of the way an engineer faces real problems.

Program
Properties of transmission lines: microstrips and striplines. Linear junctions and their matrices. Physical realizability. Losslessness, reciprocity and simmetry. Bandwidth. Two port junctions: adapters, filters, isolators and phase shifters. Three-port junctions. Symmetry. Y and T junctions. Diplexers. Coupled lines. Directional couplers. Network Analyzer.

Development of the course and examination
LEARNING EVALUATION METHODS
Oral examination. The test consists of two questions among the main topics of the course.

LEARNING EVALUATION CRITERIA
The exam is aimed at evaluating the candidate's skill in the subject, according to the following parameters: knowlegde, understanding, implementation, presentation.

LEARNING MEASUREMENT CRITERIA
The purpose of the examination is to assess the candidate's skill. There are three reference levels: base - acquistion of procedures for the solution of canonical problems, as those of the written test. Oral presentation sufficient with a few uncertainesses in the usage of specific language.intermediate - ability to apply the above procedures to problems not obviously related to canonical problems. Oral part presented correcly and in proper order. top - ability of exploiting models and developing strategies requiring the combination of procedures for solving non familiar problems. Oral

presentation clear, logical and appropriate.

FINAL MARK ALLOCATION CRITERIA

The mark is allocated on the basis of the acquired knowledge. A score ranging from 18/30 and 23/30 is attributed to the level 'base', a score ranging from 24/30 to 27/30 to the intermediate level, and a score between 28/30 and 30/30 to the top level. A candidate is awarded cum laude when they are able to deal even with new problems in a fully autonomous way.

Recommended reading

S Ramo, J. R. Whinnery, T. Van Duzer: 'Fields and Waves in Communication Electronics', J. Wiley;
D. Pozar: Microwave Engineering , Mc Graw Hill

Fondazioni

Ivo Bellezza

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Basic concepts of soil mechanics

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide the students with the knowledge and skills needed for the proper selection and correct design of foundations.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will be guided through the different stages of an actual construction work: preliminary investigation, motivations of design choices, adopted construction techniques, monitoring during the construction and post-construction stages. The ability to apply the acquired knowledge will be assessed through a written exam followed by an oral exam.
TRANSVERSAL SKILLS:
During technical visits at construction sites and completed work, the student will interact with different professionals and get cross-knowledge and complementary skills.

Program
Fundamentals of soils mechanics - in situ tests - types of shallow foundations - Bearing capacity of shallow foundations - Settlements of shallow foundations - Deep foundations - Principal types of deep fondations - Ultimate geotechnical capacity of a single pile and pile group for axial and lateral loading. - Settlements of deep foundations - Negative skin friction - Hybrid foundations - Piles as settlement reducers.

Development of the course and examination
LEARNING EVALUATION METHODS
The evaluation consists in both a written test and oral exam. During the written test the ultimate limit state of a foundation must be analysed using the methods showed in the course. In the oral session the written test is firstly discussed and then the knowledge of other topics of the program is tested.

LEARNING EVALUATION CRITERIA
During exam tests the students must demonstrate to correctly apply the knowlege acquired during the course; moreover the student must demonstrate a sufficient ability to link different topics treated in the course

LEARNING MEASUREMENT CRITERIA
During the exam the ability to solve the assigned problems is evaluated and adequate knowledge of design principles is also required.

FINAL MARK ALLOCATION CRITERIA
The maximum final mark is given to students which demonstrate full autonomy in solving the

assigned problems and full knowledge of the topics presented during the course

Recommended reading

Viggiani Fondazioni Hevelius Ed.; Lancellotta e Cavalera Fondazioni Mc Graw Hil; Duplicated lecture slides avalilable on Moodle platform.

Fotogrammetria (EA)

Eva Savina Malinverni

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 90
Period 2s

Prerequisites
Nothing

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire theoretical and practical knowledge of photogrammetry, reminding the basic concepts of geodesy and mapping in order then to deepen by means of instruments and ICT technology the surveying process. Such knowledge will be upgraded with surveying, remote sensing and GIS skills, introducing also the statistical processing of the measures, to complete the knowledge of the geomatics. In this manner the student acquires a clear awareness of the use of such techniques which provide the necessary elements for a technical approach to the analysis and understanding of the building as a complex system and its relationship with the territory. This provide skills to analyze and solve problems related to the project and planning by means of the construction and reading of architectural representations and map at different scale.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Students must learn to identify the correct survey methods and the related technologies for a correct data survey acquisition, analysis and interpretation of the results, to employ for different engineering purposes: civil or environmental. This is to enable them to apply this knowledge when tackling advanced design themes, including those of a very complex nature; they should also be able apply the knowledge for the purposes of innovation and for developing new products and technological processes. This will be expressed through the development of a mixture of both organizational and professional skills, including: 1. the ability to appropriately choose the correct survey methods and technologies suitable for their applications; 2. the ability to make a correct analysis of the survey results by means of the statistical data processing; 3. the ability to read, understand and organize the results of a topographic or photogrammetric survey by graphic representations, orthoimages for a complete knowledge of the architectural complex and its surroundings.
TRANSVERSAL SKILLS:
Practical exercises and some experiences on field about the photogrammetric processing of the measures will improve to understand the survey knowledge given during the lectures. The evaluation of the learning level of the student is made of oral test that interests every theoretical and practical topic of the course program. The positive assessment of this test allows the admission to the oral test, that consists in the discussion on deep of some topics. This will help to improve students general levels of independent judgement, their ability to communicate, their capacity for independent learning and their ability to draw conclusions. The student must carry-out a practical survey.

Program
Content (lectures 60 hours) Geodesy and Cartography basic concepts The surface datum: geoid, ellipsoid, their planimetric and altimetric differences. The reference frames. The cartographic

representations. The Italian Official Cartography. Numerical cartography. The Geographical Information Systems (GIS). Photogrammetry The analytical-geometrical espressions. The acquisition of the images by digital camera (pan/multispectral), panoramic images, UAV system. Schema and technical procedures to follow in a photogrammetry survey. Surveying methods to perfom a ground control data network. Least square adjustment using the indirect measurements. Orientation stages of the photogrammetric survey: inner, extern, relative and absolute. Aereal Triangulation. Spherical photogrammetry. The digital photogrammetry algorithms to obtain an automatic restitution. Graphical and numerical restitutions. The digital products: numerical cartography, orthoimages, DEM and 3D model for the architectures. Processing of multispectral images to produce thematic Land Use/Land Cover maps. Classroom exercises (30 hours) Instrumental exercises: data images acquisition and data photogrammetric processing to produce a 3D surveying of the architecture.

Development of the course and examination
LEARNING EVALUATION METHODS
The evaluation of the learning level of the student consists in an oral test that interests every theoretical and practical topic of the course program and an assessment of a practical survey, coming from the exercises on field.

LEARNING EVALUATION CRITERIA
To pass in positive way the exam the student must prove, by means of the oral test and the practical results of the survey, to have well learned the concepts exposed in the class. The oral test is important and it must have at least a score equal to 18/30, to pass the exam. The practical survey is evaluated on completion of the oral test only if this is positive. To overcome with positive result the oral test, the student must show to have a general knowledge of the contents, sufficiently exposed in correct way with use of suitable technical terminology. The maximum evaluation will be achieved showing a deep knowledge, exposed with complete and accurate use of the technical language.

LEARNING MEASUREMENT CRITERIA
The exam is passed when the oral test is approved at least with the sufficiency, equal to eighteen points. The practical exercise results can improve the final score if it is concluded.

FINAL MARK ALLOCATION CRITERIA
To pass the exam in positive way, the student must achieve at least the sufficiency, equal to eighteen points at the oral test. The maximum evaluation is reached showing a deep knowledge of the topics discussed during the course and the top marks is obtained performing a completed and well products of the practical exercises.

Recommended reading
G. Folloni, Topografia ed. Patron, Bologna. G. Fangi, Note di fotogrammetria , ed. Clua, Ancona. Slides and digital books related to the lessons of the course (Clua-typing office inside to the University)

Geologia Applicata

Paola Maria Vivalda

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables the students to acquire basic knowledge and application on the Earth Sciences in order to understand the geological problems in design and construction of civil engineering structures and infrastructures and in environmental action.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to address issues related to geological processes in the context of utilization, planning and management of geological resources as well as in the design of civil engineering works, the future engineer must be able, through the application of knowledge, to recognize in the territory these processes and to manage them with other professionals.
TRANSVERSAL SKILLS:
The execution of practical tests on different topics of Applied Geology (cartography, lithology, hydrogeology etc.) carried out in groups or individually, and followed by the writing of short reports, will improve both communication and comparison of the students, derived from the group work, and learning independently drawing conclusions about the subject in study.

Program
(Frontal lessons 50 hours) Minerals and rocks: classification, technical properties and utilization. Elements of tectonics and stratigraphy.Geological map and geological sections.The hydrographic basin in the territorial analysis, control and management. The hydrologic cycle and balance. Groundwaters: hydraulic characteristics of rocks and types of aquifers. Darcy s law. Circulation and quality of waters. Landslides: classification, examples, factors contributing to landslides. Preventive and remedial measures. The Geology applied to the engineering works. Classroom exercises (22 hours) Interpretation of topographic map and of geological map. Recognition of sedimentary, igneous and metamorphic rocks. River basin morphometry. Interpretation of hydrogeological map.

Development of the course and examination
LEARNING EVALUATION METHODS
The evaluation is through written and oral tests. In the written examination, students must address issues related to the theoretical part of the course, while in the oral test the students must demonstrate the ability to read a geological map and to recognize a rock with its features .

LEARNING EVALUATION CRITERIA
In examinations, students must demonstrate the ability to use independently and properly methodologies and tools related to the geological topics. They must also demonstrate capacity of synthesis and at the same time complete exposition of the subject matters of the questions.

LEARNING MEASUREMENT CRITERIA
During the examinations the student's ability to correctly answer questions about the theoretical arguments of the course, the correct interpretation of a geological map and the recognition of a rock sample are evaluated.

FINAL MARK ALLOCATION CRITERIA
The maximum mark, derived from the scores obtained by the two tests, is equal to thirty points with honors and is assigned to students that demonstrate full autonomy in the response. The minimum rating is eighteen and is assigned to students that have sufficient knowledge to set a correct answer.

Recommended reading
Scesi P., Papini M & Gattinoni P. Geologia Applicata: Il rilevamento geologico-tecnico Vol.1; Applicazione ai progetti di ingegneria civile Vol.2. Casa Editrice Ambrosiana, 2001. Learning materials prepared by the teacher.

Geometria (BIO)

Mario Marietti

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
Good knowledge of the contents of the program of mathematics of Liceo Scientifico . Complex numbers.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide the student with a clear understanding of the basic ideas of linear algebra and analytic geometry. On completion of the course, the student will be able to apply these tools for solving scientific and technological problems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
As part of the basic training, the course will provide the knowledge and ability to understand the basic mathematical methods (in particular, linear algebra and analytical geometry) which are essential for engineering disciplines, and will act as a hinge between high school and university teachings.
TRANSVERSAL SKILLS:
On completion of the course, students will be able to set and solve problems through deductive logic. These skills are fundamental in scientific and technological disciplines. In addition, students will improve their ability to learn and their independence of judgment, as well as their ability to communicate effectively, thanks to the specificity of the language of the basic courses.

Program
The space of the mxn matrices: sum and product by scalars. The transpose. Square, symmetric, skew-symmetric matrices. Product of matrices. Invertible matrices. The determinant and its properties. Laplace's Theorem. Binet's Theorem. The inverse of an invertible matrix. Rank and independence of columns (rows). Gauss elimination. Linear systems. Cramer's Theorem. Rouché-Capelli Theorem. Linear systems with parameters. Ladder reduction. Vector spaces and vector subspaces. Generators of a vector space. Linear independence of vectors. Bases, coordinates, and dimension. Vector subspaces of Rn: bases, dimension, equations. Change of bases and coordinates. Grassmann Formula. Linear maps. Matrices associated with a linear map. Kernel, Image, and their dimensions. Scalar product. Cauchy-Schwarz inequality. Fourier coefficient. Orthogonal and orthonormal bases. Gram-Schmidt process. Change of orthonormal bases. Endomorphism and change of bases: similar matrices. Diagonalizable endomorphisms and diagonalizable matrices. Eigenvectors and eigenvalues. Characteristic polynomial. Algebraic and geometric multiplicity. Criteria for diagonalizability. Symmetric endomorphisms. Spectral theorem. Plane geometry: points, lines, direction vectors. Distance. Circles. Space geometry: points, planes, lines, direction vectors. Distance. Vector product.

Development of the course and examination
LEARNING EVALUATION METHODS
There will be two examinations: - a written examination, consisting in solving some exercises, - an

oral examination, consisting in the discussion of some of the topics (part of the exposition could be asked to be written down). In order to be admitted to the oral examination, the candidate must obtain a positive mark (18 or higher) in the written examination.

LEARNING EVALUATION CRITERIA
In order to pass the exam, students must show in the examinations that they have adequately understood the topics of the course and are able to apply the acquired knowledge and understanding by using properly the methods of linear algebra and analytic geometry taught during the course.

LEARNING MEASUREMENT CRITERIA
In the exams, the teacher evaluate how well the students have understood the topics of the course and are able to apply the acquired knowledge and understanding.

FINAL MARK ALLOCATION CRITERIA
After the written examination, the papers are marked (a number between 0 and 30). In order to be admitted to the oral examination, the candidate must obtain a positive mark (18 or higher) in the written examination. The final grade of the exam is given after the oral examination (it takes into account both examinations). Candidates passing the exam have a final grade between 18 and 30 cum laude. A final grade of 30 cum laude is awarded to the candidates that have shown exceptional skill in both examinations.

Recommended reading
M. Abate, C. de Fabritiis Geometria analitica con elementi di algebra lineare , II ed., McGraw-Hill.
M. Abate, C. de Fabritiis Esercizi di Geometria , McGraw-Hill

Geometria (CA)

Amedeo Altavilla

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Good knowledge of the math program of high school Liceo Scientifico . Complex numbers.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course will teach to students basic notions of linear algebra and analytic geometry, for the comprehension and analysis of engineering problems . In particular the course will concern the notions of vector space, linear map, symmetric bilinear forms, scalar product, the geometry of lines and planes, quadric surfaces.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Students will be able to solve exercises of linear algebra on matrices, linear maps, bilinear forms, to solve linear systems and to solve problems of analytic geometry in the space.
TRANSVERSAL SKILLS:
The study and the exercises proposed will consolidate the transverse skills obtained by the students, such as the ability of critically analyze a problem and the ability of use a correct, precise and formal language. The ability to learn in autonomy and to develop the study will be strengthened, too.

Program
Vector spaces. Basis of a vector space, coordinates. Dimension of a vector space. Grassman s theorem. Linear maps. Kernel and image of a linear map. Dimension theorem. Linear systems. Rouche s theorem. Ladder reduction. Operation on matrices and linear maps. Sum and composition of linear maps. Isomorphisms. Product of matrices. Invertible matrices. Change of basis.. Matrix associated to a linear map with respsct to two basis. Similar matrices. Determinant. Eigenvalues and eigenvectors. Triangolable and diagonalizable endomorphisms. Characteristic polynomial. Algebraic and geometric multiplicity. Necessary and sufficient criterion for diagonalizability of an endomorphism. Scalar products. Cauchy s inequality. Congruent matrices. Symmetric and orthogonal endomorphisms.Spectral theorem. Affine and Euclidean geometry. Conics and quadrics

Development of the course and examination
LEARNING EVALUATION METHODS
Written and oral exam

LEARNING EVALUATION CRITERIA
In the written exam, the student should prove his/her ability to solve the exercises regarding the topics of the course. In the oral exam, the student should prove his/her understanding of the features of the mathematical tools introduced in the lectures. To pass the oral exam, the student should prove to have a general knowledge of the topics, explained in a sufficient correct mathematical language. Top marks will be obtained by showing a deep knowledge of the contents

explained with a complete mastery of mathematical language.

LEARNING MEASUREMENT CRITERIA
Final marks are expressed in thirtieths

FINAL MARK ALLOCATION CRITERIA
The final marks takes into account the mark of the written exam, the ampleness and correctness of the answers to the written theoretical questions and the mastery of the subject in the oral questions. Full marks are given to students who took all the proofs completely and correctly and who showed and cleverness in the oral exposition and in the written part of the examination.

Recommended reading
M. Abate, C. de Fabritiis Geometria analitica con elementi di algebra lineare , III ed., McGrawHill.
M. Abate, C. de Fabritiis Esercizi di Geometria , McGraw-Hill.

Geometria (EA)

Maria Chiara Brambilla

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 72
Period 1s

Prerequisites
Vector spaces. Basis and dimension of a vector space, coordinates. Grassmann's theorem. Linear maps. Kernel and image of a linear map. Dimension theorem. Linear systems. Rouche'-Capelli's theorem. Ladder reduction. Operation on matrices and linear maps.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course gives the students the basic knowledges in linear algebra and analytic geometry in all the viewpoints directly and in directly related with the planar and spatial identification of geometric shapes, using in particular tools such as vector spaces, linear applications and their representations in terms of vectors and matrices. These knowledges cooperate with the ones learned in the courses of Mathematical Analysis I and II so that the student acquires the ability to understand criteria, procedures and limits of application of mathematical methods to real problems in particular those related to representation of plane and space.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student must develop the ability to apply the tools of linear algebra and analytic geometry such as vector spaces, linear applications and their representations in terms of vectors and matrices in order to formalize, identify and solve problems in Building Engineering and Architecture.
TRANSVERSAL SKILLS:
Solving problems and exercises, that will be worked out both during class hours and at home, and the preparation for the oral part of the exam will improve judgment independence in general, communication skills, autonomous learning abilities and the capability of the student to draw conclusions.

Program
The learning evaluation is carried out by two exams: - a practical examination, which consists of solving exercises and problems related to the topics explained in the course. The test must be completed in 3 hours; - a theoretical examination, consisting in a discussion, written and oral,of the topics of the course. In particular the knowledge and the understanding of all definitions, theorems and proofs explained in the classes will be tested. The practical exam is preliminary to the theoretical one. It is necessary to pass the practical exam in order to do the theoretical one. The two exams must be passed in the same exam session. If the student fails the theoretical exam, he/she must repeat also the practical one.

Development of the course and examination
LEARNING EVALUATION METHODS
The learning evaluation is carried out by two exams: - a practical examination, which consists of solving exercises and problems related to the topics explained in the course. The test must be completed in 3 hours; - a theoretical examination, consisting in a discussion, written and oral,of the topics of the course. In particular the knowledge and the understanding of all definitions, theorems

and proofs explained in the classes will be tested. The practical exam is preliminary to the theoretical one. It is necessary to pass the practical exam in order to do the theoretical one. The two exams must be passed in the same exam session. If the student fails the theoretical exam, he/she must repeat also the practical one.

LEARNING EVALUATION CRITERIA

In order to pass the learning evaluation, the student must demonstrate that he/she has understood the basic concepts of linear algebra and geometry explained in the course. In particular in the practical test the student must show that he/she is able to apply independently the learned techniques in solving exercises and problems. In the theoretical exam the student must be able to expose the theoretical contents with the correct language and accuracy.

LEARNING MEASUREMENT CRITERIA

Each of the tests is graded on a scale from 0 to 30. The final grade will be decided starting from the two test grades.

FINAL MARK ALLOCATION CRITERIA

The final grade will be positive only if in both of the tests the students gets the passing grade (18/30). The maximal grade is reached if the student proves a knowledge and a thorough understanding of the course content. The maximal grade with honors is reserved to the students who passed both of the tests in a complet and correct way, showing special independence and excellence.

Recommended reading

In order to pass the learning evaluation, the student must demonstrate that he/she has understood the basic concepts of linear algebra and geometry explained in the course. In particular in the practical test the student must show that he/she is able to apply independently the learned techniques in solving exercises and problems. In the theoretical exam the student must be able to expose the theoretical contents with the correct language and accuracy.

Geometria (EDI)

Mario Marietti

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
Good knowledge of the contents of the program of mathematics of Liceo Scientifico . Complex numbers.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide the student with a clear understanding of the basic ideas of linear algebra and analytic geometry. On completion of the course, the student will be able to understand the tools of linear algebra and analytic geometry that are essential for the basic scientific knowledge and the engineering applications.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
On completion of the course, students will be able to apply their knowledge and understanding skills to the analysis and modeling of engineering problems, by consciously using the acquired methods of linear algebra and analytic geometry. Students will develop the ability to apply these methods also by means of exercises that require the acquired tools to solve.
TRANSVERSAL SKILLS:
On completion of the course, students will be able to set and solve problems through deductive logic. These skills are fundamental in scientific and technological disciplines. In addition, students will improve their ability to learn and their independence of judgment, as well as their ability to communicate effectively, thanks to the specific language of the basic courses.

Program
The space of the mxn matrices: sum and product by scalars. The transpose. Square, symmetric, skew-symmetric matrices. Product of matrices. Invertible matrices. The determinant and its properties. Laplace's Theorem. Binet's Theorem. The inverse of an invertible matrix. Rank and independence of columns (rows). Gauss elimination. Linear systems. Cramer's Theorem. Rouché-Capelli Theorem. Linear systems with parameters. Ladder reduction. Vector spaces and vector subspaces. Generators of a vector space. Linear independence of vectors. Bases, coordinates, and dimension. Vector subspaces of Rn: bases, dimension, equations. Change of bases and coordinates. Grassmann Formula. Linear maps. Matrices associated with a linear map. Kernel, Image, and their dimensions. Scalar product. Cauchy-Schwarz inequality. Fourier coefficient. Orthogonal and orthonormal bases. Gram-Schmidt process. Change of orthonormal bases. Endomorphism and change of bases: similar matrices. Diagonalizable endomorphisms and diagonalizable matrices. Eigenvectors and eigenvalues. Characteristic polynomial. Algebraic and geometric multiplicity. Criteria for diagonalizability. Symmetric endomorphisms. Spectral theorem. Plane geometry: points, lines, direction vectors. Distance. Circles. Space geometry: points, planes, lines, direction vectors. Distance. Vector product.

Development of the course and examination
LEARNING EVALUATION METHODS

There will be two examinations: - a written examination, consisting in solving some exercises, - an oral examination, consisting in the discussion of some of the topics (part of the exposition could be asked to be written down). In order to be admitted to the oral examination, the candidate must obtain a positive mark (18 or higher) in the written examination.

LEARNING EVALUATION CRITERIA

In order to pass the exam, students must show in the examinations that they have adequately understood the topics of the course and are able to apply the acquired knowledge and understanding by using properly the methods of linear algebra and analytic geometry taught during the course.

LEARNING MEASUREMENT CRITERIA

In the exams, the teacher evaluate how well the students have understood the topics of the course and are able to apply the acquired knowledge and understanding.

FINAL MARK ALLOCATION CRITERIA

After the written examination, the papers are marked (a number between 0 and 30). In order to be admitted to the oral examination, the candidate must obtain a positive mark (18 or higher) in the written examination. The final grade of the exam is given after the oral examination (it takes into account both examinations). Candidates passing the exam have a final grade between 18 and 30 cum laude. A final grade of 30 cum laude is awarded to the candidates that have shown exceptional skill in both examinations.

Recommended reading

M. Abate, C. de Fabritiis Geometria analitica con elementi di algebra lineare , II ed., McGraw-Hill.
M. Abate, C. de Fabritiis Esercizi di Geometria , McGraw-Hill

Geometria (EL)

Chiara De Fabritiis

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
Good knowledge of the contents of the program of mathematics of Liceo Scientifico . Complex numbers.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course gives the students the basic knowledges in geometry and in the field of complex numbers, using in particular tools in linear algebra and analytic geometry such as vector spaces, linear applications and their representations in terms of vectors and matrices. These knowledges cooperate with the ones learned in the courses of Mathematical Analysis I and II so that the student acquires the ability to understand criteria, procedures and limits of application of mathematical methods to real problems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student must develop the ability to apply the tools of linear algebra and analytic geometry such as vector spaces, linear applications and their representations in terms of vectors and matrices in order to formalize, identify and solve problems in Electronics Engineering.
TRANSVERSAL SKILLS:
Solving problems and exercises, that will be worked out both during practice hours and at home, and the preparation for the oral part of the exam will improve judgment independence in general, communication skills, autonomous learning abilities and the capability of the student to draw conclusions.

Program
Vector spaces. Basis of a vector space, coordinates. Dimension of a vector space. Grassman s theorem. Linear maps. Kernel and image of a linear map. Dimension theorem. Linear systems. Rouche s theorem. Ladder reduction. Operation on matrices and linear maps. Sum and composition of linear maps. Isomorphisms. Product of matrices. Invertible matrices. Change of basis.. Matrix associated to a linear map with respsct to two basis. Similar matrices. Determinant. Eigenvalues and eigenvectors. Triangolable and diagonalizable endomorphisms. Characteristic polynomial. Algebraic and geometric multiplicity. Necessary and sufficient criterion for diagonalizability of an endomorphism. Scalar products. Cauchy s inequality.. Congruent matrices. Symmetric and orthogonal endomorphisms.Spectral theorem.

Development of the course and examination
LEARNING EVALUATION METHODS
The learning evaluation method consists of two parts: - a written exam, with preliminary questions and exercises on topics treated in the classroom lessons; - a written and oral exam, consisting on the written exposition of theoretical topics and a subsequent discussion on one or more points seen in the course. The written exam is a prerequisite for the oral exam, to take it the student should obtain at least appena sufficiente in the written exam. The oral exam has to be taken within the

next exam session in which you passed the written exam and in any case during the accademic year 2016-2017. If the oral exam is not passed, the student should taken again also the written exam .

LEARNING EVALUATION CRITERIA

In the written exam, the student should prove his/her ability to solve the exercises regarding the topics of the course. In the oral exam, the student should prove his/her understanding of the features of the mathematical tools introduced in the lectures. To pass the oral exam, the student should prove to have a general knowledge of the topics, explained in a sufficient correct mathematical language. Top marks will be obtained by showing a deep knowledge of the contents explained with a complete mastery of mathematical language.

LEARNING MEASUREMENT CRITERIA

Final marks are expressed in thirtieths

FINAL MARK ALLOCATION CRITERIA

The written exam marks are insufficiente , appena sufficiente , sufficiente , discreto , buono , ottimo . The final marks takes into account the mark of the written exam, the ampleness and correctness of the answers to the written theoretical questions and the mastery of the subject in the oral questions. Full marks are given to students who took all the proofs completely and correctly and who showed and cleverness in the oral exposition and in the written part of the examination.

Recommended reading

Abate, C. de Fabritiis Geometria analitica con elementi di algebra lineare , third ed., McGrawHill.
M. Abate, C. de Fabritiis Esercizi di Geometria , McGraw-Hill

Geometria (MECC) (A/L)

Chiara De Fabritiis

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Good knowledge of the contents of the program of mathematics of Liceo Scientifico . Complex numbers.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide the student with a clear understanding of the basic ideas of linear algebra and analytic geometry and also with the capability of understanding more advanced topics in this area of mathematics. This will equip the student with the necessary tools pertaining to the basic scientific background and the engineering applications
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
At the end of the course, the students will be able to apply the acquired knowledge and understanding to the analysis and modelling of engineering problems, by using properly the methods of linear algebra and of analytic geometry taught during the course. The ability to apply these methods will be acquired by the student also by means of problem sessions which require their use
TRANSVERSAL SKILLS:
On completion of the course, the students will be able to set up and solve problems by logical deductive reasoning, which is essential in all scientific and technological disciplines. In addition, the students will improve the ability to develop independent thought and learning capabilities. Oral presentations of the topics taught in the course, with the language proper of the basic disciplines of the degree course will help developing communication skills

Program
The space of the mxn matrices: sum and product by scalars. The transpose. Square, symmetric, skew-symmetric matrices. Product of matrices. Invertible matrices. The determinant and its properties. Laplace's Theorem. Binet's Theorem. The inverse of an invertible matrix. Rank and independence of columns (rows). Gauss elimination. Linear systems. Cramer's Theorem. Rouché-Capelli Theorem. Linear systems with parameters. Ladder reduction. Vector spaces and vector subspaces. Generators of a vector space. Linear independence of vectors. Bases, coordinates, and dimension. Vector subspaces of Rn: bases, dimension, equations. Change of bases and coordinates. Grassmann Formula. Affine subspaces. Linear maps. Matrices associated with a linear map. Kernel, Image, and their dimensions. Isomorphisms. Scalar product. Cauchy-Schwarz inequality. Projections. Fourier coefficient. Orthogonal and orthonormal bases. Gram-Schmidt process. Change of orthonormal bases. Orthogonal matrices. Endomorphism and change of bases: similar matrices. Diagonalizable endomorphisms and diagonalizable matrices. Eigenvectors and eigenvalues. Characteristic polynomial. Algebraic and geometric multiplicity. Criteria for diagonalizability. Symmetric endomorphisms. Spectral theorem. Orthogonal endomorphisms. Plane geometry: points, lines, direction vectors. Distance. Circles. Sheaves of lines. Change of cartesian coordinates. Conics and their classification. Space geometry: points,

planes, lines, direction vectors. Distance. Spheres. Vector product. Change of cartesian coordinates.

Development of the course and examination
LEARNING EVALUATION METHODS
There will be two examinations: - a written examination, consisting in solving some exercises, - an oral examination, consisting in the discussion of some of the topics (part of the exposition could be asked to be written down). In order to be admitted to the oral examination, the candidate must obtain a positive mark (18 or higher) in the written examination.

LEARNING EVALUATION CRITERIA
In order to pass the exam, students must show in the examinations that they have adequately understood the topics of the course and are able to apply the acquired knowledge and understanding by using properly the methods of linear algebra and analytic geometry taught during the course.

LEARNING MEASUREMENT CRITERIA
n the exams, the teacher evaluate how well the students have understood the topics of the course and are able to apply the acquired knowledge and understanding. The passing grade (eighteen/thirtieths) is given to students that solve the exercises in a sufficient way and prove their knowledge of the fundamental topics of the course. The maximum grade (thirty/thirtieths) is obtained by proving a deep knowledge of the topics of the course.

FINAL MARK ALLOCATION CRITERIA
After the written examination, the papers are marked (a number between 0 and 30). In order to be admitted to the oral examination, the candidate must obtain a positive mark (18 or higher) in the written examination. The final grade of the exam is given after the oral examination (it takes into account both examinations). Candidates passing the exam have a final grade between 18 and 30 cum laude. A final grade of 30 cum laude is awarded to the candidates that have shown exceptional skill in both examinations.

Recommended reading
M. Abate, C. de Fabritiis "Geometria analitica con elementi di algebra lineare", III ed., McGraw-Hill.
M. Abate, C. de Fabritiis Esercizi di Geometria , McGraw-Hill

Geometria (MECC) (M/Z)

Mario Marietti

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Good knowledge of the contents of the program of mathematics of Liceo Scientifico . Complex numbers.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide the student with a clear understanding of the basic ideas of linear algebra and analytic geometry and also with the capability of understanding more advanced topics in this area of mathematics. This will equip the student with the necessary tools pertaining to the basic scientific background and the engineering applications
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
At the end of the course, the students will be able to apply the acquired knowledge and understanding to the analysis and modelling of engineering problems, by using properly the methods of linear algebra and of analytic geometry taught during the course. The ability to apply these methods will be acquired by the student also by means of problem sessions which require their use
TRANSVERSAL SKILLS:
On completion of the course, the students will be able to set up and solve problems by logical deductive reasoning, which is essential in all scientific and technological disciplines. In addition, the students will improve the ability to develop independent thought and learning capabilities. Oral presentations of the topics taught in the course, with the language proper of the basic disciplines of the degree course will help developing communication skills

Program
The space of the mxn matrices: sum and product by scalars. The transpose. Square, symmetric, skew-symmetric matrices. Product of matrices. Invertible matrices. The determinant and its properties. Laplace's Theorem. Binet's Theorem. The inverse of an invertible matrix. Rank and independence of columns (rows). Gauss elimination. Linear systems. Cramer's Theorem. Rouché-Capelli Theorem. Linear systems with parameters. Ladder reduction. Vector spaces and vector subspaces. Generators of a vector space. Linear independence of vectors. Bases, coordinates, and dimension. Vector subspaces of Rn: bases, dimension, equations. Change of bases and coordinates. Grassmann Formula. Affine subspaces. Linear maps. Matrices associated with a linear map. Kernel, Image, and their dimensions. Isomorphisms. Scalar product. Cauchy-Schwarz inequality. Projections. Fourier coefficient. Orthogonal and orthonormal bases. Gram-Schmidt process. Change of orthonormal bases. Orthogonal matrices. Endomorphism and change of bases: similar matrices. Diagonalizable endomorphisms and diagonalizable matrices. Eigenvectors and eigenvalues. Characteristic polynomial. Algebraic and geometric multiplicity. Criteria for diagonalizability. Symmetric endomorphisms. Spectral theorem. Orthogonal endomorphisms. Plane geometry: points, lines, direction vectors. Distance. Circles. Sheaves of lines. Change of cartesian coordinates. Conics and their classification. Space geometry: points,

planes, lines, direction vectors. Distance. Spheres. Vector product. Change of cartesian coordinates.

Development of the course and examination
LEARNING EVALUATION METHODS
here will be two examinations: - a written examination, consisting in solving some exercises, - an oral examination, consisting in the discussion of some of the topics (part of the exposition could be asked to be written down). In order to be admitted to the oral examination, the candidate must obtain a positive mark (18 or higher) in the written examination.

LEARNING EVALUATION CRITERIA
In order to pass the exam, students must show in the examinations that they have adequately understood the topics of the course and are able to apply the acquired knowledge and understanding by using properly the methods of linear algebra and analytic geometry taught during the course.

LEARNING MEASUREMENT CRITERIA
n the exams, the teacher evaluate how well the students have understood the topics of the course and are able to apply the acquired knowledge and understanding. The passing grade (eighteen/thirtieths) is given to students that solve the exercises in a sufficient way and prove their knowledge of the fundamental topics of the course. The maximum grade (thirty/thirtieths) is obtained by proving a deep knowledge of the topics of the course.

FINAL MARK ALLOCATION CRITERIA
After the written examination, the papers are marked (a number between 0 and 30). In order to be admitted to the oral examination, the candidate must obtain a positive mark (18 or higher) in the written examination. The final grade of the exam is given after the oral examination (it takes into account both examinations). Candidates passing the exam have a final grade between 18 and 30 cum laude. A final grade of 30 cum laude is awarded to the candidates that have shown exceptional skill in both examinations.

Recommended reading
M. Abate, C. de Fabritiis "Geometria analitica con elementi di algebra lineare", II ed., McGraw-Hill.
M. Abate, C. de Fabritiis Esercizi di Geometria , McGraw-Hill

Geotecnica

Giuseppe Scarpelli

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
A sound Knowledge of basic principles of Structural Mechanics and Fluid mechanics as studied in the relevant courses of the previous years.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course teaches the basics of the mechanics of granular materials, that is natural or artificial soil bodies, subjected to external actions or to changes of the boundary conditions. From the fundamental principles of continuum mechanics, assumed to be known by the students from previous courses, the relevant aspects of the theory are discussed with reference to water saturated porous media, to derive stress-strain fields, settlements, to analyze groundwater flow both stationary and transient. Concepts of limit analysis are introduced to derive, with examples, the safety margins against common soil instability mechanisms. Large part of the course is devoted to the analysis and interpretation of soil behaviour from laboratory testing.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The course is intended to be the basic reference for more practical courses of geotechnical engineering given in more advanced master course programs. The problem solving capacity is sought only for not complex but very simple problems, to learn the details of the most common solution schemes of the discipline. The course cannot be considered in any way sufficient to provide itself solutions to geotechnical engineering design problems.
TRANSVERSAL SKILLS:
The course implies for the student a deep and autonomous study of the given topics and aims at developing the student attitudes to solve typical problems of soil mechanics in a detailed a precise manner. The solution to geotechnical problems is never unique and it is therefore necessary to acquire by the students methods to analyze and critically judge any proposed solution.

Program
Soil general properties: Physical properties of soil particles. Description, identification and classification of soils. Definition of stresses: effective stress principle; geostatic stresses. Soil strains. Groundwater: capillarity, groundwater flow: stationary and transient flow; hints on the soil consolidation theory . Soil mechanics: Basic equipments for soil mechanical testing (oedometer, triaxial cell, direct shear box). Compressibility and strength of granular and cohesive soils from soil laboratory testing. Geotechnical engineering: Earth thrusts and stability of gravity and flexible walls; stability and settlements of spread foundations. Practical work: 8 to 10 numerical examples on problems of geotechnical engineering, simplified from real practical case studies.

Development of the course and examination
LEARNING EVALUATION METHODS
The candidate is required to pass a written plus an oral examinations, in different days, typically the colloquium is programmed 7 days after the written test. The written paper lasts 3 hours and requires

abilities in geotechnical problem solving. The oral colloquium is a careful check of the knowledge of the candidate about the theoretical and experimental parts of the discipline.

LEARNING EVALUATION CRITERIA

The written paper aims at prooving the ability of the candidate in solving few typical geotechnical excercises, representing more complex problems of geotechnical engineering. The oral examinations aimis at assessing the level of knowledge on both theoretical and practical aspects of the the discipline.

LEARNING MEASUREMENT CRITERIA

The written paper is graded with A, B, C,D corresponding to (18-21), (21-24), (24-27), (27-30) over 30 classes. With the oral examination very rarely the candidate can upgrade grade class assigned with the written paper. The lode is reserved to the students showing not only a full comprehension of the theoretical and experimental aspects of the subject but also outstanding abilities in exposing and representing the physical phenomena and the models for Soil Mechanics.

FINAL MARK ALLOCATION CRITERIA

The final mark is given through a discussion between the members of the examination panel about the performance of the candidate in the written paper and in the colloquium.

Recommended reading

Lecture notes available at the Faculty Copy Centre; example problems given in classes during the practical sessions.

Geotecnica (EA)

Erio Pasqualini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 90
Period 1s

Prerequisites
Basic knowledge of analytical calculation, phisics and construction science.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide students with the tools needed to understand the hydraulic and mechanical behaviour of a soil and how it interacts with the structures in contact with it, and to provide the basic knowledge for designing of retaining walls and foundations.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The course is aimed at giving the students the basic knowledge of soil mechanics and geotechnical engineering. They are guided and required to solve simple geotechnical problems as the basic skill for a building engineer.
TRANSVERSAL SKILLS:
The course requires many skills given in previous courses. During the course the students are encouraged to a review of their basic knowledge and to work in groups to solve proposed exercises in order to improve their learning and ability to analyse the geotechnical problems.

Program
Basic characteristics and classification of soils. The principle of effective stress. Fundamentals of continuum mechanics. State of stress within a linear elastic half-space for different loaded areas. Steady flow through soil. Darcy s law. Coefficient of permeability. Seepage force. Piping. Laplace s equation and its solutions. Consolidation process. One-dimensional consolidation theory. Oedometer test. Compressibility and stress history. Preconsolidation pressure and overconsolidation ratio. Secondary compression. Stress-strain and strength characteristics. Lab soil testing (direct shear test, triaxial tests). Mechanical behaviour of sands and of clays. Shear strength parameters. In situ testing (CPT, SPT) Stability problems. Limit equilibrium method. Active and passive pressure. Earth retaining rigid walls. Bearing capacity of shallow and deep foundations and geotechnical design principles according to the italian rules. Settlements of shallow foundations on clayey and sandy soi. Different types of deep foundations. Bearing capacity of piles.

Development of the course and examination
LEARNING EVALUATION METHODS
Written test and oral examination

LEARNING EVALUATION CRITERIA
Written test: to evaluate students' ability in applying theory. Oral exam: to evaluate students' theoretical and practical knowledge.

LEARNING MEASUREMENT CRITERIA
Written test and oral exam are evaluated in thirtieths.

FINAL MARK ALLOCATION CRITERIA
The exam is passed if oral exam is sufficient. Errors in the written test, if any, are discussed during the oral exam. The oral exam is more important than the written test for the final mark. Full marks are assigned in case of correct written text and correct and brilliant oral exam with a proper technical language.

Recommended reading
Copies of slides and texts delivered during the course. Lancellotta Geotecnica . Zanichelli
Viggiani Fondazioni Hevelius

Geotecnica Ambientale

Evelina Fratalocchi

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide the students with theoretical and technical skills on the geotechnical aspects of design and construction of landfills and of remediation of polluted sites. After the course, the students know the Italian rules concerning waste landfills and remediation of polluted sites and they are able to: plan investigations on a polluted site, perform the site-specific risk analysis, select the most appropriate remediation technology and design it as far as the geotechnical aspects in concerned, design and control the bottom and cover system of waste landfills.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
To make the students able to apply the acquired knowledge, they are guided in performing the risk analysis and in selecting the remediation technology for a contaminated site, to be presented as technical note at the exam. They have also to answer some questions as final examination. The course aims at providing the student with the ability of: 1) selecting the most appropriate investigation techniques; 2) recognizing the most appropriate approach to analyse and deal with the issues; 3) proposing and developing a design solution.
TRANSVERSAL SKILLS:
Cooperative learning and study groups for some subjects are encouraged. Technical visits and on-site team practice are organized at specialised laboratories and, when available, at contaminated sites or waste landfills. All these activities improve cooperation and communication skills, autonomous assessment and learning ability of the students.

Program
Pollutant migration through soils. Interaction phenomena soil-water-pollutants. Migration mechanisms: testing and modelling. Chemical compatibility. Analysis of the italian laws and regulations for waste disposal by landfills and polluted soils. Geotechnical design and construction of waste landfills: bottom and sidewall liners, cover system. Compacted clay liners, geosinthetic clay liners, geomembranes, geotextiles and related hydraulic and mechanical characteristics. Mechanical behaviour of wastes. Chemical and geotechnical characterisation of polluted sites. Risk assessment and analysis. Remedial strategy. Remediation technologies. Confinement of polluted sites by cut-off walls: technologies and design. Plastic cement-bentonite cutoffs: performance, mix-design, construction and controls. Cutoffs by jet-grouting and by different types of deep soil mixing. Technologies for remediation of polluted soils and groundwater: stabilisation/solidification, on site and off- site physical treatments, termal remediations. Permeable reactive barriers.

Development of the course and examination
LEARNING EVALUATION METHODS
Risk analisys (technical report) to be delivered at the exam + written test with a question on theory

and an exercise.

LEARNING EVALUATION CRITERIA
Written test: to evaluate students' ability in applying theory and their knowlegde of parameters' unit and magnitude. Oral exam: to evaluate students' theoretical knowledge.

LEARNING MEASUREMENT CRITERIA
The technical report, the theoretical question and the exercise are 10/30 each.

FINAL MARK ALLOCATION CRITERIA
Arithmetic mean of the technical report, theoretical question and exercise. Full marks are assigned if the student shows a study in depth and a proper technical language.

Recommended reading
Lecture slides (available on professor's univpm web page:
http://www.univpm.it/Entra/Engine/RAServePG.php/P/320710010421/idsel/207/docname/EVELINA%20FRA
click: allegati) Sharma & Reddy. Geoenvironmental Engineering . J.Wiley & Sons Inc.

Geotecnica e Fondazioni

Evelina Fratalocchi

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Basic knowledge of analytical calculation, phisics and construction science.

Program
Basic characteristics and classification of soils. The principle of effective stress. Fundamentals of continuum mechanics. State of stress within a linear elastic half-space for different loaded areas. Steady flow through soil. Darcy s law. Coefficient of permeability. Seepage force. Piping. Laplace s equation and its solutions. Consolidation process. One-dimensional consolidation theory. Oedometer test. Compressibility and stress history. Preconsolidation pressure and overconsolidation ratio. Secondary compression. Stress-strain and strength characteristics. Lab soil testing (direct shear test, triaxial tests). Mechanical behaviour of sands and of clays. Shear strength parameters. In situ testing (CPT, SPT) Stability problems. Limit equilibrium method. Active and passive pressure. Earth retaining rigid walls. Bearing capacity of shallow and deep foundations and geotechnical design principles according to the italian rules. Settlements of shallow foundations on clayey and sandy soi. Bearing capacity of piles.

Development of the course and examination
LEARNING EVALUATION METHODS
Written test to be passed to stand the oral examination

LEARNING EVALUATION CRITERIA
Written test: to evaluate students' ability in applying theory and their knowlegde of parameters' unit and magnitude. Oral exam: to evaluate students' theoretical knowledge.

LEARNING MEASUREMENT CRITERIA
Written test and oral exam are evaluated in thirtieths.

FINAL MARK ALLOCATION CRITERIA
The exam is passed if both written test and oral exam are sufficient. Errors in the written test, if any, are discussed during the oral exam; therefore the oral exam is more important than the written test for the final mark. Full marks are assigned in case of correct written text and correct and brilliant oral exam with a proper technical language.

Recommended reading
Lecture slides (available on the professor's univpm web page:
http://www.univpm.it/Entra/Engine/RAServePG.php/P/320710010421/idsel/207/docname/EVELINA%20FRA
click: allegati) Lambe & Withman, Soil mechanics , John Wiley & Sons..

Gestione dei Progetti e degli Impianti Industriali

Filippo Emanuele Ciarapica

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Basic knowledges of mathematics

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
Project management body of knowledge concepts will complete and enrich students competencies in industrial management focussing on the specific multidisciplinary features.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The acquired students core competencies can be summarized as in the following: 1. Workmpackages identification and budgeting; 2. Project time and resource management; 3. Project scheduled and performed work and cost control at stakeholders level
TRANSVERSAL SKILLS:
Classroom exercise sessions coupled with a students team prepared report with will enhance students interest in team working improving thus their judgements applying, communications and learning skills

Program
The course aims to give to the students the basic concepts about Project Management (PM). Understanding Project Life Cycle and Project Management Processes. Project Scope Management. WBS: creating the Work Breakdown Structure. Resource planning and estimating. Time estimating techniques. Cost estimating techniques. Establishing project planning controls. Identifying quality standards. Developing the project team. Project Business Plan. Risk management planning: qualitative and quantitative risk analysis.

Development of the course and examination
LEARNING EVALUATION METHODS
The assessment of student qualification will be carried out using a written test and oral questions. In the written examination, students have to solve numerical exercises related to economic evaluation of investments, project scheduling, management and control using the criteria and methods developed during the course lessons. In the oral examination, after a critical analysis of the written paper, some specific questions are asked about the criteria for project developing and managing with particular attention to industrial projects.

LEARNING EVALUATION CRITERIA
During the written test the student has to demonstrate his knowledge in using quantitative methods for managing mechanical and indutrial projects. During the oral section the student has to show his knowledges in identifying and evaluating the project feasibility and performance analysing the most important variables and equations explained during the course.

LEARNING MEASUREMENT CRITERIA

The student capability and autonomy in solving problems is evaluated during the examination phase. The student has to correctly use methods for managing and developing industrial and mechanical projects.

FINAL MARK ALLOCATION CRITERIA

The minimum vote of eighteen out of thirty is awarded to students who demonstrate to be able to solve problems using methods and criteria developed throughout the course. The vote of thirty thirtieths is assigned to students who, in both examinations, have demonstrated full independence in setting and properly solve problems as well as a complete mastery of the methods and criteria given to them. Full marks is reserved for the student who also showed correct use of language and adequate synthesis capacity.

Recommended reading

- Archibald R. D. (1996) Project Management. La gestione di progetti e programmi complessi , Franco Angeli. - Caron F., Corso A. Guarrella F. (1997) Project Management in Progress , Franco Angeli. - Harold Kerzner (2000) Project Management: a syste

Gestione dei Sistemi Energetici

Flavio Caresana

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
basics of physics, mathematics and chemistry

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course gives the student the basic skills for understanding energy conversion processes. Such knowledge adds to that of mechanics and thermodynamics and will give the student competence on the main energy conversion technologies, so that he will command the tools and the methodologies needed to solve the energy and environmental issues of a company.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Within the general aim of giving the student the ability to use the fundamental laws of mechanics, chemistry, thermodynamics and electromagnetism for design or analysis purposes, the course will in particular provide the tools needed to analyze, understand and characterize, from the cost and environmental impact points of view, the energy systems, with particular attention to those employed in industries. This ability will involve a number of professional skills, such as: 1. the ability to recognize and properly use the typical symbolism of energy conversion plants 2. the ability to properly analyze the operation of civil and industry energy systems and assess their performance; 3. the ability to commend the tools needed for the selection and management of energy systems.
TRANSVERSAL SKILLS:
Teamwork problem solving exercises involving energy conversion systems, and finalized in a report, will help improving the student s autonomous judgment, his communication skills and his learning and conclusion drawing abilities.

Program
basics:conservation of mass, first law of thermodynamics, generalized Bernoulli equation, second law of thermodynamics, ideal gases and their main transformations, combustion heat exchangers:global heat transfer coefficient, logarithmic mean temperature difference method, efficiency steam power plants:steam, Carnot cycle, Rankine cycle, Hirn cycle, reheat cycles, regenerative cycles, steam boiler gas turbine power plants:Brayton cycle, performance combined cycle power plants :operating principle, performance cogeneration:definition, indicators, high efficiency cogeneration pollutant emissions:types of pollutants, measurement units energy markets: basics on the energy market in Italy and the incentives for energy efficiency

Development of the course and examination
LEARNING EVALUATION METHODS
the exam procedure consists in an oral examination, during the examination the student may present a written work on a topic chosen in agreement with the lecturer.

LEARNING EVALUATION CRITERIA
the evaluation consists in verifing the student's knowledge on the basic concepts connected with the

operation of the energy systems addressed in the course. The student will be required to critically apply the thermodinamical models learnt in the course in order to verify his depth of knowledge in the sector. During the oral examination the student will be required to solve simple problems to validate his knowledge of the units and the order of magnitude of the main parameters related.

LEARNING MEASUREMENT CRITERIA
The student knowledge is graded through the attribution of a final mark out of thirty. The passing score is 18/30, the highest score is 30/30, brilliant students may receive in addition a praise.

FINAL MARK ALLOCATION CRITERIA
The outcome of the evaluation is positive if the student proves to have knowledge of all the basic subjects covered in the course. The highest score is achieved by demonstrating in-depth knowledge of the course contents. Praise is given to students who are particularlly brilliant in exposure and/or demonstrat particular mastery of the matters treated in the course, being able to analyze topics not explicitly covered or to treat standard topics in alternative ways.

Recommended reading
- lecturer's notes - Cavallini, Mattarolo, Termodinamica Applicata , CLEUP - Negri di Montenegro, Bianchi, Peretto, Sistemi energetici e macchine a fluido. Vol. 1 , Pitagora Editrice

Gestione del Ciclo di Vita del Prodotto

Michele Germani

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire advanced skill on design methods life cycle oriented and manage the process with appropriate software tools, especially in view of economic, environmental and social impact of products-processes-services. This skill, by integrating the knowledge gained in the teachings of industrial plants, mechanical products design, power systems design, virtual prototyping and manufacturing technologies, will form the insights that will enrich the knowledge of the methods and tools used to ensure the flow and exchange of technical information within the company. In this way, the student acquires a clear awareness of the wider multidisciplinary context of engineering, with a clear reference to the energy aspects and sustainability related to the entire life cycle of the product-process-service system
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to address advanced design topics, even of considerable complexity, and treat the innovation and development of new products, processes and services through the application of the acquired skills, the student will be able to use the methodologies and tools for the description of the product / process development and for the integrated management of data throughout its entire life cycle, with particular attention to aspects of sustainability (economic, environmental and social) This ability will be concretized through a number of vocational skills, such as: 1. the ability to design technical solutions that are conceived on the base of analysis of the entire life cycle; 2. the ability to assess the characteristics of a product-process-service based on criteria of sustainability (economic, environmental and social); 3. the ability to properly interpret the simulation of use scenarios of products-processes-services, working in teams with other students involved in the study of the problem
TRANSVERSAL SKILLS:
The execution of a problem-solving exercise that will be done in groups and that will lead to the realization of a report, will help the student to improve both the degree of independence of judgment in general and the ability to communicate that also is achieved from team working, and, finally, the ability to learn independently and to determine conclusions

Program
Outline of Product Design Methods. Product Life Cycle Management Systems: definitions, functionalities and implementation. Life Cycle Costing; Life Cycle Design and Life Cycle Assessment. Ecodesign methods and tools. Design for Eco-Sustainability. Design for Assembly and Design for Disassembly. Recycling, Reuse and Remanufacturing. Design for Energy Efficiency. Outline of Virtual Manufactring. A real case of product design will be faced

Development of the course and examination

LEARNING EVALUATION METHODS
The evaluation of the level of understanding of the students is done with a written report and an oral exam: the written report regards the eco-sustainable design or redesign of a product or process or service. During the oral examination, the student will be asked to answer to questions related to the writtene report or about some of the topics of the course. The written report is preparatory for the oral exam. In case of fail during the oral exam, the student will be requested to repeat also the written exam.

LEARNING EVALUATION CRITERIA
In order to pass the exam, the student must demonstrate that he/she knows the systems relevant to the life cycle management of the product and in particular the rules and methods for sustainable design considering the entire life cycle and to have developed the skills to know how to successfully implement a sustainable project of product / process / service.

LEARNING MEASUREMENT CRITERIA
The mark of the written report is determined by taking into account the following criteria: ability to use the methods and systems for environmentally sustainable design, consistency of the results with the requirements of project assigned The mark of the oral exam is determined by taking into account the following criteria: knowledge of methods and tools covered in the course; capacity for analysis and synthesis of practical cases of application of the life cycle management in terms of sustainability

FINAL MARK ALLOCATION CRITERIA
In order to get the minimum mark (i.e. 18/30), the student must get at least 18/30 for the written report and he/she must answer in a sufficient way during the oral examination, in order to demonstrate that he/she has acquired know how to use methods and tools to manage the life cycle of a system in a sustainable way.. The maximum mark (i.e. 30/30 cum laude) can be achieved by providing a very accurate and detailed written report with significant results from the design point of view and showing that he/she has acquired a significant knowledge of the course content.

Recommended reading
E.Manzini, C.A. Vezzoli, Design for Environmental Sustainability , Springer 2008. A. Saksvuori, A. Immonen, Product Lifecycle Management , Springer 2010. Documents handed out during the course and material available on the eLearning platform (http://moodle.univpm.it)

Gestione della Filiera Produttiva Industriale e Commerciale

Raffaele Zanoli

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Basic notions of Marketing and Budgeting

Program
Contents (lectures/flipped calssrooms, 27 hours) Characteristics of B2B markets Strategy in B2B Markets Analysis of Market Opportunities: Segmentation and Positioning Staregy managemnt and marketing tactics IThe industrial customer: need analysis and product development and decisions (QFD) HR managemnt: Leadership and team management Accounting, Reporting and budgeting Guidelines on how to make a Business Plan Practicals (45 hours) Marketplace SCCM Simulation, consisting in: 6 rounds/quarters, 5 executive briefings, 3 Peer/Leadership Evaluations, Venture Capital Fair/Presentazione Business Plan, Assurance of Learning Assessment (AOLA), Final Report to Board

Development of the course and examination
LEARNING EVALUATION METHODS
For attending students (blended): The assessment is based on individual and group activities carried out on the Moodle platform, on a group practical (Marketplace business simulation), oral tand / or written lassessment of learning. For those not attending (e-learning): The evaluation is based on a written test, an individual practical (individual Marketplace business simulation) and an oral examination.

LEARNING EVALUATION CRITERIA
The criteria for the assessment of learning are based on the accreditation standards of the Association to Advance Collegiate Schools of Business (AACSB). Specifically, the various assessments of learning are designed to test students' ability to: Perceiving, understand, and predicting the market conditions in which they compete in the simulation; Develop an integrated business perspective; Use the tools of marketing and management to understand and manage the company's position in the market; Present in a clear, concise style and appropriate language the results of business management. Provide a tactical business plan and present it to potential venture capitalists. Working in teams, managing conflicts in a constructive way and negotiation

LEARNING MEASUREMENT CRITERIA
All tests and practicals will be given a grade which will be converted in 0/30 marks.All tests and practicals grading rubrics are published on the LMS course site Specifically, a Balanced Scorecard is used to measure the teams performance within the simulation. It is a measure of the ability to create value for the firm s stakeholders. It is also a measure of the team s ability to integrate (harmonize) all of its business functions. Optimization can only be achieved by using the tools of management to assess the performance and evaluate the relative value of each option. Furthermore, it requires an understanding of how each decision can affect the business metrics which have been incorporated into the scorecard.

FINAL MARK ALLOCATION CRITERIA
The final mark will be a weighed average of all assessments, based on both individual and group work.

Recommended reading
Bruce-Cadotte, The Management of Startegy in the Marketplace, ILS (will be availble online for free together with simulation materials)

Gestione e Manutenzione delle Pavimentazioni Stradali

Francesco Canestrari

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Basic knowledge of road pavement construction

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims at providing the understanding of both theoretical methods and practical applications to plan management and maintenance activities related to road infrastructures. In particular, the actual need of studying a proper management process of road networks is highlighted in order to achieve the optimal cost-benefit balance.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The course will provide to the students specific abilities to analyze the main distresses typical of flexible pavements and select the most appropriate rehabilitation technique. Lectures and a group work planning practice will be given to students in order to transfer the required knowledge.
TRANSVERSAL SKILLS:
The acquired analytical and methodological skills along with a critical approach on the topics will aim at improving the level of independence in judgment, the communication ability and the learning skills, which are aspects helpful for solving issues common to the Civil and Environmental Engineering framework.

Program
Maintenance management. Pavement survey and analysis of work requirements. Bearing Capacity. Falling Weight Deflectometer FWD. Benkelman beam. Skid resistance. Road surface texture: definitions and measurements. International Friction Index (IFI). Longitudinal road profile measuraments. Basic concepts of signal analysis. International Roughness Index (IRI). Acoustic outlines. Road pavement traffic noise. Technological solutions for traffic noise reduction. Noise properties of road pavements. Low noise pavement materials (low emitting and/or sound-absorbing). Distress definitions for flexible pavements. Cracking. Distorsion. Disintegration. Skid hazard. Pavement Condition Index PCI. Constructive and functional aspects of road marking materials. Road applications of bituminous emulsions. Pavement reinforcement systems. Flexible Pavement Maintenance and Rehabilitation techniques.

Development of the course and examination
LEARNING EVALUATION METHODS
the learning evaluation consists of an oral exam composed of two parts: - evaluation of the knowledge necessary for preparing the practice exercise (carried out as working group of at most 4 students); - discussion of topics covered in class focused on flexible pavement maintenance and rehabilitation techniques.

LEARNING EVALUATION CRITERIA
A positive score in the first part of the oral exam (practice exercise) is mandatory in order to access

to the second part focused on the discussion of topics covered in class. In the case of a negative score in the oral examination, the student has to repeat again both parts of the exam. In order to pass positively the examinations, the student needs to prove a complete understanding of the topics covered in class and to have learned the criteria for the visual identification and the measurements of pavement distresses, as well as further alternative maintenance and rehabilitation techniques.

LEARNING MEASUREMENT CRITERIA

During the oral exam, the student understanding of engineering fundamentals which constitute the basis of the topics covered in class is evaluated, as well as the student ability to appropriately use equipments, models and technologies adopted for road pavements.

FINAL MARK ALLOCATION CRITERIA

the final score is assigned out of 30. In order to pass the exam with a minimum score (18/30), the student needs to know sufficiently each topic covered in class. Higher score will be assigned based on the general and specific skills demonstrated by the student. The maximum score (30/30) will be achieved by proving an extensive knowledge of the topics covered in class. The score cum laude will be assigned to students who, having achieved the maximum score, will prove a strong competence on the subject as well as brilliance in the oral presentation.

Recommended reading

Santagata, Bocci, Canestrari, Cardone, Ferrotti, Graziani, Virgili, et al. Strade - Teoria e Tecnica delle Costruzioni Stradali , Ed. Pearson. Slides available on the professor's webpage inside Allegati - download menu (downloading through password provided by the professor).

Gestione Industriale della Qualità

Mohamad El Mehtedi

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
Knowledge on fundamental aspects concerning the most common manufacturing processes for goods and services, statistics data analysis and probability.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course intends to acquire the skills to analyse in detail important items of a quality management system as a manufacturing enterprises or services. This knowledge, by integrating the knowledge acquired in the courses of technologies and production systems, probability and mathematical statistics, programming and production control, industrial plants and industrial logistics, will form the insights that will enrich the knowledge of quality management in the manufacturing sector, so that the student acquires a clear awareness of the wider multidisciplinary context of engineering, with a clear reference to the aspects strictly connected with the tools for the quality control of processes and products in production systems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to address design and advanced management issues, even of considerable complexity, and treat the innovation and development of new products, technological processes and production systems through the application of knowledge, the student must acquire the ability to apply and use statistical tools for quality industrial control. This ability is expressed through a number of vocational skills, such as: 1. the ability to choose the design techniques in perspective quality of a product/service (FMEA, QFD and others); 2. understanding of principles and measurement methods of quality in manufacturing systems; 3. the ability to apply and implement the basic concepts provided by the reference standard for Quality (ISO 9000 and 14000); 4. the ability to design appropriate tools for statistical control of manufacturing processes and the design of control plans for acceptance and testing trials.
TRANSVERSAL SKILLS:
The acquisition of methodological competencies through the resolution of individual and group exercises, including of a multidisciplinary nature, carried out in the classroom will help to improve both the capacity to learn autonomously and the degree of independent judgment, both the communication skills that also stems from teamwork.

Program
The meaning of Quality and Quality Improvement. A brief history of Quality control and improvement. The ISO 9001:2008/15 specific terminology. The concept of quality products and related industrial practices. Methods and philosophy of engineering process control and SPC. FMEA analysis and QFD. The six-Sigma tool applied for product and process. Control Charts for variable and for attributes and guidelines for implementing control Charts. Process and measurement system capability analysis, estimating the Natural Tolerance limits of a process. Factorial and fractional factorial experiments for process design and improvement. Lot-by-Lot acceptance sampling for attributes, the acceptance-sampling problem (Single, double, multiple and

sequential Sampling Plans).

Development of the course and examination
LEARNING EVALUATION METHODS
The exam consists in written and oral tests. In the written one, the student must answer four/five questions chosen among the topics of the course. It will also be required to solve practical cases related to complex problems. The oral exam will prove the level of knowledge showed in the written test.

LEARNING EVALUATION CRITERIA
The student has to demonstrate to have an excellent command of the real meaning of the Quality and be able to autonomously deal with the application of the main tools used in the Industrial Quality Management. Aspects, such as the mastery of technical language and clarity of exposition, will also be assessed. Finally, the ability to properly use the acquired knowledge in solving complex problems must be proven.

LEARNING MEASUREMENT CRITERIA
The ability to independently deal with the topics of the course by applying the models, methods and tools in analysing features related to the industrial Quality management, the clarity of exposition, the mastery of technical language are evaluated.

FINAL MARK ALLOCATION CRITERIA
The final grade will be assigned considering the evaluation obtained in both tests. The minimum score, equal to eighteen points, will be achieved by the students who demonstrate sufficient capacity to answer to all the questions raised. The maximum grade, equal to thirty points with honors, will be given to students who have proven full mastery of the topics, exposed in full autonomy and with appropriate technical language.

Recommended reading
D. C. Montgomery, Introduction to statistical Quality Control , Wiley. F. Franceschini, M. Galetto, Esercizi di gestione industriale della qualità , Celid. Slides of the lectures are available on the Moodle platform of the Polytechnic University of Marche.

Human Physiology

Mara Fabri

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
Notions of byilogy, biochemistry, anatomy and physics

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course will allow to know and understand the basic concepts of the physiology and the advanced knowledge of setting mechanisms of the physiological functions. The integrative role of the central nervous system on the human motor and sensory functions will be particularly emphasized.These notions, integrating those acquired during the course of Functional Anatomy of the previous cycle, will provide a further insight into the functioning of the human body, to allow therefore a student s awareness of the wide multidisciplinary field of the Engineering; the numerous aspects linked to the analysis and support systems and technology will also be recalled, as well as the aspects resulting in the planning instrumentation for the measure and analysis of physiological parameters, and design of supporting systems for medically assisted help.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
This course, mandatory for the master students, allows to learn the basic concepts of the physiology and the advanced knowledge of setting mechanisms of the physiological functions. The contents of the course will have to be exposed with the use of an adequate technical-scientific terminology.To deal with advanced and complex planning contents, and to promote the advancement and innovation of technological products and processes through the knowledge implementation, the student will have to properly interpret the results of physiological analysis. This skill will emerge through professional competences, as: 1. choosing the appropriate physiological variable to measure and/or analyze; 2. foreseeing the behavior of a physiological system in control conditions; 3. correctly interpreting the results of laboratory analysis, by working in team with other subjects involved in the study of the question
TRANSVERSAL SKILLS:
The students will have to acquire the ability to give clear presentation of their results, by using an appropriate technical and scientific language. By analyzing models originating from the true life experience and by simulating the solution of practical physiological problems the student will improve his/her level of independent judgment, his/her communication ability, independent learning ability, and the capability of critically analyze the questions.

Program
General principles of Physiology. Concept of homeostasis. Fluid compartments. Cell membrane. Transport mechanisms across membranes. Cell physiology. Resting membrane potential. Action potential: origin and conduction. Synaptic transmission. Central nervous system neurotransmitters.? Functional organization of the vertebrate nervous system. The autonomic nervous system. Muscle physiology. Morphological and functional characteristics of skeletal, cardiac and smooth muscle. Muscle contraction. Mechanical and biochemical aspects. Energy sources for muscle contraction. Motor unit.? Physiology of movement. Definition of reflex. Spinal reflexes: stretch and withdrawal

reflexes. Neural substrate for reflex responses. Control of posture and voluntary motor activity. Role of cortical motor areas. Corticospinal and corticobulbar tracts. Role of cerebellum and basal ganglia.?? Sensory physiology. Cutaneous, deep and visceral sensation. Neurophysiology of pain. Neurophysiology of vision. Neurophysiology of hearing and equilibrium. Neurophysiology of taste and smell. Cardiovascular physiology. Electrical activity of the heart. The heart as a pump. General hemodynamic principles. Laminar and turbulent flow. Measurement of arterial blood pressure.?Capillary exchanges. Blood flow from the major veins to the heart. The regulation of cardiac output and of peripheral circulation.? Respiratory physiology. Respiratory mechanics. Lung volumes. Alveolar ventilation. Alveolar gas exchanges. Blood transport of oxygen and carbon dioxide. Nervous and chemical regulation of respiration.? Renal physiology. Kidney functional anatomy. Glomerular filtration and renal blood flow. Absorptive and secretory functions of renal tubules. Homeostatic mechanisms maintaining osmolality and normal volume and ionic composition of extracellular fluids. Micturition. Gastrointestinal physiology. Motility and secretions. Digestion and absorption of carbohydrates, proteins and fats. Nervous and hormonal control of gastrointestinal functions.

Development of the course and examination
LEARNING EVALUATION METHODS
The student's learning will be evaluated by means of an oral exam.

LEARNING EVALUATION CRITERIA
To pass the exam, the student must show to have an overall knowledge of the principke of functioning of human organs in normal conditions, and of the role of different organs in the integrated systems. The contents of the course should be presented by using an appropriate technical-scientific terminology.

LEARNING MEASUREMENT CRITERIA
The final evaluation will be expressed in thirtieths.

FINAL MARK ALLOCATION CRITERIA
To pass the exam the student should reach a sufficient evaluation, 18/30. The maximum evaluation, 30/30, is reached when the student demonstrates a La valutazione massima è raggiunta dimostrando a complete knowledge of the arguments of the course. The honors are reserved to those students who demonstrate a personal in-depth analysis and a bright presentation.

Recommended reading
a) Title: Fisiologia umana?b) Authors: Stanfield, Germann?c) Publisher: EdiSES a) Title: Fisiologia di Vander?b) Authors: AAVV?c) Publisher: CEA? ? a) Title: Principi di Fisiologia?b) Authors: Berne, Levy?c) Publisher: CEA?? a) Title: Fisiologia b) Authors: Scotto Ed.?c) Publisher: Poletto

Idraulica

Maurizio Brocchini

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
Knowledge of the basics of Mathematical Analysis (e.g. infinitesimal calculus, theory of integration, solution of differential equations), Classical Physics (e.g. Mechanics, Electromagnetism, Optics and Thermodynamics).

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course allows the students to acquire the basis for the interpretation and description of the problems typical of the Hydraulics and Fluid Mechanics. The couse also aims at forming a graduate engineer capable of identifying, formulating and solving the problems of the Hydraulics
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
To the aim of facing advanced theoretical and applicative themes, also of great complexity, the student will have to acquire capabilities of design and critical analysis for the problems typical of the Hydraulics. Such capabilities will be expressed through the ability to solve applicative Hydraulics problems, with specific reference to problems of hydrostatics and hydrodynamics
TRANSVERSAL SKILLS:
The teaching of the Hydraulics contributes, along with the teaching of the Physics, to introduce the fundamental laws of Fluid Mechanics, emphasizing the investigation methodologies and the descriptive rigour of the phenomena under scrutiny. Moreover, along with the teaching of the Structural Engineering, provides and deepens the theoretical foundations of the Continuum Mechanics, with reference to the fluids.

Program
Introduction to the scheme of fluid continuum . The forces acting on a fluid. Quiescent fluids and the equation of the hydrostatic. The pressure in a quiescent fluid. The equation of state. Interfacial phenomena. The static thrust of a fluid on planar/non-planar surfaces. The fluids in motion: kinematics and local flow analysis. The principles of fluid mechanics and hydraulics. The Cauchy equation. Thermo-conductive, viscous fluids: constitutive laws and the theorem of mechanical power. The flow problem: the Navier-Stokes equation. Fundamental solutions of the Navier-Stokes equations. High Reynolds numbers flows. Vorticity dynamics and the Bernoulli theorem. The irrotational flows. Examples of planar irrorational flows. Dimensional analysis, similitude and models. The boundary layer theory. Friction and shape flow resistance. The separation of the boundary layer. Fundamentals of turbulent flows. Turbulent flows in pipes. The wall turbulence. The fluid streams. The equations for fluid streams. Distributed head losses. The flow in circular pipes. Localized head losses. Problems of design and control of hydraulic plants. Free-surface streams: the steady-uniform flow, the equation for the free-surface location, free-surface solutions for the riverine and torrent regimes. The hydraulic jump. Examples

Development of the course and examination
LEARNING EVALUATION METHODS

Pass of a written test, made of 2 exercises and 2 questions, with a valuation of at least 18/30 to access the oral exam.

LEARNING EVALUATION CRITERIA
To positively pass the exam, the student has to demonstrate, through the above-mentioned tests, to be well acquainted with both theoretical concepts and use of the applicative tools of the Hydraulics.

LEARNING MEASUREMENT CRITERIA
For each of the above-mentioned tests a mark between zero and thirty is given and each test is passed if a mark larger than 18/30 is obtained. In particular, it is necessary that the student gets at least six thirtieths in each of the 2 exercises contained in the written test.

FINAL MARK ALLOCATION CRITERIA
The overall mark, in thirties, is given by the sum of the mark of the written test and a mark ranging between -5/30 and +5/30, as function of the correct answering to the question made during the oral assessment. The highest mark is achieved by a clear demonstration of the knowledge of the course contents. Honours are reserved to students who, having correctly and fully completed all the tests, have demonstrated an exceptionally clear knowledge of the topics.

Recommended reading
Marchi E. e Rubatta A., Meccanica dei Fluidi, UTET, Torino, 1981; Cengel Y e Cimbala J, Meccanica dei Fluidi, McGraw Hill, Milano, 2007. Notes of the course of Hydraulics (with exercises) available at the "Centro Copie" of the Faculty.

Idraulica

Maurizio Brocchini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Knowledge of the basics of Mathematical Analysis (e.g. infinitesimal calculus, theory of integration, solution of differential equations), Classical Physics (e.g. Mechanics, Electromagnetism, Optics and Thermodynamics).

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course allows the students to acquire the basis for the interpretation and description of the problems typical of the Hydraulics and Fluid Mechanics. The course also aims at forming a graduate engineer capable of identifying, formulating and solving the problems of the Hydraulics.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
To the aim of facing advanced theoretical and applicative themes, also of great complexity, the student will have to acquire capabilities of design and critical analysis for the problems typical of the Hydraulics. Such capabilities will be expressed through the ability to solve applicative Hydraulics problems, with specific reference to problems of hydrostatics and hydrodynamics.
TRANSVERSAL SKILLS:
The teaching of the Hydraulics contributes, along with the teaching of the Physics, to introduce the fundamental laws of Fluid Mechanics, emphasizing the investigation methodologies and the descriptive rigour of the phenomena under scrutiny. Moreover, along with the teaching of the Structural Engineering, provides and deepens the theoretical foundations of the Continuum Mechanics, with reference to the fluids.

Program
Introduction to the scheme of fluid continuum . The forces acting on a fluid. Quiescent fluids and the equation of the hydrostatic. The pressure in a quiescent fluid. The equation of state. Interfacial phenomena. The static thrust of a fluid on planar/non-planar surfaces. The fluids in motion: kinematics and local flow analysis. The principles of fluid mechanics and hydraulics. The Cauchy equation. Thermo-conductive, viscous fluids: constitutive laws and the theorem of mechanical power. The flow problem: the Navier-Stokes equation. Fundamental solutions of the Navier-Stokes equations. High Reynolds numbers flows. Vorticity dynamics and the Bernoulli theorem. The irrotational flows. Examples of planar irrorational flows. Dimensional analysis, similitude and models. The boundary layer theory. Friction and shape flow resistance. The separation of the boundary layer. Fundamentals of turbulent flows. Turbulent flows in pipes. The wall turbulence. The fluid streams. The equations for fluid streams. Distributed head losses. The flow in circular pipes. Localized head losses. Problems of design and control of hydraulic plants. Free-surface streams: the steady-uniform flow, the equation for the free-surface location, free-surface solutions for the riverine and torrent regimes. The hydraulic jump. Examples

Development of the course and examination
LEARNING EVALUATION METHODS

Pass of a written test, made of 2 exercises and 2 questions, with a valuation of at least 18/30 to access the oral exam.

LEARNING EVALUATION CRITERIA
To positively pass the exam, the student has to demonstrate, through the above-mentioned tests, to be well acquainted with both theoretical concepts and use of the applicative tools of the Hydraulics.

LEARNING MEASUREMENT CRITERIA
For each of the above-mentioned tests a mark between zero and thirty is given and each test is passed if a mark larger than 18/30 is obtained. In particular, it is necessary that the student gets at least six thirtieths in each of the 2 exercises contained in the written test.

FINAL MARK ALLOCATION CRITERIA
The overall mark, in thirties, is given by the sum of the mark of the written test and a mark ranging between -5/30 and +5/30, as function of the correct answering to the question made during the oral assessment. The highest mark is achieved by a clear demonstration of the knowledge of the course contents. Honours are reserved to students who, having correctly and fully completed all the tests, have demonstrated an exceptionally clear knowledge of the topics.

Recommended reading
Marchi E. e Rubatta A., Meccanica dei Fluidi, UTET, Torino, 1981; Cengel Y e Cimbala J, Meccanica dei Fluidi, McGraw Hill, Milano, 2007. Notes of the course of Hydraulics (with exercises) available at the "Centro Copie" of the Faculty.

Idraulica Ambientale

Maurizio Brocchini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Knowledge of the basics of Mathematical Analysis (e.g. infinitesimal calculus, theory of integration, solution of differential equations), Classical Physics (e.g. Mechanics, Electromagnetism, Optics and Thermodynamics) and Hydraulics.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course allows the students to acquire an in-depth knowledge of the problems related with the mixing of natural fluids and of pollutant transport. This contributes to increase the capability of design and understanding of complex systems for the environmental safety, the soil defense and protection against natural risks.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
To the aim of facing advanced theoretical and applicative themes, also of great complexity, the student will have to tackle exercises of increasing complexity, always finalized to the testing of their design capabilities and critical analysis of the applicative problems typical of the Environmental Hydraulics.
TRANSVERSAL SKILLS:
The teaching contributes to establishing a proper culture for the implementation of civil works in the environment, the prevention of natural risks, the management of refuses, the development and application of techniques for pollution control and the construction of chemical and environmental plants.

Program
Definitions. The Fick law. The molecular diffusion in a quiescent fluid. The method of images . The diffusion-convection in a fluid in laminar flow motion. Fundamentals of turbiulent flows. The turbulent diffusion: the clouds of tracers. The Taylor's theory on turbulent diffusion. The equation for convetcion and turbulent diffusion. The laminar dispersion: Taylor's theory and Elder's theory . The free turbulence. The self-similar solution for the jet case. Entarinment, mixing and mass transport. Denso-mechanic phenomena: the bouyant jets and the plumes. The mixing in natural streams: the near, intermediate and far fields. The mixing in groundwater flows for both uniform and non-uniform terrains. Evaluation of feasible and reliable forecasting models for the evaluation of pollutants dispersion. The mixing of reactive tracers. The oxygen balance in absence of mixing. The re-oxygenation process. The oxygen balance in presence of mixing. Mixing processes in groundwater flows. Physical properties of soils. The Darcy Law. The transport of solutes in heterogeneous aquifers.

Development of the course and examination
LEARNING EVALUATION METHODS
Oral test and numerical project on the solution of the convection-diffusion equation.

LEARNING EVALUATION CRITERIA
To positively pass the exam, the student has to demonstrate, through the above-mentioned tests, to be well acquainted with both theoretical concepts and use of the applicative tools of the Environmental Hydraulics.

LEARNING MEASUREMENT CRITERIA
Final mark, in thirtieths.

FINAL MARK ALLOCATION CRITERIA
The final mark will be made by summing the marks of the oral tests and of thel numerical project. The student will obtain max 5 marks for the numerical project. The oral test consists of three questions. Each question will be marked between 0 and 10 points. Honours will be given to those students who, reaching the highest marks, demonstrate a full mastery of the topics.

Recommended reading
Fischer, H.B. et al., Mixing in inland and coastal waters, Academic Press. Notes of the course of Environmental Hydraulics available at the Centro Copie of the Faculty.

Idrogeologia Applicata

Torquato Nanni

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
40

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course provides the student with the knowledge about the geological processes that originated aquifers, the hydrodynamics of aquifers, the water balance, the groundwater chemistry and the hydraulic relations between groundwater and surface water.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The knowledge gained from the future environmental engineer provide the ability to evaluate the volume of resources stored in aquifers and define rational works for withdrawal of groundwater and preservation of the surface water system.
TRANSVERSAL SKILLS:
The knowledge on Hydrogeology gives to the future environmental engineer the ability to interact with different hydrogeological specialists in projects for withdrawal of groundwater, management and protection of aquifers and remediation of contaminated sites.

Program
Basic concepts of Hydrogeology and Applied hydrogeology. Methodologies for the analysis of the aquifers. Examples of studies on porous and fissured aquifers. Pumping tests, artificial tracers and hydrodynamic parameters. Hydrological balance and water resources of the aquifers. Management, preservation and protection of aquifers. Wells, springs and water supply.

Development of the course and examination
LEARNING EVALUATION METHODS
The assessment is through written with oral discussion. In the written test, students have to deal with the issues related to the theoretical part of Hydrogeology, reading and analysis of hydrogeological maps with recognition sites for withdrawal groundwater and water pollution hazard.

LEARNING EVALUATION CRITERIA
In examination, students must demonstrate the ability to use independently and properly methodologies and tools related to the Hydrogeological topics. They must also demonstrate capacity of synthesis and at the same time complete exposition of the subject matters of the questions.I

LEARNING MEASUREMENT CRITERIA
During the examinations is assessed the student's ability to answer the questions correctly on the theoretical part of the course, on the interpretation of hydrogeological maps and on the use and protection of groundwater aquifers.

FINAL MARK ALLOCATION CRITERIA
The maximum mark, derived from the scores obtained by the test, is equal to thirty points with honors and is assigned to students that demonstrate full autonomy and synthesis in the response. The minimum rating is eighteen and is assigned to students that have sufficient knowledge to set a correct answer.

Recommended reading
Civita M. - Idrogeologia applicata e ambientale. Ed. Cea Ambrosiana, 2003 Celico P. Prospezioni idrogeologiche - Ed. Liguori, 1986 - Vol.1 e 2 - Fetter C.W. - Applied Hydrogeology . Ed. Prentice Hall, 2001

Impianti Chimici Ambientali

Francesco Fatone

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Elements of hydraulic

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire advanced knowledge of design of operative units related to the biological treatment of urban and industrial wastewater. This knowledge will allow to acquire scientific approach to complex and interdisciplinary engineering problems with clear reference to the design aspects and to the critique analysis of the typical application problems of the chemical-environmental engineering.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will acquire the knowledge of the technological productive processes for the treatment of municipal and industrial wastewaters with biological systems. The problem of the traditional or advanced nutrient removal and sludge treatment will be developed in order to learn the structure and design phases. The use of specific software for the solution of applied problems will allow comparable approach to that commonly used in the labor market.
TRANSVERSAL SKILLS:
The approach to the design of engineering structures and environmental and chemical plants will increase the degree of independence in terms of the critical choices during the design phase and the learning capacity in the analysis and definition of the project data.

Program
1-Law: Design and realization of treatment and drinkable waters plants. Analysis of the law for the sludge treatment plants. 2-Wastewater: Project data for waste water treatment plants. Biological treatments. Attached and suspended growth reactors, kinetics of biological growth. Aerobic and anaerobic processes; theory of processes design. 3-Design in advanced treatments: Biological nitrogen removal, nitrification, denitrification. Biological phosphorus removal. Combined removal of nitrogen and phosphorus by biological methods. Removal of nutrients by physical and chemical processes. MBR processes, Constructed Wetlands. 4- Simulation models: Simulation model in biological processes: IAWPRC model. Calculation example for real plants .Plant engineering. 5-Process types: Phoredox process and its modifications, UCT process and its modification. Systems for small communities. 6- Sewage sludge treatment: Biological treatment of sludge. Sludge anaerobic digestion and aerobic stabilization, composting; process theory and design methods. Plant design 7- Wastewater treatment plant design

Development of the course and examination
LEARNING EVALUATION METHODS
The evaluation will be oral examination during which it is expected to be discussed the topics related to biological processes and methods of treatment of sludge and the design implications

LEARNING EVALUATION CRITERIA
To successfully pass the evaluation of learning, the student must demonstrate the understanding of the concepts presented in class and the acqusition of the theoretical principles, design and application of biological processes and sludge treatment methods.

LEARNING MEASUREMENT CRITERIA
During the examinations will be evaluated the understanding of the theoretical and experimental principles of the treated topics and the ability to properly use the design principles of processes units and technologies

FINAL MARK ALLOCATION CRITERIA
The final mark is attributed with minimum grade of 18/30 associated with complete knowledge of the treated topics. Additional points up to 30/30 will be awarded based on the general and specific skills. The evaluation "cum laude" will be given to students with elevated outstanding and critical exposition of the arguments.

Recommended reading
Course notes; Metcalf and Eddy, Wastewater engineering treatment disposal and reuse , Ed. Mc Graw Hill (Hoepli inter); Beccari et al., Rimozione di azoto e fosforo dai liquami , Ed. Bibliotece Tecnica Hoepli; Masotti, Depurazione delle acque , Ed. Calderoni; Sirini P., Ingegneria sanitaria ambientali , Ed. Mc Graw Hill; Henze, Harremoës, La Cour Jansen Arvin, Wastewater treatment Biological and chemical processes , Sec. Ed. Springe

Impianti di Conversione Energetica

Gabriele Comodi

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Rankine and Brayton thermodynamic cycles; knowledge on main turbomachineries (pumps, compressor, hydraulic turbines, gas and steam turbines); steam generators; heat transfer.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The aim of this course is to provide students with advanced knowledge on energy conversion plants. The course completes the previous engineering education deepening the understanding of energy conversion systems in both industrial and energy fields. In particular, students increase their knowledge on the issues related to the systems involved in the production and conversion of energy also taking into account the different sources and their energy markets. The study of energy conversion systems under a technical and economic point of view provide the students with the awareness of the multidisciplinary context of the mechanical engineering
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Students enhance their ability to assess both the main parameters affecting the design of energy conversion systems (both renewable and fossil) and their techno-economic-environmental impact. The main skills acquired in the course are: 1. Ability to assess, under technical/economic/ environmental point of view, the potentialities and limits of energy conversion systems; 2. Ability to choose the suitable energy conversion plant in order to reduce costs, energy consumption and environmental impact; 3. Ability to pinpoint the criticalities related to the external context of energy systems such as legislation and energy markets; 4. Ability to communicate with proper, high level, engineering terminology
TRANSVERSAL SKILLS:
The deepen knowledge of energy conversion systems will improve the judgement autonomy of students and their communications skills with particular regard to the use of a proper, high level, engineering terminology. The study of energy conversion systems under a technical and economic point of view provide the students with the awareness of the multidisciplinary context of the mechanical engineering so that they will be able to communicate and cooperate in different context both with engineers and non-engineers

Program
Introduction to the global energy question; the Italian energy system (gas and electricity); big power plants (nuclear, gasification of coal, natural gas); IGCC, combined cycles and repowering of steam plants; distributed generation, cogeneration, absorption chillers and trigeneration, smart grid, energy storage; the energy markets and tariffs: electricity, natural gas; green certificats, feed-in tariff, white certificates, Emission Trading System; role of both Energy Service Companies (ESCOs) and energy manager in the industry and tertiary sector.

Development of the course and examination
LEARNING EVALUATION METHODS

The final exam consists in a written examination. Students must answer to several (usually 12) questions. Student could have the opportunity of taking a preliminary examination in order to get the final examination vote. Disabled persons with difficulties in writing or foreign students can take an oral examination.

LEARNING EVALUATION CRITERIA
Following criteria are used for the evaluation of the answers: 1) relevance with the question; 2) completeness; 3) correct use of engineering terminology; 4) clearness

LEARNING MEASUREMENT CRITERIA
Each answer will be evaluated with a vote ranging between 0-30

FINAL MARK ALLOCATION CRITERIA
The final vote will be calculated as the average of the votes of all the questions (both answered or not). To pass the exam, the average of votes must be equal or higher than 18/30.

Recommended reading
slides of the lecture; Lozza, turbine a gas e cicli combinati , Ed.Pitagora; Pedrocchi, Lombari, introduzione all'energia nucleare , Polipress)

Impianti di Elaborazione

Nazzareno Bordi

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course introduces concepts, models and methodologies of performance engineering for sizing of computer systems, such as the concept of dependability and the key efficiency and reliability metrics, Markov chains, queuing networks models, operational analysis.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
At the end of the course, students will be able to estimate the work load of the resources of a computer infrastructure and properly sizing these resources to meet dependability requirements and provide users with an acceptable quality of service at a reasonable cost.
TRANSVERSAL SKILLS:
The resolution of problems of wokload estimation and sizing of processing equipment, realized in groups and individually, will help improve the degree of independent judgment by the ability to properly analyze and esign, the ability to communicate, also deriving from the teamwork, by defining a common (written and spoken) language, the ability to learn independently and to draw conclusions.

Program
Content of lectures (47 hours): computer systems and their architectures, performance engineering and its correlation with the life cycle of a computer system; quality performance of a computer system: properties and quality of service metrics, models for performance engineering: Markov and queuing networks, performance engineering methodology, case studies: services, databases, web services, data centers, call centers, services for e-business. Classroom exercises (25 hours): exercises on all the lectures' topics, for example: model design of queuing networks (open and closed) of single class or multiclass computer systems, calculation of stationary probability distributions, calculation of the performance of the computer system resources (service time, service demand, residence time, utilization, bottleneck, ...) and of the same system (throughput, response time, throughput times of a transaction, response time and throughput asymptotic, ...), calculation of the foreseeable development of the system performance as a result of variation of the needs and / or of the Quality of Service, ...

Development of the course and examination
LEARNING EVALUATION METHODS
the assessment of the student knowledge level consists of two tests: a written test with the solution of three exercises on topics covered in the course, to be completed in an hour; an oral exam, consisting in the discussion of at least three topics covered in the course. The written test is preparatory to the oral exam and the student must have earned at least a pass in the written test and the vote in based on thirty. The oral exam must be done in the same session of the written test

or in the subsequent session. In case of a negative outcome for the oral examination, the student has to repeat the written test.

LEARNING EVALUATION CRITERIA
to successfully pass the examination, the student must demonstrate, through the trials described above, that has understood the concepts presented during the course and must prove that has understood the criteria and the procedures for the design and dimensioning of the processing systems.

LEARNING MEASUREMENT CRITERIA
each of the two tests indicated above has a score between zero and thirty thirtieths; the overall grade, based on thirty, is given by the vote assigned in the oral test.

FINAL MARK ALLOCATION CRITERIA
the evaluation is positive if the student achieves at least the sufficiency, equal to eighteen points, in each of the two tests described above; each correctly done written exercise worth 10 points; the highest rating is achieved by demonstrating a thorough understanding of the course content by the tests; full marks with honours is reserved for students who, having done all the tests so correctly, have demonstrated full knowledge of the course topics.

Recommended reading
- D. A. Menascè, V. A. F. Almeida, L. W. Dowdy: Performance by Design: Computer Capacity Planning by Example , Prentice Hall PTR, 2004. - G. Bracchi, C. Francalanci, G. Motta, Sistemi Informativi d Impresa , McGraw-Hill, 2010.

Impianti Industriali (GEST)

Giancarlo Giacchetta

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire knowledge on the main stages of the study of an industrial plant: feasibility study including analysis of the product, the study of the production process until the economic evaluation of the initiative; systematic study of the project layout, including analysis of the material flow, the relationships between the various production and service activities, the size of the production lines and the necessary spaces; study of methods on the timing of the projects; outlines the general design criteria of service facilities, such as the water service, the thermal energy facilities, etc .. This knowledge, integrating concepts they have acquired in the Mechanical technology courses, Economics, Operations Research, will enrich the knowledge in the field of mechanical design of industrial plants, so that the student acquires a clear awareness of the wider multidisciplinary context of engineering, with a clear reference to the aspects specifically related to computer systems and production technologies and services to the industry. They will be able to give an overall vision and aware of the large multidisciplinary context Engineering management.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to apply the basic concepts for a basic engineering education in industrial learned during the study, the student must know how to perform analysis of industrial plants in order to evaluate the productive performance and energy consumption of the plant and choose the best solutions in relation to industrial sector. This ability manifests through a number of vocational skills, such as: 1. basic knowledge on the feasibility study of the industrial equipment and the choice of the product and of the production cycle; 2. ability to conduct economic evaluations of capital expenditures; 3. ability to design service facilities needed for industry.
TRANSVERSAL SKILLS:
The ability to solve complex problems related to the industry life cycle will help improve the degree of independence of judgment in general, both the communication skills that comes from knowing of its powers, is the ability to learn independently and to draw conclusions student.

Program
Feasibility study of industrial plants. Choice of the product and of the production cycle. Analysis of the production and exercise costs. Evaluation of the industrial investments. Facility location problems. Systematic layout planning. Flow analysis and activity analysis. The relationship diagram. Space requirements and availability. Designing the layout. Group technology. Lines balancing. Project management techniques: Gant, PERT and CPM. Piping : fundamentals and components. Water systems piping.

Development of the course and examination
LEARNING EVALUATION METHODS

The assessment of student qualification will be carried out using a written test and oral questions. In the written examination, students have to solve numerical exercises related to economic evaluation of investments, the design of production systems and industrial plants using the criteria and methods developed during the course lessons. In the oral examination, after a critical analysis of the written paper, some specific questions are asked about the criteria for selecting, designing and developing industrial and mechanical systems with particular attention to manufacturing systems and elementary notions of service plants analysed during the course.

LEARNING EVALUATION CRITERIA
During the written test the student has to demonstrate his knowledge in using quantitative methods for designing mechanical and indutrial plants. During the oral section the student has to show his skills in identifying the most important variables and equations for designing industrial plants.

LEARNING MEASUREMENT CRITERIA
The student capability and autonomy in solving problems is evaluated during the examination phase. The student has to correctly use methods for designing and developing industrial and mechanical systems.

FINAL MARK ALLOCATION CRITERIA
The minimum vote of eighteen out of thirty, is awarded to students who demonstrate to be able to solve problems using methods and criteria developed throughout the course. The vote of thirty thirtieths is assigned to students who, in both examinations, have demonstrated full independence in setting and properly solve problems, complete mastery of the methods and criteria given to them. Full marks is reserved for the student who also showed correct use of language and adequate synthesis capacity.

Recommended reading
- Pareschi - Impianti industriali Progetto Leonardo , Bologna 1994 - R.L. Francis, J.A. White - Facility layout and location: an analytical approach. Prentice Hall Inc. , New Jersey 1994
-A.Monte. Elementi di Impianti Industriali. Vol. 1° e 2° -

Impianti Meccanici (A/L)

Filippo Emanuele Ciarapica

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Basic knowledges of thermodynamics

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
This course aims at giving the students the basic knowledge of the main steps that lead to the design an industrial plant: feasibility study, which includes product analysis, process analysis and techno-economic assessment; layout analysis, which includes the material flows, the connection between manufacturing and service activity, the design of assembly lines; fundamentals of service plant design: plant water distribution system, thermal energy production, self-production of thermal and electrical energy. Together with the fundamentals in fluid dynamics, applied physics, fluid machines, energy systems and economy, this course will increase the knowledge in the fields of industrial engineering with particular focus on the design of industrial plants giving the student the awareness of the multidisciplinary context of engineering with particular focus on the issues related to the manufacturing and service plants
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Aiming at applying the fundamentals knowledge acquired, students must be able to assess the production and energy performance of industrial plants according to the application context. The main skills acquired in the course are: 1. Fundamental knowledge of feasibility study of industrial plants, selection of product and of the production cycle; 2. Ability of carrying out techno-economic assessment of investment in the industrial sector; 3. Ability of designing service plant for the industrial sector.
TRANSVERSAL SKILLS:
The ability of solving complex problems related to life cycle in the industry sector, together with the awareness of their knowledge, will improve the judgement autonomy of students, their communications skills and their learning ability

Program
Feasibility study of industrial plants. Choice of the product and of the production cycle. Analysis of the production and exercise costs. Evaluation of the industrial investments. Facility location problems. Systematic layout planning. Flow analysis and activity analysis. The relationship diagram. Space requirements and availability. Designing the layout. Group technology. Lines balancing. Project management techniques: Gant, PERT and CPM. Piping : fundamentals and components. Water systems piping. Steam systems piping. Compressed air piping systems.

Development of the course and examination
LEARNING EVALUATION METHODS
The assessment of student qualification will be carried out using a written test and oral questions. In the written examination, students have to solve numerical exercises related to economic evaluation of investments, the design of production systems and industrial plants using the criteria and

methods developed during the course lessons. In the oral examination, after a critical analysis of the written paper, some specific questions are asked about the criteria for selecting, designing and developing industrial and mechanical systems with particular attention to manufacturing systems and service plants analysed during the course.

LEARNING EVALUATION CRITERIA

During the written test the student has to demonstrate his knowledge in using quantitative methods for designing mechanical and indutrial plants. During the oral section the student has to show his skills in identifying the most important variables and equations for designing industrial plants.

LEARNING MEASUREMENT CRITERIA

The student capability and autonomy in solving problems is evaluated during the examination phase. The student has to correctly use methods for designing and developing industrial and mechanical systems.

FINAL MARK ALLOCATION CRITERIA

The minimum vote of eighteen out of thirty, is awarded to students who demonstrate to be able to solve problems using methods and criteria developed throughout the course. The vote of thirty thirtieths is assigned to students who, in both examinations, have demonstrated full independence in setting and properly solve problems, complete mastery of the methods and criteria given to them. Full marks is reserved for the student who also showed correct use of language and adequate synthesis capacity.

Recommended reading

Lectures notes available at moodle univpm platform. Pareschi - Impianti industriali Progetto Leonardo , Bologna 1994 - R.L. Francis, J.A. White - Facility layout and location: an analytical approach. Prentice Hall Inc. , New Jersey 1994 -A.Monte. Elementi di Impianti Industriali. Vol. 1° e 2° - Edizioni Libreria Cortina , Torino 1994 A. Pareschi - Impianti meccanici per l'industria - Progetto Leonardo Bologna

Impianti Meccanici (M/Z)

Giancarlo Giacchetta

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Basic knowledges of thermodynamics

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
This course aims at giving the students the basic knowledge of the main steps that lead to the design an industrial plant: feasibility study, which includes product analysis, process analysis and techno-economic assessment; layout analysis, which includes the material flows, the connection between manufacturing and service activity, the design of assembly lines; fundamentals of service plant design: plant water distribution system, thermal energy production, self-production of thermal and electrical energy. Together with the fundamentals in fluid dynamics, applied physics, fluid machines, energy systems and economy, this course will increase the knowledge in the fields of industrial engineering with particular focus on the design of industrial plants giving the student the awareness of the multidisciplinary context of engineering with particular focus on the issues related to the manufacturing and service plants
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Aiming at applying the fundamentals knowledge acquired, students must be able to assess the production and energy performance of industrial plants according to the application context. The main skills acquired in the course are: 1. Fundamental knowledge of feasibility study of industrial plants, selection of product and of the production cycle; 2. Ability of carrying out techno-economic assessment of investment in the industrial sector; 3. Ability of designing service plant for the industrial sector.
TRANSVERSAL SKILLS:
The ability of solving complex problems related to life cycle in the industry sector, together with the awareness of their knowledge, will improve the judgement autonomy of students, their communications skills and their learning ability

Program
Feasibility study of industrial plants. Choice of the product and of the production cycle. Analysis of the production and exercise costs. Evaluation of the industrial investments. Facility location problems. Systematic layout planning. Flow analysis and activity analysis. The relationship diagram. Space requirements and availability. Designing the layout. Group technology. Lines balancing. Project management techniques: Gant, PERT and CPM. Piping : fundamentals and components. Water systems piping. Steam systems piping. Compressed air piping systems.

Development of the course and examination
LEARNING EVALUATION METHODS
The assessment of student qualification will be carried out using a written test and oral questions. In the written examination, students have to solve numerical exercises related to economic evaluation of investments, the design of production systems and industrial plants using the criteria and

methods developed during the course lessons. In the oral examination, after a critical analysis of the written paper, some specific questions are asked about the criteria for selecting, designing and developing industrial and mechanical systems with particular attention to manufacturing systems and service plants analysed during the course.

LEARNING EVALUATION CRITERIA

During the written test the student has to demonstrate his knowledge in using quantitative methods for designing mechanical and indutrial plants. During the oral section the student has to show his skills in identifying the most important variables and equations for designing industrial plants.

LEARNING MEASUREMENT CRITERIA

The student capability and autonomy in solving problems is evaluated during the examination phase. The student has to correctly use methods for designing and developing industrial and mechanical systems.

FINAL MARK ALLOCATION CRITERIA

The minimum vote of eighteen out of thirty, is awarded to students who demonstrate to be able to solve problems using methods and criteria developed throughout the course. The vote of thirty thirtieths is assigned to students who, in both examinations, have demonstrated full independence in setting and properly solve problems, complete mastery of the methods and criteria given to them. Full marks is reserved for the student who also showed correct use of language and adequate synthesis capacity.

Recommended reading

Lectures notes available at moodle univpm platform. Pareschi - Impianti industriali Progetto Leonardo , Bologna 1994 - R.L. Francis, J.A. White - Facility layout and location: an analytical approach. Prentice Hall Inc. , New Jersey 1994 -A.Monte. Elementi di Impianti Industriali. Vol. 1° e 2° - Edizioni Libreria Cortina , Torino 1994 A. Pareschi - Impianti meccanici per l'industria - Progetto Leonardo Bologna

Impianti Tecnici (EA)

Costanzo Di Perna

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 90
Period 2s

Prerequisites
All the topics presented in Fisica Tecnica course

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire advanced knowledge on diagnosis and energy certification and the technical installations in the buildings service. This knowledge, by integrating the knowledge gained in the teachings of Technical Physics, will form the insights that will enrich the knowledge of the field of energy efficiency, so that the student acquires a clear awareness of the wider multidisciplinary context of engineering, with a clear reference the aspects strictly related to energy consumption linked to the housing components and systems of a building.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to address advanced design themes, even of considerable complexity, and treat the innovation and development of new products and new technological processes through the application of knowledge, the student will be able to face an energy assessment of a building and a sizing in the building of a service facility. This ability consists in a series of vocational skills, such as: 1. the ability to appropriately select the materials constituting the building envelope and the systems; 2. the ability to size the system; 3. the ability to properly interpret the dimensioning and calculations carried out
TRANSVERSAL SKILLS:
The execution of a project, that will be done during the course help to improve the design capacity, and the use of computer tools for the realization of thermal plants.

Program
The control of heat, air, and mixture to provide the theoretical background for the analysis of the building enclosures. Thermo physics of buildings. Energy design according to national and European laws. Thermal and hygrometric performance of building enveloped. Insulants. Heating and cooling loads. Lighting loads. Service water heating loads. Energy certification of buildings. Air conditioning and heating systems.

Development of the course and examination
LEARNING EVALUATION METHODS
The exam consists of an oral examination. If necessary, the questions, whose answer requires the execution of short calculations, will be carried out in writing together with the oral test.

LEARNING EVALUATION CRITERIA
The student, in the course of the oral examination, must demonstrate knowledge of the major technical plants. To pass the oral exam, the student will demonstrate an overall knowledge of the contents with the use of appropriate terminology technique. The highest rating will be achieved by demonstrating in-depth knowledge content, shown with complete mastery of technical language,

using appropriately such knowledge to solve simple problems related to technical installations for buildings

LEARNING MEASUREMENT CRITERIA
Attribution of the final grade in thirty

FINAL MARK ALLOCATION CRITERIA
The oral exam will consist in three questions, each of which will be evaluated with a score ranging between 0 and 10 points. The praise will be given to students who, having achieved the highest rating, have demonstrated full mastery of the subject

Recommended reading
Notes provided by the lecturer

Impianti Tecnici per gli Edifici

Francesco Corvaro

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Knowledge of the basic principles of thermodynamics and heat transfer mechanisms: conduction, convection, radiation.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course allows students to acquire basic knowledge about the shape and design of the technical plants provided either in residential and non residential buildings. This knowledge, by integrating the knowledge acquired in technical physics courses, will constitute a deeper base that will increase the knowledge of the thermo-mechanical engineering sector, so that the student will acquires a better awareness of the wider multidisciplinary context of engineering, with a clear reference to the aspects connected to systems and technologies for electricity and heat production, and to thermal plants design.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to address the basic design themes, even the more complex ones, and address the innovation and the development of new technological systems through the application of the acquired knowledge, the student should consider the building as a complex system in which the ability to integrate functional instances, distribution, construction, plant engineering and aesthetic-composition is achieved. This ability will be exploited through a number of vocational skills, such as: 1. the ability to identify the suitable primary source of energy 2. the ability to identify the most suitable plant structure; 3. the ability to start and develop a first system sizing.
TRANSVERSAL SKILLS:
The presentation of different real systems during the course lessons, will improve the capability to apply knowledge and competencies acquired by the students through the execution of guided exercises that require the use of models and methodologies described in the lessons.

Program
Energy from the sun: the PV and solar thermal. Wind energy. Geothermal energy. Energy from biomass. Energy from waste. Hydroelectric power. The terminals for the technical installations. The boilers. Thermal and hygrometric comfort: Fanger equation.

Development of the course and examination
LEARNING EVALUATION METHODS
The assessment of the level of learning consists of an oral e/0 written exam during which the student must answer questions related to the topics covered in class. The duration of the test will be the maximum of 30 minutes.

LEARNING EVALUATION CRITERIA
To successfully pass the exam, the student must demonstrate, through the test described above, to have assimilated the concepts contained in the program

LEARNING MEASUREMENT CRITERIA
Normally the student must answer to three different questions. Each question has a maximum score of 10 points.

FINAL MARK ALLOCATION CRITERIA
The final grade will consist of the sum of points obtained by the student in each question. The Lode is given to those who, in addition to achieving the maximum score, demonstrate to master very well the subject.

Recommended reading
Nothing

Impianti Termotecnici

Costanzo Di Perna

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
Heat transfer

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course allows students to acquire advanced knowledge on technical plants in the buildings. This knowledge, by integrating the knowledge gained in the teachings of Technical Physics, will increase the knowledge of the energy efficiency field and plant, so that the student acquires a clear awareness of the wider multidisciplinary context of engineering, with a clear reference to the aspects specifically related to the energy consumption related to the components of the systems of a building.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to address advanced design, even of considerable complexity, and to have the innovation and development of new products and new technological processes through the application of knowledge, the student will know how to design a plant. This ability will be reached through a series of sample, such as: 1. the ability to select the materials; 2. the ability to size the system; 3. the ability to design plants
TRANSVERSAL SKILLS:
L esecuzione di un progetto realizzato, che verrà svolto a lezione durante il corso contribuirà a migliorare la capacità progettuale, e l utilizzo di strumenti informatici per la realizzazione di impianti termotecnici.

Program
Air conditioning and heating system. Equipment. Boilers. Pipe sizing. Panel heating

Development of the course and examination
LEARNING EVALUATION METHODS
The exam consists of an oral examination. If necessary, the questions, whose answer requires the execution of short calculations, will be carried out in writing together with the oral test.

LEARNING EVALUATION CRITERIA
The student, in the course of the oral examination, will present and discuss the possible project developed and demonstrate the knowledge and methodological skills and technology for the design of HVAC systems. To successfully pass the oral exam, the student will demonstrate an overall knowledge of teaching content, presented in a sufficiently corrected with the use of proper technical terminology. The highest rating is achieved by demonstrating a thorough understanding of teaching content, exposed with complete mastery of technical language

LEARNING MEASUREMENT CRITERIA
Attribution of the final grade in thirty

FINAL MARK ALLOCATION CRITERIA
The oral exam will consist in three questions, each of which will be evaluated with a score ranging between 0 and 10 points. The praise will be given to students who, having achieved the highest rating, have demonstrated full mastery of the subject

Recommended reading
Notes provided by the lecturer

Informatica Grafica (EA)

Primo Zingaretti

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 60
Period 2s

Prerequisites
none

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course allows students to acquire the basic concepts of information technology and the basic elements of computer graphics in architectural and urban planning. At the end of the course students will be able to understand the functionalities of the main components of computer systems and the most important aspects of the graphical modeling and of the rendering process, both viewed as a series of logical processes.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Through knowledge application, on the one hand, the student must be able to address the solution of problems by subsequent abstraction levels with both top-down and bottom-up strategies, and, from another side, must be able to correctly interpret the causes of occurrence of critical situations in the running processing system.
TRANSVERSAL SKILLS:
The variety of the problems faced will improve in students the ability to solve problems in any application field, while participatory study of algorithms will help to improve the communication skills that comes with working in groups.

Program
Part I Fundamentals of Computer Science: i) course introduction and basic concepts; ii) programming elements; iii) information representation in computers; iv) introduction to C language.
Part II Fundamentals of Computer Graphics: i) introduction to graphics: digital images; raster and vectorial graphics; hardware and software components; ii) raster graphics: structure, functions and performances of the human visual system (perception); colour coding and chromatic spaces; image processing; iii) introduction to 3D graphics: graphics pipeline; renderer architecture; iv) modelling transformations; v) view transformations: projections; object vs viewer and pinhole camera metaphores; methods for placing a camera and specifying an arbitrary 3D view; vi) rendering: lighting and shading; models for light sources, local and global lighting; materials; local shading techniques and texture mapping; rasterization; clipping; antialiasing; hidden surface removal; vii) geometric modelling: curves and surfaces; viii) solid modelling: representation schemes.

Development of the course and examination
LEARNING EVALUATION METHODS
Evaluation of students' learning level consists of three parts: a written examination, an individual work-project and a final oral examination. The written examination consists of questions on theory and exercises concerning the first part of the course (fundamentals of Computer Science). Only who will obtain a positive result will be admitted to the oral examination. The individual work-project, also preceding the oral examination, consists of the rendering of a 3D model of an environment whose

layout is provided by the teacher. The oral examination starts with eventual gaps come out from the written examination, continues with the discussion of the individual work and ends with questions on the second part of the course (fundamentals of Computer Graphics).

LEARNING EVALUATION CRITERIA
To pass the learning test the student must show, by means of the three examinations described above, of having well understood the fundamental concepts of Computer Science (Part I) and the fundamental elements of Computer Graphics (part II). Besides, she/he must show to be able to apply the various models (objects, materials, lights, cameras, etc.) of the rendering process.

LEARNING MEASUREMENT CRITERIA
Marks in thirtieths.

FINAL MARK ALLOCATION CRITERIA
The final evaluation will be in relation to the grade of knowledge of the course contents, as comes out from written and oral examinations and on the base of her/his control on correctly managing the rendering project. Honours are reserved to students who proved a particular brightness in the preparation and exposition of results during the three tests.

Recommended reading
P. Zingaretti, E. Frontoni, Informatica: tematiche generali, Ed. Simple, 2006 P.Zingaretti, Fondamenti di Computer Graphics, Pitagora, 2004.

Informatica Medica

Micaela Morettini

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide the main theoretical and practical tools to recognize and address the problems related to applications of information technology in health care.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
This teaching is characterizing for the Bioengineering sector (ING-INF / 06) and will provide knowledge about the main theoretical and practical tools to recognize and address the problems related to applications of information technology in health care. The knowledge will be provided through lectures. The student should prove to be able to apply the main concepts of database design, and to know the main tools related to health informatics (electronic patient record), the main health information systems (RIS, PACS, etc.) and the main standards and classification system in the healthcare (DICOM, HL7, ICD9-CM).
TRANSVERSAL SKILLS:
The practical application of the theoretical concepts discussed during the course regarding various aspects of the database design will improve the ability of the student in learning and in drawing conclusions The project, requiring autonomous and motivated choices, will also help to improve the overall autonomy of judgment of the student, and also the communication capability.

Program
Data and information: introduction and overview; medical knowledge and decision support (methods, systems, strategies and tools); information and communication. Data in computers: data processing; telecommunication; networking and integration; database design (conceptual and logical model, relational model, normalization, relational algebra, SQL). Data from patients: coding and classification (ICD9-CM, DRG, SNOMED); patient record, electronic patient record structuring; biosignal analysis, medical imaging analysis; standard for medical informatics (DICOM, HL7); healthcare information systems (HIS - Hospital Information System; RIS - Radiology Information System; PACS - Picture Archiving and Communication System; LIS - Laboratory information System).

Development of the course and examination
LEARNING EVALUATION METHODS
The assessment of student learning level consists of two parts: I) a written test, which is compulsory, lasting two hours, during which the student has to answer three theoretical questions and solve one practical exercise; II) an optional oral examination consisting in the discussion of 2 or 3 topics covered in the course, which can be accessed only if the written test is taken at least 18. The optional oral test must be supported in the same appeal of the written test.

LEARNING EVALUATION CRITERIA
In order to pass the written exam, the students must demonstrate that they have acquired a good theoretical knowledge of the subject and learned how to use the theoretical principles to solve practical problems by hand (exercise).

LEARNING MEASUREMENT CRITERIA
During the examination, the student's independent ability to solve problems and the knowledge of the theoretical principles of medical informatics will be evaluated.

FINAL MARK ALLOCATION CRITERIA
The final mark (out of thirty), will coincide with that of the written test in case the student chooses not to take the oral exam, or averaging the grades of written and oral. The honors will be given to students who, having achieved the highest rating, have demonstrated complete mastery of the subject.

Recommended reading
1) Teaching material. 2) JH van Bemmel, MA Musen. Handbook of Medical Informatics . Springer, 2000. 3) P Atzeni, S Ceri, S Paraboschi, R Torlone. Basi di dati: modelli e linguaggi di interrogazione . McGraw-Hill, 2009. 4) AS Tanenmbaum. Reti di calcolatori . Pearson Italia, 2003.

Informatica Multimediale

Primo Zingaretti

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
none

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course allows students to acquire methodological and technological knowledge for the design of multimedia systems and intelligent systems (based on graphics interfaces, computer vision, augmented/extended reality, etc.)
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
This abilty is expressed through a number of professionalizing skills, such as: ability to assess the quality of multimedia systems, in particular of Web sites; ability to develop graphical and intelligent interfaces; ability to choose software and technology solutions for Computer Vision systems and augmented reality.
TRANSVERSAL SKILLS:
The execution of a project on a topic agreed with the teacher and that will be done in a group of 3-4 students, will help improving the degree of autonomy of judgment in general, the ability to communicate stemming from teamwork, the ability to learn independently and to draw conclusions.

Program
1. Introduction. Definition of multimedia. Multimedia communication. Structure of hypertexts. Actual multimedia systems. Applications. 2. Representation. Digital images (vector and raster), text, animations. videos. Compression. 3. Computer Graphics. Introduction to 3D graphics, rendering pipeline, illumination and shading, curve-surface-solid modelling. 4. Perception. Colour. Fundamentals of Image processing and Computer Vision. 5. Interfaces. Input and output devices (monitors, digital cameras, scanners, etc.). Vocal and MIDI interfaces. Graphic and intelligent interfaces. Augmented reality. Virtual Reality. 6. Multimedia system design. Valutation of web sites: functionalty, accessibility, usability, etc. 7. Case studies/applications.

Development of the course and examination
LEARNING EVALUATION METHODS
Evaluation of students' learning level consists of two parts: the development of a work-project on topics agreed with the teacher and an oral examination. The work-project can also be developed in team, with a maximum of three students. In such a case, project discussion during oral examination must be done with the contextual participation of all members of the group.

LEARNING EVALUATION CRITERIA
The student will present and discuss the developed work-project during the oral examination. She/he must show to know well the knowledge and the methodological and technological competences for the design of multimedia systems. To pass the oral examination the student must show a comprehensive knowledge of the course contents, expounded in a sufficiently correct way

by using an adequate tecnical terminology.

LEARNING MEASUREMENT CRITERIA
Marks in thirtieths.

FINAL MARK ALLOCATION CRITERIA
The final evaluation will be in relation to the grade of knowledge of the course contents, as comes out from oral examination and on the base of her/his control on correctly managing the work-project. Tha maximum evaluation will be attained showing an in-depth knowledge of course contents, expounded with a complete control of tecnical terminology. Honours are reserved to students who proved a particular brightness in the oral exposition and/or in carrying out the work-project.

Recommended reading
1. Nigel Chapman & Jenny Chapman, "Digital Multimedia 4th ed", Wiley, 2011 2. P.Zingaretti, Fondamenti di Computer Graphics, Pitagora, 2004 3. Roberto Polillo, PLASMARE IL WEB Road map per siti di qualità Edizioni Apogeo, 2006

Information and Communication Technologies for Healthcare

Susanna Spinsante

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
To better address the study of this course contents, the student should have acquired at least the basics of signals theory and processing

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
Starting from the study of the problems of acquisition, processing and transmission of information in healthcare, the teaching enables students to acquire the knowledge necessary to understand the solutions currently proposed, and to lay the groundwork for the design of new solutions, relatively to the application of Information and Communication Technology to health. This knowledge, by integrating the knowledge gained in the teachings of signal processing and electromagnetic waves, will provide the student with a solid technical background, combined with a working methodology that will allow to design ICT systems for health.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to deal with advanced design issues, the student must be able to understand the issues related to the application of ICT in the health care and the system requirements, and implementing the correct design choices of engineering practice related to these types of systems. This ability will be applied in practice through a number of vocational skills, such as: 1. the ability to properly choose the right technology, and its system architecture, to meet the quality requirements and transmission capacity; 2. the ability to quantify the parameters necessary to the dimensioning of the system, through the use of appropriate mathematical models and design tools; 3. the ability to identify the causes of performance degradation, and the related countermeasures.
TRANSVERSAL SKILLS:
Simulations and practical experiences on particular application scenarios will enable students to improve learning skills in autonomy and to draw conclusions. Both the ability to communicate that the degree of independence of judgment in general, will be stimulated and refined through the oral discussion of the issues related to the sizing and design of ICT solutions in healthcare.

Program
Electronic Health Care (E-health): architectures and systems Communication requirements for E-health systems Communication technologies for E-health systems and sensors Wearable and implantable sensors and transmission requirements Communication technologies for M-health Interoperability among different E-health solutions Security and Privacy in E-Health Tele-Medicine and Tele-Rehabilitation Case Studies in E-health

Development of the course and examination
LEARNING EVALUATION METHODS
The assessment of student learning consists of an oral test, based on the discussion of two or more topics covered in the course, including the laboratory sessions. Some questions posed during the oral session may require the execution of short calculations.

LEARNING EVALUATION CRITERIA
In order to successfully pass the assessment of learning, the student must demonstrate that he/she possesses the knowledge and methodological skills for the characterization of the telecommunication requirements for E-health and M-health systems, the definition of their performance, the selection of the most suitable architecture in relation to specific use cases. To successfully pass the oral exam, the student will demonstrate an overall knowledge of the course content, including the laboratory sessions, presented in a sufficiently correct way with the use of proper technical terminology. The highest rating is achieved by demonstrating a thorough understanding of the course content, exposed with complete appropriateness of technical language.

LEARNING MEASUREMENT CRITERIA
For the oral test, a score between zero and thirty/thirty and praise is assigned.

FINAL MARK ALLOCATION CRITERIA
The highest rating is achieved by demonstrating a thorough understanding of the course content (including the laboratory sessions) exposed with complete appropriateness of technical language. Praise is given to students who demonstrate a particular brilliance in the oral test. Minimum rating is assigned to students showing enough knowledge of the course contents and ability to select and evaluate the correct technological approaches to E-health systems and architectures.

Recommended reading
Lecturer's handnotes available from course website; additional reading material (like papers) suggested or provided by the lecturer through the website.

Infrastrutture Viarie Urbane e Metropolitane

Maurizio Bocci

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
No required

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course deals with several aspects typical of urban road infrastructures providing analysis criteria for critical states, planning and management methods, theories and techniques of specific project solutions aimed at improving traffic and road safety in urban areas.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The course will give to students the background for acquiring analysis methods and techniques related to urban road infrastructures issues in order to identify, planning and put the most appropriate technical solution into practice. Theoretical and practical background will be acquired through classroom lectures.
TRANSVERSAL SKILLS:
The capability of planning, designing and analyzing through specific methodologies within the urban road infrastructures will allow students to improve own decision-making and judgment skills as well as learning abilities with the aim at improving the matching between the acquired background and the demands of the labor market.

Program
Classification of urban road: throughway, district, local and service roads. Roadways, lanes, shoulders, sidewalks, lanes for public transportation. Passages, pedestrian crossings, passage ways for vehicles, service stations, cycle-paths. Crossroads, road junction on different levels; directional, non-directional, semi-directional ramps. Cloverleaf interchange, partial cloverleaf interchange, collector/distributor road, diamond interchange, trumpet. Roundabouts. Automated, synchronized and coordinated traffic-lights. Calculation of traffic-lights cycle. Parking on one level and multi-levels. Fireproof standard specifications. Design methods. Urban traffic planning: standard specification, design general criteria. Traffic flow survey, O/D investigations, parking supply and demand. Networks traffic management. Pedestrian areas and limited traffic zones. Bus stations, tramways, subways, innovation systems with automatic driving, mechanized pedestrian paths.

Development of the course and examination
LEARNING EVALUATION METHODS
The examination consists of an oral test about the topics provided in the course program.

LEARNING EVALUATION CRITERIA
During the oral test, the student should demonstrate to have an overall knowledge of the subject. The exposition should be clear and include an appropriate technical terminology. The maximum mark is achieved when a brilliant exposition is associated with a deep knowledge of the subject.

LEARNING MEASUREMENT CRITERIA
Assignment of the final mark on a 30-point scale, with possible merit attribution.

FINAL MARK ALLOCATION CRITERIA
In order to pass the examination with the minimum mark, the student must have a proper knowledge of all the topics demanded. The maximum mark is achieved by means of a thorough analysis of the topic. The laude is assigned to the students which, through a brilliant exposition, show to have a deep knowledge of the topic.

Recommended reading
- G. Ferrari, M. Riccardi POSTO AUTO Ed. BE-MA - V. Dell'Aquila, V. Vannucci MANUALE DI TECNICA DELLA CIRCOLAZIONE E METODI DI MISURA DEL TRAFFICO - Ed. Maggioli - S.Canale e al. PROGETTARE LE ROTATORIE Ed. EPC Libri - S.Canale e al. PROGETTARE LE INTERSEZIONI Ed. EPC Libri - Slide presentations shown in classroom that are available on the official teacher page on UNIPM website.

Ingegneria Costiera

Carlo Lorenzoni

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Subjects of mathematics, physics, chemistry, geometry, hydraulics geotechnics, on the building materials and on graphic plots.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course allows the students to acquire the knowledge and the understanding ability of methods and applications for the conception, the interpretation and the analysis of the typical problems of the Coastal and of the Maritime Engineering. The course also aims at providing the students a vocational training capable of identifying, formulating and solving the main practical problems on the typical topics of the Coastal and of the Maritime Engineering.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
To the aim of facing advanced planning and applicative themes, the student will have to acquire capabilities of design and critical analysis for the practical problems typical of the Coastal and Maritime Engineering. Such capabilities will be expressed through the ability to solve applicative problems of the Coastal and Maritime Engineering, with specific reference to the identification of the wave attack features on the maritime structures. The ability to apply the acquired knowledge will be assessed through an oral exam.
TRANSVERSAL SKILLS:
The implementation of exercise works of solving practical problems on the Coastal and Maritime Engineering, that will be carried out singularly or grouped, with a report writing, will contribute to improve both the level of the general judgement autonomy and the communication ability bound to the group work, and finally the independent learning ability and leading to conclusions of the student.

Program
Maritime environment. Winds, waves and currents. Wind wave hindcast. Linear wave theory development and engineering properties of these waves. Wave propagation from deep waters towards the shore. Outlines of non-linear waves and of waves in nature. Outlines of wave statistics of short and long period. Typical harbour structure placements. Types and design outlines of external and inner structures of maritime harbours. Outlines of main marine dock furnitures, means of transport and for transshipment of the harbour merchandises. Outlines of realization of maritime works, of construction materials, of work equipments and of dredging operations. Outlines of littoral dynamics and of coastal protection systems. Outlines of off-shore structures. Outlines of physical models for maritime and coastal engineering.

Development of the course and examination
LEARNING EVALUATION METHODS
The exam consists in an oral test and in the discussion of the individual exercise work that the candidate presents for the exam. The oral test consists in some questions requested to the

candidate about the topics of the course. The individual exercise work consists in resolving some applying practices about the topics of the course, proposed during the lessons and autonomously carried out by the candidate.

LEARNING EVALUATION CRITERIA
The positive result of the exam is proved if the candidate shows, by means of the previously described tests, to have well understood the topics proposed during the lessons and to be able to apply autonomously and accurately the methods, the procedures and the models tipycal of the coastal engineering.

LEARNING MEASUREMENT CRITERIA
Assignment of the final grade in thirtiethes.

FINAL MARK ALLOCATION CRITERIA
If the candidate obtains at least the pass grade for both the oral test questions and the individual exercise work and in describing the applyied methods, he reaches a positive final evaluation. Maximum evaluation is reached when the candidate shows a deep and complete knowledge of the topics of the course. The praise is reserved to those candidates that carry out exactly and completely their oral test and individual exercise work and that distinguish themselves for them special excellence both for the oral presentation and for the editing of their individual exercise work.

Recommended reading
Dean R.G., Dalrymple R.A. Water Wave Mechanics for Engineers and Scientists , World Scientific, 1991. Matteotti G., Lineamenti di costruzioni marittime , Servizi grafici editoriali, Padova, 2001. US Army Corps of Engineers, Coastal Engineering Manual , CERC, Vicksburg, Mississipi, 2002. Partial notes of the course lessons are available at the copy service.

Ingegneria del Software

Luca Spalazzi

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Object oriented programming

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire knowledge and skills about software engineering principles and methods, especially requirement analysis, design and testing of a software system. This knowledge will allow the student to gain a clear understanding of the broader multidisciplinary context represented by the computing and automation engineering, in particular of the aspects specifically related to design and development of software systems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to deal with advanced and complex design issues and with innovation and development of new software systems, the student must be able to properly apply software engineering models and methodologies. This ability will be expressed through a number of professional skills, such as: 1. analyzing functional and non-functional system requirements; 2. designing usable and maintainable softwares; 3. testing a software.
TRANSVERSAL SKILLS:
Working in team to software develpment and writing the related report will improve the independence of judgment in general, the communication ability (also stemming from teamwork), and the ability to autonomously learn and draw conclusions of the student.

Program
Requirement Elicitation, Scenario-oriented, flow-oriented, data-oriented, behavior-oriented Analysis Architectural Design, Component-Level Design, User Interface Design Testing Strategies, Testing Techniques Specification languages: i*, UML, formal methods.

Development of the course and examination
LEARNING EVALUATION METHODS
The learning evaluation consists of two parts: 1) individual oral exam - a discussion about three topics from the syllabus; 2) group project - a group of 4 or 5 students must design a software agreed with the teacher and present the results. The group can choose a project that is also valid for the course: Distributed Computing Techniques

LEARNING EVALUATION CRITERIA
1) Individual oral exam - students must know what are methods and techniques to be used in software engineering. 2) Group project - the group must be able to apply such methods and techniques to the development of a software and to produce a final project report.

LEARNING MEASUREMENT CRITERIA
1) Individual oral exam: each one of the three topics assignes a score up to 10. The final mark for

the oral exam is the average score. 2) Group project - the review process takes into account the completeness and correctness of the final report (up to 20 marks), the software quality (up to 20 marks), and the presentation (up to 20 marks). The final mark for the group project is the average score. Up to 1 bonus mark is assigned according to group autonomy.

FINAL MARK ALLOCATION CRITERIA

Individual oral exam: up to 10 marks Group project: up to 21 marks Final mark: the sum of the previous two marks. 31 marks is equivalent to 30 e lode (full mark with distinction)

Recommended reading

J. Arlow, I. Neustadt, UML 2 e Unified Process (2^ ed.) , McGraw-Hill Italia. I. Sommerville, Ingegneria del software 8/Ed., Pearson Italia.

Ingegneria Economico Gestionale

Marcello Falasco

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
a basic knowledge of mathematics

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course will enables students to acquire knowledge about vertical integration choices (make or buy), the management of the supply chain and the management of innovation processes. This knowledge will further contribute to enrich students knowledge about the factors affecting firms decisions about the introduction of new products and the organization of the production processes. The course will also provide students with basic knowledge about the internationalization processes and the management of the supply chain in an international context.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
After completing the course students will be able to evaluate factors affecting make or buy decisions and the choice of contractual arrangements within the supply chain. Students will acquire several specific skills, such as: 1. the ability to evaluate the cost and benefits of vertical integration choices taking into consideration both production and transaction costs; 2. the ability to design and manage a supply chain; c) the ability to evaluate costs and benefits of innovative projects and to manage the introduction of technological and organizational innovations.
TRANSVERSAL SKILLS:
During the course students are required to solve a variety of organizational issues, referring to make or buy decisions or the evaluation of innovation projects. They are therefore required to present and discuss the results of their work in class. These activities will contribute to improve independent judgment, communication skills and autonomous learning.

Program
Microeconomics, value creation as aim of the firm. Corporate governance and management control system. Cost accounting. Cost benefit analysis. Supply Chain. The balance sheet and its interpretation. Investment decision making

Development of the course and examination
LEARNING EVALUATION METHODS
written and oral test

LEARNING EVALUATION CRITERIA
classroom writings

LEARNING MEASUREMENT CRITERIA
gradual interviews and pre-tests

FINAL MARK ALLOCATION CRITERIA

of the written examination and vote in thirty / thirty

Recommended reading

Begg D., Fischer S., Dornbusch R. Microeconomia Falasco M., Cardinali M., Guzzini E., Governo d'impresa e analisi dei costi . McGraw-Hill, Milano 2007 Falasco M., Guzzini E., Strumenti per la valutazione degli investimenti industriali ,McGraw-Hill, Milano 2009

Ingegneria Idraulica per l'Edilizia

Sara Corvaro

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables the students to acquire the theoretical and practical basis of the Hydraulic useful for the knowledge of the sewer collection and water distribution systems, moreover it allows to analyze and solve the problems of the design of the internal waterworks and rainwater collection. The course also allows students to face advanced themes about the recent-market demands and the research development of the hydraulic design in the buildings
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
To the aim of facing applicative themes of great complexity and to pay attention on the new design ways, the student will have to acquire capabilities for the critical resolution of engineering design phases. Such capabilities will be expressed through specific abilities like as the ability to identify and analyze the main characteristics of the system defined in a probabilistic way (rain and discharge); the ability to find the more suitable hydraulic model necessary to analyze the specific problem and to design the hydraulic systems of a building
TRANSVERSAL SKILLS:
The implementation of exercise works, made alone or in a group, about solving practical problems on Hydraulic Engineering in a building, will increase the degree of independence in terms of the critical choice, the communication ability and will allow to mix the multidisciplinary abilities.

Program
Frontal lecture (classroom, 60 hours) Part I: Generalities on fluids and basic principles of hydrostatics. The static thrust of a fluid on planar/non-planar surfaces. Fluid kinematics and dynamics. Momentum equation. Continuity equation. The Bernoulli Theorem. Pressure channel flow. Overview of open-channel flow. Part II: Overview and design of urban sewer collection and water distribution systems. Hydrological cycle. Rainwater statistical analysis. Maximum flowrate evaluation methods. Design of sanitary sewer and of internal waterworks for civil buildings. Overview of wastewater engineering treatment disposal. Rainwater harvesting and reuse for environmental-friendly buildings. Exercise works (classroom or in laboratory, 12 hours) Problems of design and control of hydraulic plants. Define of the main charatteristics of an hydraulic system (rain, flowrate). Example of the design of sanitary sewer and of internal waterworks for civil buildings. Design of sewer collection systems.

Development of the course and examination
LEARNING EVALUATION METHODS
The exam consists in an oral test and in the discussion of the exercise work that the candidate presents for the exam. The oral test consists in some questions requested to the candidate about the topics of the course. The exercise work consists in resolving some applying practices about the

topics of the course, proposed during the lessons and individually carried out by the candidate or by a group of a maximum of three students.The topic of the exercise work is the design of the internal waterworks for a civil building (if carried out by a single candidate) and the design of rainwater collection system, harvesting and reuse of the same civil building (if carried out by a group).

LEARNING EVALUATION CRITERIA
the positive result of the exam is proved if the candidate shows, by means of the previously described tests, to have the capabilities for the critical resolution of engineering design phases and to have well understood the topics proposed during the lessons and to be able to apply autonomously the methods and the procedures used for the exercise work.

LEARNING MEASUREMENT CRITERIA
Assignment of the final grade in thirtiethes.

FINAL MARK ALLOCATION CRITERIA
the candidate reaches a positive final evaluation if he obtains at least the pass grade for both the oral test and the exercise work and in describing the applyied methods. Maximum evaluation is reached when the candidate shows a deep and complete knowledge of the topics of the course. The praise is reserved to those candidates that carry out oral test and exercise work exactly and completely and that distinguish themselves for them special excellence both for the oral presentation and for the editing of their exercise work.

Recommended reading
Citrini D., Noseda G, Idraulica , Ed. Casa Editrice Ambrosiana, Milano, ISBN 88-408-0588-5 Da Deppo L., Datei C., Fognature , Libreria Cortina, Padova. Da Deppo L., Datei C., Fiorotto V., Salandin P., Acquedotti , Libreria Cortina, Padova Slides about the Part II of the Topics (MOODLE platform)

Ingegneria Sanitaria e Ambientale

Anna Laura Eusebi

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Elements of hydraulic

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire advanced knowledge of design of the physical units and physical-chemical processes for the treatment of urban, drinking and industrial wastewaters. This knowledge will allow students to acquire a scientific approach to the analysis and understanding of engineering problems with net reference to the design aspects and criticism of the typical application problems of environmental engineering.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will know how to interpret the problems related to the treatment of wastewater for the critical resolution of engineering design phases and construction of treatment plants. These capabilities will become applicative through specific expertise: 1. the ability to understand the issues of urban, drinking and industrial wastewaters; 2. the ability to structure the process flow schemes for the wastewater treatment; 3. the ability to dimension and design the physical operative unit and the physical-chemical processes.
TRANSVERSAL SKILLS:
The approach to the design the environmental engineering units will allow to increase the degree of independence in terms of the critical choices during the design phase and the learning capacity in the analysis and definition of the project data.

Program
1-Law: law analysis in matters of: drinking waters , wastewater treatment, waters protection from pollution and treatmement sludge . 2-Waters of supply: water cycle and natural water characteristics. hardless and aggressive waters. water supply requisites for drinkable use. management and measuring for water treatment processes (membrane processes, ionic exchange, coagulation, filtration, sedimentation and disinfection). 3-Waste waters: waste water characteristics (chemical, physical and biological characteristics, composition, unitary load factors, waste variation in concentration, management and control of the analytical data). elements of conceptual process design; evaluation and selection of the flows, evaluation and selection of the loads, process selection, hydraulic profile, mass balances. 4-Physical treatments: screening, grit removal, flow equalization, granular medium filtration, sedimentation, mixing, thickening, carbon adsorption, flocculation,flottation,disinfection,sludge dewatering: process theory, design and management 5-Biological reactor: main parameters and processes for WWTPs of small communities

Development of the course and examination
LEARNING EVALUATION METHODS
The evaluation will be written and following oral examination during which it is expected to be discussed the topics related to design the chemical, physical and biological processes for

wastewater treatment.

LEARNING EVALUATION CRITERIA
To successfully pass the evaluation of learning, the student must demonstrate the understanding of the concepts presented in class and the acqusition of the principles to design the chemical, physical and biological processes for wastewater treatment.

LEARNING MEASUREMENT CRITERIA
During the examinations will be evaluated the understanding of the theoretical and experimental principles of the treated topics and the ability to design the chemical, physical and biological processes for wastewater treatment.

FINAL MARK ALLOCATION CRITERIA
The final mark is attributed with minimum grade of 18/30 associated with complete knowledge of the treated topics. Additional points up to 30/30 will be awarded based on the general and specific skills. The evaluation "cum laude" will be given to students with elevated outstanding and critical exposition of the arguments.

Recommended reading
Course notes; Metcalf and Eddy, Wastewater engineering treatment disposal and reuse , Ed. Mc Graw Hill (Hoepli inter); Beccari et al., Rimozione di azoto e fosforo dai liquami , Ed. Bibliotece Tecnica Hoepli; Masotti, Depurazione delle acque , Ed. Calderoni; Sirini P., Ingegneria sanitaria ambientali , Ed. Mc Graw Hill; Henze, Harremoës, La Cour Jansen Arvin, Wastewater treatment Biological and chemical processes , Sec. Ed. Springe

Ingegneria Sismica

Laura Ragni

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Material covered in Structural Analysis is considered as assumed knowledge.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide the student with the basic theoretical knowledge and practical skills required for the design and the assessment of structures in seismic areas. By improving skills deriving from the first cycle degree, the student improves his knowledge in the framework of structural safety from natural hazards.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student develops skills necessary to analyse and design complex structural systems subjected to seismic actions. These skills are developed through lectures and design activities, developed in working groups, which implies the drafting of technical executive documents.
TRANSVERSAL SKILLS:
The designing exercise, which is developed in working group and requires the use of specific software for the solution of practical problems, contributes to improve the student s capability of identifying, formulating and solving problems, as well as the communicative skill, necessary for the teamwork.

Program
Elements of seismology Earthquake causes and mechanisms. Seismic wave propagation; laws governing the seismic motion, magnitude; elements of seismic risk and vulnerability, macrozonation and microzonation of Italy. Seismic action: performance based design, elastic response spectra. Dynamics of linear Single Degree Of Freedom (SDOF) systems: motion for the linear SDOF system; undamped and damped free vibration; response to forced vibrations: harmonic and periodic excitations, arbitrary excitations and seismic action; displacement, pseudo-velocity and pseudo-acceleration response spectra; static equivalent analysis. Non-linear SDOF systems: motion of the elasto-plastic oscillator; constant ductility spectra. Dynamics of Multi Degree Of Freedom (MDOF) systems: motion for a linear system with N degrees of freedom; free undamped vibrations (modal analysis) and forced vibrations (seismic action); linear analyses: static equivalent analysis and dynamic modal analysis. Design general rules: design spectra, structural ductility (material ductility, local and global ductility), capacity design. Seimic behaviour of three-dimantional frame buidings. Seismic code: general characteristics of buildings (elevation regularity, floor stiffness/resistance, plan regularity, seismic gaps and non-structural elements) , analysis methods and safety verifications. Seismic analysis of reinforced concrete buildings: behaviour factor; capacity design; structural ductility (material ductility, local and global ductility); Ultimate Limit State safety verifications, Damageability Limit State verifications. Basics on the seismic behaviour of other structural systems: steel buildings, masonry buildings, seismic isolation design and passive control systems. Tutorials: seismic design of a reinforced concrete frame building.

Development of the course and examination

LEARNING EVALUATION METHODS

The evalulation of student learning is based on two assessments: - the devopment of a seismic resistant design of a reinforced concrete building; - an oral exam consisting in a discussion of the design project and in some theoretical questions on the topics covered during the course; students may be requested to answer some questions in writing and the answers will be successively discussed. To access the oral exam the student is required to have completed the project. Revisions of the projects will be carried out in class during the trimester. These will provide an opportunity for students to receive feedback on their progress on the assigned projects.

LEARNING EVALUATION CRITERIA

Through the design project and the oral exam the student must demonstrate to have learned the topics covered during the course, such as analysis and design methods of seismic resistant structures.

LEARNING MEASUREMENT CRITERIA

The evaluation of both the assessment is expressed in thirtieths.

FINAL MARK ALLOCATION CRITERIA

The student is expected to pass both assessments. The final mark of the course will be calculated after the oral exam as the average of the marks received for these two assessments. The 'lode' will be awarded to students who, having correctly completed the two assessments, show an outstanding understanding in the subject.

Recommended reading

Castellani A., Faccioli E. Costruzioni in zona sismica. Hoepli, 2008. (in Italian) Petrini L., Pinho R., Calvi G.M. Criteri di progettazione antisismica degli edifici. Iuss Press, 2006. (in Italian) Cosenza E., Maddaloni G., Magliulo G., Pecce M., Ramasco R. Progetto antisismico di edifici in cemento armato. Iuss Press, 2007. (in Italian) Mezzina M., Raffaele D., Uva G., Marano G.C. Progettazione sismo-resistente di edifici in cemento armato. Città Studi, 2011. (in Italian) AICAP. Progettazione sismica di edifici in calcestruzzo armato. Guida all uso dell Eurocodice 2 con riferimento alle Norme Tecniche D.M. 14.1.2008. Edizione Publicemento, 2008. (in Italian)

Intelligenza Artificiale

Aldo Franco Dragoni

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course objective is to provide a broad overview of the concepts and methods that traditionally are grouped under the designation of "Artificial Intelligence". More emphasis is given to logic-based approaches, that is the methods that tend to replicate in the machines the logical inference mechanisms of human thought, and problem solving techniques based on research in a state space (with and without heuristics). As a programming tool theoretical and practical teaching of logic programming with constraints is provided.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will be able to represent knowledge and to design "smart applications" based on logical reasoning and research in a state space.
TRANSVERSAL SKILLS:
The knowledge provided during the course is completely oriented to "problem solving" and therefore to the ability to solve complex problems through the synthesis of suitable resolution algorithms. The study of symbolic logic helps to acquire a "mindset" that enables the student to formalize the problems correctly.

Program
Introduction to Artificial Intelligence Problem solving with Search. Euristic Search. Constraint Satisfaction Problems Adversary Search and Games Knowledge Representation and Reasoning Uncertain Reasoning and Fuzzy Logic First Order Logic Logic Programming PROLOG AI applications in PROLOG

Development of the course and examination
LEARNING EVALUATION METHODS
The examination is held in two tests: a test of programming in PROLOG and a written exam with exercises of Artificial Intelligence to solve with the help of textbooks and class notes

LEARNING EVALUATION CRITERIA
The evaluation focuses on the practice: the student must demonstrate the ability to program in PROLOG and knowing how to use the ideas of artificial intelligence to solve concrete problems.

LEARNING MEASUREMENT CRITERIA
Both tests are evaluated thirty

FINAL MARK ALLOCATION CRITERIA
The final evaluation is the average of thirty between the two assessments reported

Recommended reading

Russel, Norvig "Intelligenza Artificiale-un approccio moderno" Pearson Sterling, Shapiro "L'arte del Prolog" Hoepli

Laboratorio di Architettura e Composizione Architettonica 1 (EA)

Sabrina Cantalini

Seat Ingegneria
A.A. 2016/2017
Credits 3
Hours 50
Period E/1s-2s

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course provides students with basic knowledge on both the theoretical and on the setup tools and project control. the understanding of the functional reasons, logical-formal, technical and technological that govern the formation of the constituent characteristics of architectural design will be put into practice by the development of a design exercise about a specific study case about a single family house and of its annexes, even of public utility, that requires a functional coherence, spatial distribution and, in relation to theme of the project and the context of intervention, contained within limited spatial dimensions.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to address the design theme of elementary aspects of the project, the student must be able to correctly apply the critical skills of analysis of the design process in its synergy between technical and aesthetic components; in relation to its belonging to a physical environment and therefore with the seniority, with the landscape or the urban context, motivating design and technical solutions in relation to the compatibility and environmental sustainability and possible solutions in relation to requirements and regulatory and contextual constraints.
TRANSVERSAL SKILLS:
Transversal skills will be verified by performing an exercise in solving a problem, (architectural design of a single-family house) that will be done in groups and that will lead to the drafting of drawings that will allow the student to improve the degree of autonomy of judgment in general, his ability to communicate that also originates from the teamwork, his ability to learn independently and to get original conclusions. The teaching of the laboratory activity is coordinated with the disciplines of Architecture and Art History Area, the Representation and Survey Area, the Architectural and Engineering design Area.

Program
The project deals the issue of housing in consolidated urban system from the new habitability needs that are being consolidated in the contemporary city. This condition becomes a matter of great interest and importance, which requires a search on innovative forms and models of living (temporary, co-housing, flexibility, emergency) to be devoted to types of users increasingly diverse (non-resident students, young couples, singles, seniors, immigrants). Testing this architecture issue means to face, on one hand, the review and adaptation of traditional methods of urban design and architecture, and on the other hand, the more and more urgent debate about environmental and energy matters. The workshop will be about the housing issue in this new framework, in a multi-disciplinary approach that will take into account different aspects: morphological and typological (innovation of building types; quality fruition of the living space, both in terms of livability of housing and characterization of buildings and open spaces; analysis and research of the

distribution features and management of special residences; typological experimentation flexibility), energy and technology (innovation of construction techniques; testing of the final design to different scales of representation and the various building systems; verification of technical performance of the building organism with emphasis on the role of the building skin as the interface between the interior and the exterior of the building; definition of the basic environmental sustainability requirements) and environmental that an up-to-date architectural design culture today requires.

Development of the course and examination
Students activity will be tested in the examination of the teaching which is entrusted with the management of the laboratory.

Recommended reading
01. J. Lucan. Oma. Rem Koolhaas. Architetture 1970-1990 Electa, Milano 1991 02. P. Eisenman, La fine del classico . Cluva Venezia 1987 03. Oma/Rem Koolhaas, El Croquis n°53 , 1992, editore Richard Levene 04. MVRDV, El Croquis 79 , editore Richard Levene 05. B. TSCHUMI, Event-cities , PRAXIS 06. S. HOLL, El Croquis 78 , editore Richard Levene 07. UN Studio, Arnhem Central, in: MOVE, 010 Publisher, Rotterdam 08. UN Studio, IFCCA competition penn station, N. Y. in: MOVE , 010 Publisher, Rotterdam 09. SANAA, El Croquis 139 , editors Fernando Márquez Cecilia y Richard Levene arquitectos 10. D. ADJAIE, Houses , Thames & Hudson Ed. 2005 11. S. HOLL, El Croquis 1986-2003 , editors Fernando Márquez Cecilia y Richard Levene arquitectos

Laboratorio di Architettura e Composizione Architettonica 2 (EA)

Francesco Leoni

Seat Ingegneria
A.A. 2016/2017
Credits 3
Hours 50
Period E/1s-2s

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The Laboratory aims to implement, through exercises, the theoretical lessons learned during the connected course, related to the distribution and functional aspects of one or more buildings of collective character. The students have to apply disciplines of the area of representation and of the survey, of architectural design and restoration area, urban area, area of building production and building technologies to obtain a complete comprehension of the whole process of the urban and architectonic design.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
To apply the concepts the starting point consists in the interpretation of the environment, intended as a guideline for the design development, both in the case you have to intervene on a free area or to reconfigure an existing building. This ability will be carried on through design exercises, aimed at studying the types of public and private buildings in which the interdependences between the building and the city are clear, as well as the ones connected to the landscape and urban green.
TRANSVERSAL SKILLS:
Each working group will have to develop a different project, developing all the issues, and present it through technical drawings or renders. This will allows the student to improve his ability to communicate originating from the team-working, as well as his ability to learn and get the proper conclusions. The teaching of the laboratory activity is related with the disciplines of Architecture and Art, History, Rapresentation, Survey, Architectural and Engineering design.

Program
The project will work within the port areas of the Marche region and address the topic of the urban regeneration of areas historically used for the production and industry. It will focus on the theme of the waterfront and the reconnection between the city and the sea. Reuse, housing replacement, densification and reduction of land use, construction of public spaces are central issues of contemporary design of the waterfront which can be understood as a privileged field of experimentation of a project approach to sustainable and integrated transformation .

Development of the course and examination
Students activity will be tested in the examination of the teaching which is entrusted with the management of the laboratory.

Recommended reading
-R. Moneo,Inquietudine teorica e strategia progettuale nell'opera di 8 architetti contemporanei, Mondadori Electa, Milano 2005 -Le Corbusier, Verso una architettura, Longanesi&C., Milano 1984 -Le Corbusier, Il Modulor+Il Modulor 2, Gabriele Capelli Edit

Laboratorio di Architettura e Composizione Architettonica 3 (EA)

Giovanni Tecco

Seat Ingegneria
A.A. 2016/2017
Credits 3
Hours 50
Period E/1s-2s

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The laboratory gives to the students the knowledge and skills to apply the theorical issues learned in the course lessons. In particular, it is developed the detailed analysis of a of a coherent set of buildings, both historic and new, and explore possible different building types with the study of its relationship spaces in the broader urban context and landscape. The proposed project will enrich the knowledge of the plural aspects of contemporary architectural design, its connections with the urban scales and the multisciplinary and technological aspects of the design process.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to deal with the proposed issues and problems, the student will have to correctly understand and apply the notions he already received in the previous classes, and aspects that are commonly faced in the project design process. Those notions and skills will be applied in the laboratory sessions, where it will be developed project solutions and ideas in order to understand the complex layers of issues that concurr to elaboration of an architectural project. The student will have to interpret the issues given by the existing context and will have to express the talent to choose corrects forms and technicques and the ability to undertand their possible sinergy by identifying and motivating the proposed project solutions.
TRANSVERSAL SKILLS:
It is fundamental, in order to understand the wide and multidisciplinary dimesion of the architectural project, that the theorical knowledge will be tested in the several project step of the laboratory; those steps need to be always coordinated with the other disciplines, from urban planning to the structural project. The exercise will be done in work groups, in wich every student will develop his own communication skills and ability to learn.

Program
The first order of reasoning that the course offers is the need for tout court Sustainability that both in urban and architectural spatial terms, means reconstruct what exists and is condition of degradation rather then simply build less. The second order of interest is relative to how to tackle today the relationship between the new and heritage. Exceeded the proper respect for history and for the role and significance of the architecture of the past, our interest is now primarily oriented towards the large amount of architecture produced in the late twentieth century, whose character, though not without issues and meaning, should stimulate new ways and approaches to architectural experimentation. More possibilities for critical thinking are traceable within the increasingly central role of technical issues, and could convey new ways of interpreting the physical relationship between new and pre-existence. The recent economic crisis, beyond the measures financed by large capital, private and public, suggests a new way of intervention; "economies of scale", which until now often suggested demolition and reconstruction compared to regeneration, are reviewed

today with new parameters, stimulating recovery and expansion; all these issues, are the core on which the course will focus.

Development of the course and examination
Students activity will be tested in the examination of the teaching which is entrusted with the management of the laboratory.

Recommended reading
P. S. Byard, The architecture of Additions: Design and Regulation, Norton Books, Londra, 1998 Manuel Gausa, Housing, New alternatives, New systems, Bickhauser Actar, 2002 AA. VV, Parasite Paradise a manifesto for contemporary architecture and flexibleurbanism, NaiPublishers, Rotterdam, 2003 Ed Melet, Rooftop architecture, Building on an elevated surface, Nai Publishers, Rotterdam, 2005 Frederic Druot, Anne lacaton, J.p. Vassal, Plus, 2G, Editorial Gustavo Gili, Barcellona, 2007 Philip Jodidio, 100 great extensions & renovations, Image Publishing, 2007 S. Marini, Architettura Parassita, Strategie di riciclaggio della citt , Quodlibet, Ascoli Piceno, 2009 C. Anselmi C. Prati, Upgrade Architecture, Edilstampa, Roma, 2010 Anthony Vidler, The architectural uncanny, 1992 Santiago Ciruceda, Situaciones Urbanas, 2007 Tadei Pogacar & P.A.R.A.S.I.T.E., Museum of contemporary art the best is yet to come, 2007 AA. VV, Public cities:guidelines for urban regeneration, Mondadori, milano 2009 AA. VV, the ecological sustainability of design, AREA, 2009 G. Mondaini. Ri-Composizioni, Gangemi, Roma 2008 - G. Mondaini. MICROCITIES. Alinea Editori, Firenze, 2011 - G. Mondaini, M. Zambelli, BEHNISCH ARCHITEKTEN. Ance Edizioni, Roma, 2012 .G.Mondaini, D. Potenza, ABDR Architetti Associati. Ance Edizioni, Roma 2014

Laboratorio di Architettura Tecnica 1 (EA)

Simona Cerolini

Seat Ingegneria
A.A. 2016/2017
Credits 3
Hours 50
Period 2s

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course contributes to understand the complexity of the design process with regard to the scale of the detail, exploring the theme of the comparative choice among different building solutions from both a functional and technical approach and a formal one, that is coherent with the whole planning thought. To that aim the meaning of the architectural detail is described as the synthesis of both the technical and linguistic reflection as regards to a specific problem; projects are presented to understand how to consider the variety of aspects that are involved in the design approach; different methods are presented to help the reading of a reference project from the point of view of the building detail. This basic knowledge will guide the design choices among several possible solutions.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The course enables the students to develop a critical attitude that makes it possible to analyse the technical and aesthetic components of the design process at the detail scale and to apply the knowledge of the Architectural Engineering 1 course to a specific case. Using this knowledge, the student will be able to develop autonomous design solutions, that are both correct with regard to the construction and the performance and conscious of the formal implications in the whole architectural design. The student will also be able to justify his choices as the solution of the specific problem. These abilities will be developed carrying out the executive project of a residential building that is pre-defined during a previous exercise of the Architectural engineering 1 course and then modified in the laboratory.
TRANSVERSAL SKILLS:
The laboratory has the aim to improve the students ability to analyze and synthesize the several technical and aesthetic aspects of the architectural design at the constructive detail scale. The development of the executive project, carried out in groups, facilitates the exchange of ideas between the students and the discussion on the possible design options and it leads the students to improve their abilities in cooperation and communication of their own choices. The acquisition of independent judgment skills will be evaluated through the revision discussion with the teacher.

Program
The workshop explores the planning process of a family residence . The planning workshop particularly develops the theme of the architectural detail, with reference to the external and internal space and the envelope

Development of the course and examination
Students activity will be tested in the examination of the teaching which is entrusted with the management of the laboratory.

Recommended reading

Quarterly review "The Plan" ed. Centauro Bologna Monthly review "Detail" ed. Institute fur internazionale Architektur - Dokumantakio, GmbH&Co, KG, Munchen

Laboratorio di Architettura Tecnica 2 (EA)

Placido Munafo'

Seat Ingegneria
A.A. 2016/2017
Credits 3
Hours 50
Period 2s

Prerequisites
Knowledge of construction systems masonry.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course analyse the current design trends for the restoration of an existing building; methods for the definition of degradation and for the comparison between the traditional building techniques and innovative ones are presented; the main techniques of rehabilitation, consolidation and new building adequate to the current standards are examined.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The course provides the student with the ability to express critical attitudes and analysis of the design process in relation to the individual building and its aesthetic and technical components, the relationship with the pre-existence, with their conservation and maintenance. These skills are put into practice through the preparation of projects carried out individually or in group, during the hours of laboratory. These skills will be evaluated in order to determine the level of learning of the student.
TRANSVERSAL SKILLS:
The execution of individual projects will help improve the degree of independence of judgment in general and communicative ability that comes with working in a group, is the ability to learn and draw conclusions of each individual student.

Program
The laboratory will be divided into two parts: 1- recovery structural of an existing building in masonry, proposed or by chosen by a student. Analysis of the current state, project of interventions and functional requalification; 2- the project of a new small building in reinforced masonry. Both will proceed to the drafting of the design, construction details, the estimate metric calculation, so to allow an definitive and executive planning adequate to the Law in force.

Development of the course and examination
Students activity will be tested in the examination of the teaching which is entrusted with the management of the laboratory.

Recommended reading
- F. Doglioni, P. Mazzotti. Codice di pratica per gli interventi di miglioramento sismico nel restauro del patrimonio architettonico. - P. Munafò. Le capriate lignee antiche per i tetti a bassa pendenza. Evoluzione, dissesti, tecniche di intervento, 2002,

Laboratorio di Automazione

Andrea Bonci

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Elements of automatic control, elements of programming, elements of electronics

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire advanced knowledge on microcontroller's embedded systems design, to manage stand-alone or automated systems. This knowledge, by integrating the knowledge gained in the computer lessons, and automatic foundations, will gain a clearer understanding of the engineering multidisciplinary context, with reference to the aspects specifically related to: automation systems, IT, electronic technologies, and embedded systems design
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to acquire the ability to design, to innovate and to develop automation systems, the student must be able to correctly interpret the programming issues of autonomous systems already analyzed in other courses that are commonly addressed in engineering practice. This ability will come out through a series of vocational skills, such as: 1. the ability to appropriately choose the embedded microcontroller system, with all the calculation and potential interfacing, so that it provides the required performance; 2. the ability to program an embedded device also at the firmware level; 3. the ability to properly interpret the results of laboratory testing analysis, working in teams with other elements involved in the study of the problem.
TRANSVERSAL SKILLS:
The resolution of design issues, which will be done in groups, and that will lead to the drafting of a report, will help to improve the the student's degree of independence of judgment, the ability to communicate that also stems from teamwork, and the ability to learning and to draw conclusions.

Program
Contents (front lecturing 18 hours) This course deals with the design of embedded control systems. A specific micro controller is examined in detail as an example of embedded controller. In this analysis the resources incorporated and integrated with this micro controller are showed. Analog to digital conversion, PWM outputs, Timers, Serial communications and Wireless comunications are presented as functional blocks for real time controllers. Exercises (classroom and laboratory 54 hours) For all the items are provided both classroom and laboratory activities. Guided exercises about programming of embedded devices have been planned during the classroom activities. Students are invited to develop a project on a topic of the course. All projects have a hardware realization, the electronics of the I/O interface will be analysed. Students will learn how to analyse data-sheets of interface devices with the micro controller in order to allocate processor resources and to define driver electronics. The course also addresses design, control, programming of automatic systems as well as navigation problems of auonomous systems; it provide the background knowledge for the design of small automatic systems and atonomous robotic systems and provide the necessary tools to operate autonomously in indoor or outdoor environments applying state-of-the-art on navigation and control algorithms based on embedded technology.

During the course, the basics of embedded microcontroller are firstly treated, along with their application to control. Than, different of the more important types of technologies used for sensing and to control autonomous systems is introduced. Finally, the field of application and programming of an embedded microcontroller will be investigated, basically equipping an autonomous system designed and maded in our laboratory. These topics provide the link to real applications and to the state of the art in embedded robotics and autonomous systems.

Development of the course and examination
LEARNING EVALUATION METHODS
oral is on the course contents and on the individual laboratory activity.

LEARNING EVALUATION CRITERIA
During the oral discussion of the design task, hhe student must to During the oral discussion of the project, the student will present and discuss the technical report of the project developed and the activities carried out in the laboratory demonstrating that he/she has the knowledge and methodological skills and technology for the design and implementation of control and automation of autonomous systems. To successfully pass the test, the student will demonstrate: - to understand how to implement, independently, basic techniques of programming of the main devices of embedded micro-controllers - to know how to prepare a technical report.

LEARNING MEASUREMENT CRITERIA
to the project will be assigned a score from 0 to 30. The evidence is sufficient only if the score is greater than or equal to 18.

FINAL MARK ALLOCATION CRITERIA
The vote will be awarded by an assessment of the technical report and oral discussion about the project developed. The student will be able to achieve up to a maximum of 20 points in the project. The oral exam will consist of questions concerning the activities of a project, or arguments in class. The question will be evaluated with a score ranging from 0 to 10 points. The praise will be given to students who, having achieved the highest rating, have demonstrated complete mastery of the subject and clarity of exposition.

Recommended reading
James M. Conrad, Alexander G. Dean EMBEDDED SYSTEMS, AN INTRODUCTION USING THE RENESAS RX62N MICROCONTROLLER edition 201, available on web site (http://www.cesr.ncsu.edu/agdean/Books/RENESAS%20RX62N%20MICROCONTROLLER.pdf), lecture slides are made available by the teacher in electronic format.

Laboratorio di Disegno dell'Architettura 1 (EA)

Giorgio Domenici

Seat Ingegneria
A.A. 2016/2017
Credits 3
Hours 50
Period 2s

Prerequisites
Adequate knowledge of the classical methodologies of representation.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The workshop deals with simple works on the themes of drawing an representation of architecture, the laboratory activity iscoordinated with other disciplines in the areas: History of architecture and art.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to address advanced design themes, even of considerable complexity, and treat the innovation and development of new products and new technological processes through the application of knowledge, the student will be able to identify the method of representation that best fits case to deal with. This ability through a series of skill in the base part is partly governed by professional skills, such as: 1. the ability to appropriately choose the correct methods of representation and the appropriate technologies for its implementation; 2. The ability to make the most suitable choice to the representation of the case in question; 3. The ability to interpret and communicate the ideas that gave rise to the representation.
TRANSVERSAL SKILLS:
The execution of practical activities that they will apply the knowledge gained on specific case studies, which will be conducted in groups or individually and that will lead to the drafting of a representation of the product will help improve the degree of independence of judgment in general, and the ability communication that is also derived from the work group and the ability to learn independently and to draw conclusions, the student.

Program
The course aims to provide the specific skills of architectural drawing which, in its various phases, becomes the complete representation of the creative idea, both artistic and technical, with the prerogative of a drawing aimed and intended for the construction process. The course will address the various methods of representation in order to convert the idea of a building or part of it in tecnhical design, by means of the essential documents allowing the complete understanding of the architectural manufact. Preliminary sketches, plop plans, planimetries, sections, execution details, prospects and axonometries, will be hence addressed, as well as essential completion elements: sheet formats, margins, lay outs, scales, quotes, graphical signs, symbols, etc..

Development of the course and examination
Students activity will be tested in the examination of the teaching which is entrusted with the management of the laboratory.

Recommended reading
Il disegno dell'architettura by G. Parra - ed. Pitagora - Bologna; Handouts provided by G.

Domenici.

Laboratorio di Informatica Grafica (EA)

Ferruccio Mandorli

Seat Ingegneria
A.A. 2016/2017
Credits 3
Hours 50
Period 2s

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The laboratory course allows students to acquire the main methods and technologies for the graphical modeling and, above all, the rendering process.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Laboratory lessons, focused on exercises to illustrate the methodologies for the realistic rendering of three-dimensional models, will express a range of professionalizing skills, such as the ability to use raster and vector graphics software packages and ability to assess the quality of their project in relation to projects of fellow students.
TRANSVERSAL SKILLS:
The execution, which will start during laboratory hours, of a predefined rendering project will help improve communication skills coming from working in groups.

Program
Laboratory workshops with software systems for modeling and rendering of 3D interior scenes. The workshops include: definition of simple 3D geometric models; import and tuning of the geometric model; camera setting; setting of standard and photometric lights; choice and setting of the parameters of the lighting algorithm and rendering; definition of the materials also through procedural maps and texture; textures quality analysis and correction.

Development of the course and examination
Students activity will be tested in the examination of the teaching which is entrusted with the management of the laboratory.

Recommended reading
Documents handed out during the course and material available on the eLearning platform (https://lms.univpm.it)

Laboratorio di Meccatronica

Giuseppe Conte

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Basic notions of automatic control, computer sciences, electronics

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course provides students with knowledge about design and control techniques of mechatronic devices and/or systems. It facilitates the acquisition of the necessary practice in their construction and it develops the ability to understand and to assess the adequacy of mechatronic solutions to real problems, with particular regard to the control aspects.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Student acquires the ability to understand and to formalize specific issues concerning the design of devices and/or mechatronic systems starting from a description of the requirements they must meet. They learn to use the knowledge previously acquired in the area of automatics, computer science and electronics - adding, if appropriate, basics notions of other engineering disciplines in order to organize and perform all activities required to construct specific devices and/or mechatronic systems, according to design specifications. They develop their ability to assess the proposed solutions and the results of their work by validation and testing.
TRANSVERSAL SKILLS:
By formalizing a problem and designing and constructing a device and/or mechatronic system that solves it, students, working in groups of three/four individuals, develop their ability: to learn by evaluating, individually and in groups, the completeness and adequacy of their preparation; to make judgment in dealing with interdisciplinary problems, in evaluating in a critical way their own resources and those of the group, in organizing the work so as to respect assignments, in managing equipment and materials; to communicate effectively in dealing with group dynamics, in formulating and properly describing solutions to the problems under consideration, in presenting their own work

Program
- Mechatronics systems: examples, characteristics, features. - Control aspects in mechatronics systems.. - Design and realization of mechatronics systems. - Design and realization of controllers for mechatronics systems.. - Realization of simple mecha

Development of the course and examination
LEARNING EVALUATION METHODS
The work is evaluated according to the following criteria: attendance, ability to interact with the group, respect of deadlines; ability to define formally, to analyze and to summarize practical design, construction and testing problems; ability to design and to implement solutions to the considered problems; adequacy of the proposed solutions in relation to the specifications; ability to document the work done through weekly reports and final presentation; clarity and correcteness of the final presentation.

LEARNING EVALUATION CRITERIA
The work is evaluated according to the following criteria: attendance, ability to interact with the group, respect of deadlines; ability to define formally, to analyze and to summarize practical design, construction and testing problems; ability to design and to implement solutions to the considered problems; adequacy of the proposed solutions in relation to the specifications; ability to document the work done through weekly reports and final presentation; clarity and correcteness of the final presentation.

LEARNING MEASUREMENT CRITERIA
Grade for each of the above criteria is as following: - totally missing: 0 points seriously not sufficient (lack of competence, substantial errors and/or substantial gaps that prevent the fulfillment of specifications): 1 point moderately not sufficient (marginal errors and/or marginal gaps that do prevent the fulfillment of specifications): 2 points - sufficient (substantial absence of substantial errors and/or substantial gaps; specifications are substantially fulfilled): 3 points - good (absence of errors and/or gaps; specifications are fulfilled): 4 points very good (high competence, reliability and autonomy; specifications are completely fulfilled): 5 points.

FINAL MARK ALLOCATION CRITERIA
The overall grade is the sum of the gades obtained for each criterion. 30/30 cum Laude is for candidates who master completely the topics and are able to illustrate them clearly.

Recommended reading
Lecture notes

Laboratorio di Restauro Architettonico (EA)

Fabio Mariano

Seat Ingegneria
A.A. 2016/2017
Credits 3
Hours 50
Period 2s

Prerequisites
Knowledge of ancient and modern History of Architecture; good handling of drawing instruments for Architectural Survey, manual techniques and electronic softwares for graphical rendering

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
For "Restoration / conservation" it is understood any intervention aimed at protecting and fully transmitted to the future a historical-artistic and environmental monument, facilitating the reading of its parts that have evolved over time, putting in security in a reversible way its structures and surfaces and providing durability and its transmissibility in time. It is however a "critical act" by the designer, whose reliability increases with the analytical knowledge of the building of scientific and cultural bases. The lab is aimed specifically to train students capable of dealing with these issues in a way independently and effectively. The lab is designed in coordination with Area of the History of Architecture; Area Imaging and Surveying; Area Technology of Building Elements; Area Technical Architecture; Area of Structural Engineering, Area of Architecture and Architectural Composition.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to address specifically the issues, even of considerable complexity, inherent in the project of restoration and conservation, through the application of acquired knowledge, students will be confronted with the main methods of investigation on the monuments. These investigations will be articulated through a series of professionalizing skills, such as: acquisition of architectural, photographic and cartographic survey, historical and documents analysis, survey and definition of fissures and degrade framework. The result of the investigation will then be synthesized in elaborate technical and graphical project.
TRANSVERSAL SKILLS:
Students will be divided into working groups and each of them will be entrusted with project exercise that will target the testing of cognitive analysis on the monument and the design methodologies presented during the lessons. The assigned topics will be related to urban scale architectural complex or singol monuments or to parts of historic architectural organisms.

Program
Laboratories will be strictly connected to the Course of Restauro Architettonico. Restoration means to be engaged in the guardianship of an historical monument and to hand it on to the future as it is, with his total heritage of historical marks, by making it easy to be understood to our posterity in every part, giving readability to his transformations during the times. Likewise we are obliged to set up all technical actions to preserve his structural and surfaces integrity during the times to come. As well restoration is a critical action , which is the more effective the more we deeply know his history (age, building documents, surveys, materials analysis, etc.). Since this informations are basic to restore the past, they will be analyzed and carefully handled in our restoration project, with realistic consciousness of up-to-date technical rules and laws. On-the-spot investigations, technical specimens and papers, as well as specific lectures by professional advisers will help us to carry out

our academic projects.

Development of the course and examination
Students activity will be tested in the examination of the teaching which is entrusted with the management of the laboratory.

Recommended reading
S. FRANCESCHI, L. GERMANI, Manuale operativo per il Restauro Architettonico, Ed. DEI, Roma 2010.

Laboratorio di Storia dell'Architettura 1 (EA)

Stefano Santini

Seat Ingegneria
A.A. 2016/2017
Credits 3
Hours 50
Period 2s

Prerequisites
In relation to educational objectives that have a tendency to develop critical knowledge of the residential buildings in their particular conformation, does not considers necessary any prerequisites.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The laboratory provides additional tools for the understanding of the design process, from the idea to the design and the construction of architecture, the city and the landscape through reading exercises of case studies selected from the ancient history and the contemporary. In close relation to the issues addressed in the course, it helps to provide the students with the analysis of the heritage and to stimulate sensitivity to cultural and architectural context.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The knowledge and understanding of the complexity of architectural design are tested in laboratory activities, ranging from the graphic workd to the elaboration of spatial models at different scales.
TRANSVERSAL SKILLS:
The reading of case studies to understand the evolution of languages and techniques of architecture and construction carried in the laboratory is aimed to encourage the learning ability of critical and technical tools that will be developed in the design disciplines.

Program
The laboratory provides additional tools for the understanding of the design process, from the idea to the design and the construction of architecture, the city and the landscape through reading exercises of case studies selected from the ancient history and the contemporary. In close relation to the issues addressed in the course, it helps to provide the students with the analysis of the heritage and to stimulate sensitivity to cultural and architectural context. The knowledge and understanding of the complexity of architectural design are tested in laboratory activities, ranging from the graphic workd to the elaboration of spatial models at different scales. The reading of case studies to understand the evolution of languages and techniques of architecture and construction carried in the laboratory is aimed to encourage the learning ability of critical and technical tools that will be developed in the design disciplines.

Development of the course and examination
Students activity will be tested in the examination of the teaching which is entrusted with the management of the laboratory.

Recommended reading
Bruno Zevi, Saper vedere l architettura , Einaudi, Torino 1993. Robert Venturi, Complessità e contraddizioni nell architettura , Dedalo libri, Bari 1980. James S. Ackerman, La villa , Edizioni di Comunità, Torino 2000. David Watkin, Storia dell'architettura occidentale , Zanichelli, Bologna

2016.

Laboratorio di Tecnica delle Costruzioni (EA)

Giuseppe Pace

Seat Ingegneria
A.A. 2016/2017
Credits 3
Hours 50
Period 2s

Prerequisites
Knowledge of differential calculus and basic concept of theory of elasticity.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course gives knowledge and comprehension s ability on the complexity of design structural process. It allows students to acquire advanced knowledge on the structural behavior of reinforced concrete and steel. In the laboratory, projects on the theme of static security of buildings with concrete or steel structure are developed. The laboratory didactic activity is coordinated with subjects from the Area of the architectural design and restoration, the Area of building production and of building technologies.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
For the purpose of facing structural design themes - even very complex ones - and of illustrating the innovation and development of new technological processes throughout the knowledges application, students will be able to express a gamut of professionalizing abilities, such as: 1. the ability of giving the appropriate dimension to the structural elements so that building s execution will reveal itself compatible also with architectural needs. 2. the ability of identifying the developing behavior of structural elements under the provided actions.
TRANSVERSAL SKILLS:
The students dedication in a design field - which will be confronted in groups and will bring to a written report and design papers - will give its contribute for the improvement of both the degree of independence in judgement, and the communicative capacity, which comes from the team work too.

Program
Design procedures and project of common RC structures characterised by frames in seismic area.

Development of the course and examination
Students activity will be tested in the examination of the teaching which is entrusted with the management of the laboratory.

Recommended reading
R. Giannini Teoria e Tecnica delle Costruzioni Civili Ed. CittàStudi, 2011; R. Capozucca Teoria e Tecnica delle Strutture in Muratura Ed. Pitagora, BO, 2014.

Laboratorio di Tecnica Urbanistica (EA)

Fabio Bronzini

Seat Ingegneria
A.A. 2016/2017
Credits 3
Hours 50
Period 1s

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
Laboratory work consists of studying and developing projects and/or plans on an urban or territorial scale. Regeneration or new plant projects, with an evaluation of the approaches to plans, legislative choices and project/planning proposals of alternative intervention solutions. The Laboratory may appropriately coordinate itself with other urban planning, environmental, composition, infrastructure, geological and geotechnical fields.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to address design issues through the application of knowledge, the student should know how to draw up analysis and project maps, giving the solutions to eliminate the pathologies, protect and enhance the values, with graphs, reports and regulations. Laboratory work may be carried out through direct inspections in recovery and redevelopment urban areas. The skills acquired will be expressed through professional skills applied to the products of the Laboratory, such as: 1. the ability to design implementation Plans, or participate fully in design groups of complex plans; 2. the ability to identify pathologies and values and, on one hand, define solutions to mitigate/resolve pathologies and risks, and, on the other hand, to safeguard and enhance such values; 3. the ability to suggest good practices and guidelines to enhance urban and territorial structures.
TRANSVERSAL SKILLS:
Even when carrying out Laboratory work, all the possibilities of studying urban and territorial themes and contexts will be explored, coordinating these with other teaching, in order to encourage teamwork, communication skills, the student ability to judge autonomously, learning skills and the ability to draw conclusions and design solutions.

Program
Theory lessons and exercitation are focused on the editing of the PRG and sub ordered plans. Lessons also concern with: zoning technique evolution und use, principal laws in force, urban plan structure, elements of environmental planning.

Development of the course and examination
Students activity will be tested in the examination of the teaching which is entrusted with the management of the laboratory.

Recommended reading
TEXT BOOKS: F.Bronzini, M.A.Bedini, G.Marinelli, Il respiro italiano, Gangemi Editore 2015; Fabio Bronzini, Paola Nicoletta Imbesi, Maria Angela Bedini. Il Corsivo di Giuseppe Imbesi, La misura del Piano. Valutazione comparata della qualità nei piani urbanistici , Vol. 1, Gangemi Editore, Roma, 2014. Fabio Bronzini, Paola Nicoletta Imbesi, Maria Angela Bedini, Giovanni Marinelli,

Francesco Alberti, Giuseppe Michelangeli, introduzione di Paolo Colarossi, La misura del Piano. Strumenti e strategie , Vol. 2,, Gangemi Editore, Roma, 2014 OTHER REFERENCE BOOKS: M.A. Bedini, F. Bronzini, The new territories of urban planning: The issue of the fringe areas and settlement filaments, Land Use Policy, Volume 57, pp. 130 138, 30 November 2016. F.Bronzini, M.A.Bedini, G.Marinelli (a cura di), Mterritorio numerotre, Ancona Univerity Press, Ancona, 2015

Laboratorio di Tecnologia degli Elementi Costruttivi (EA)

Doriano Sordoni

Seat Ingegneria
A.A. 2016/2017
Credits 3
Hours 50
Period 2s

Program
Definition of the subject areas of study: simulation of theengineering process of a final project. analysis of a final draft is not realized, the definition of invariantdesign, verification of regulatory constraints. Identification of critical points of the proposed project andalternatives: this step is performed mainly with sketches on paperwithout the aid of computer programs - scale 1:100 Definition of significant portions of the project. For these processes the executive architectural portion is in particular: plans, sections and elevations scale 1:50 Choice of one / two section design to be developed at a scale of 1:50 with relative depth (details and details of scale 1:10) analysis of a proposed architecture constructed from the structural point of view: structural morphology, extempore preparation of a special project engineered with particular attention to the choice of their components from the point of view of performance

Development of the course and examination
Students activity will be tested in the examination of the teaching which is entrusted with the management of the laboratory.

Recommended reading
Schulitz Sobek Habermann, atlante dell acciaio , UTET; Rem Koolhaas, S,M,L,X,XL , Evergreen; Mario Salvadori, Robert Heller, Le strutture in architettura, UTET

Laboratorio di Urbanistica 1 (EA)

Maria Angela Bedini

Seat Ingegneria
A.A. 2016/2017
Credits 3
Hours 50
Period 1s

Prerequisites
Basic elements of urban and territorial project.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire advanced knowledge on the history of urban planning and examines the structure of settlements from a historical, analytic and planning point of view. The aim of the course is to provide a basic disciplinary culture, on which the student may build his or her training as an urban planning engineer. The Laboratory of Urban Planning allows students to gain advanced knowledge on urban history and examines the structure of settlements from a historical, analytic and planning point of view. The aim of the course is to provide a basic disciplinary culture, on which the student may build his or her training as an urban planning engineer.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to address design issues through the application of knowledge, the skills acquired will be expressed through a range of professional skills, such as: 1. the ability to correctly interpret the evolutive phenomena of the past through diachronic critical readings of historical settlement patterns, able-oriented technical solutions in response to contemporary issues; 2. the ability to identify the values and critical issues, considering a number of tangible and intangible elements; 3. the ability to interpret the phenomenal aspects in place, in order to suggest good practices and design guidelines for urban and territorial structures.
TRANSVERSAL SKILLS:
The description of the cultural and socio-economic dynamics, which have led to the current settlement contexts, must necessarily be compared to the expertise in other aspects of the town and territory, such as, for example, the evolution of national and regional planning legislative, the environmental protection, the re-use of cores and historical centres, the enhancement of the productive landscape, the urban development of coastal areas and the settlement layout of the hinterland territories, as well as new settlement models in extra-urban areas.

Program
Students have to arrange an essay concerning with topics of the course: meanings and symbols of ancient or ideal towns to be compared with planning choices for the town of the future.

Development of the course and examination
Students activity will be tested in the examination of the teaching which is entrusted with the management of the laboratory.

Recommended reading
TEXT BOOK: F.Bronzini, M.A.Bedini, G.Marinelli, Il respiro italiano, Gangemi Editore 2015; F. Bronzini, P. N. Imbesi, Maria Angela Bedini, La misura del Piano. Valutazione comparata della qualità nei piani urbanistici , Vol. 1, Gangemi Editore, Roma, 2014; F. Bronzini, P. N. Imbesi, M. A.

Bedini ed altri La misura del Piano. Strumenti e strategie , Vol. 2,, Gangemi Editore, Roma, 2014.
OTHER REFERENCE BOOKS: F.Bronzini, M.A.Bedini, G.Marinelli (a cura di), Mterritorio numerotre, Ancona Univerity Press,

Lingua Inglese Livello Avanzato

Antonella Pascali

Seat Ingegneria
A.A. 2016/2017
Credits 3
Hours 24
Period II

Prerequisites
Knowledge of the English language at Level B2 of the CEFR.

Program
1) Grammar: main English grammar structures with a focus to the gaps highlighted by the placement test. 2) Vocabulary: specific language of the business economics field through the analysis of real texts. 3) General Programme: Europass and cover letter, job interview, telephone conversation, work organization and responsibilities, company departments and job titles, customer service, products and packaging, international trade, the marketing, the Marche Region: internal market, industry, entreprenuership and SMEs, etc.

Development of the course and examination
LEARNING EVALUATION METHODS
The final evaluation is assessed through a written proof and a brief conversation. The written proof consists of grammar exercises, multiple choice and true/false questions regarding the specialized vocabulary and open questions about the topics of the general programme. The written test will be followed by a brief conversation in English.

LEARNING EVALUATION CRITERIA
In the written examination, students must demonstrate the knowledge of the English grammar structures, the specialized vocabulary of their field of study and the contents of the programme carried out in class. In the oral proof, they must be able to communicate in English fluently.

LEARNING MEASUREMENT CRITERIA
Exam assessment: grammar correctness, knowledge of the specialized vocabulary and of the topics of bussiness economy as well as the student's speaking skill.

FINAL MARK ALLOCATION CRITERIA
The minimum passing mark of eighteen is given to students who show a sufficient grammar and vocabulary preparation and a minimal knowledge of the programme carried out in class. The highest mark of thirty with honors, is awarded to students who show complete mastery of the English language, both written and oral, at the B2 level and a thorough knowledge of the topics of the general programme.

Recommended reading
1) Allison J., Townsend J., Emmerson P. - The Business 2.0 B2 Student's Book (2013) - Macmillan Education 2) Murphy R. - Englilsh Grammar in Use Fourth Edition (2012) - Cambridge University Press

Linguaggi di Programmazione

Alessandro Cucchiarelli

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
basic knowledge of computer programming and programming languages.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide students with advanced knowledge on different programming paradigms, along with the characteristics of the languages and the programming techniques associated with them. The acquisition of such knowledge will allow the students to expand the skills acquired in the other courses related to programming languages and programming methodologies.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
At the end of the course the student will be able to design software applications using the most appropriate programming paradigm and choosing the best programming language with respect to the application context. In particular, she/he will have the skills to use the declarative, functional, concurrent, stateful, multi-agent, relational and constraints based programming paradigms, along with the related programming techniques.
TRANSVERSAL SKILLS:
The process of knowledge acquisition required by the course will enhance the student s learning skills, the ability to deal with programming problems and make judgments to choose the solutions to be adopted, with respect to their efficiency and effectiveness. The illustration and the following deep analysis of a problem solving exercise, during the examination, will stimulate the improvement of the student's communication skills.

Program
1. Introduction to programming concepts - Computation model, programming model and reasoning model. Declarative model: main characteristics. 2. The Programming Languages - Syntax, semantics and pragmatics. Context Free Grammars. EBNF. Syntactic ambiguity. Parsing Techniques. Compilers and interpreters. Data representation: simple types (Integer, Real, Char) and structured types (record, tuple and lists). 3. A model of programming language: the kernel language - Motivation for its use. Definition: linguistic abstractions, data types, variables and partial values, statements and expressions. Language semantics. 4. Procedural abstraction in programming languages - Procedures: lexical scoping, closure, procedures and values, procedures activation. High order programming: procedural abstraction, genericity, instantiation and embedding. Application examples: loop abstraction and folding. 5. Declarative programming techniques - Last call optimization, recursion and iteration, recursion on tuples, exception handling. Data type definition. Abstract data type. Abstract data type programming. 6. Declarative concurrency - Definition. Threads Streams and stream objects. Demand-driven execution. Triggers. Lazy functions. Principles of real-time programming and message-passing. 7. Stateful programming - State definition. The stateful programming model. State representation: cells and arrays. Stateful programming vs. declarative programming. 8. Object Oriented programming - General characteristics. Modelling tools; Class and Objects. Abstraction: inheritance, forwarding and

Delegation. Visibility of properties and methods. OOP techniques. Examples. 9. Relational programming - General characteristics. Modelling tools. Choice and Fail. Solutions Space and Search strategies. Logic Programming. Examples. 10. Constraint programming. Contraint definition. Solution techinques and Search strategies. The constraint-cased computation model. Examples.

Development of the course and examination

LEARNING EVALUATION METHODS

the examination consists of an oral test, aimed at verifying the level of knowledge of the programming languages characteristics, the main programming paradigms and the programming techniques acquired by the student during the course. In order to assess the ability to define algorithms by using the concepts learned, the test begins with the request to code a simple function, according to given specifications, in the programming language adopted in the course and by applying the programming techniques learned. A correct coding is a prerequisite to continue the examination.

LEARNING EVALUATION CRITERIA

the candidate must show an adequate knowledge of the theoretical aspects related to the programming languages and the tools used for the validation of the lexical and syntactic correctness of programs coded in these languages. He/she must also show an adequate knowledge of the main programming paradigms, their correlation and the associated programming techniques, by solving simple application problems. A proper use of the technical language will be also evaluated. The maximum mark will be achieved by demonstrating in-depth knowledge of the course topics and the ability to efficiently and effectively use the knowledge learned to solve the proposed problems.

LEARNING MEASUREMENT CRITERIA

the student's learning will be measured with a maximum of 30 points.

FINAL MARK ALLOCATION CRITERIA

during the examination at least three questions are asked to the student, one of which implies the coding of a simple function by using the programming language adopted in the course. The mark is given as the sum of the evaluations of the answers. The laude is given to the students who have demonstrated a thorough understanding of the course topics.

Recommended reading

P.Van Roy, S.Haridi, Concepts, Tecniques, and Models of Computer Programming , MIT Press.

Logistica Industriale (GEST)

Maurizio Bevilacqua

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course allow the students to tackle with logistics topics related to a firm operation, for both industrial and service ones. Analysis and methodological tools are provided so that to effectively and efficiently manage physical and informative goods flow across the firm and the the logistic system.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The acquired students competencies can be summarized as in the following: 1. Analysis of packaging systems; 2. Plant layout influence on logistics policies; 3. Design and management of traditional and advances internal transportation systems; 4. Warehouse design
TRANSVERSAL SKILLS:
Classroom exercise and practises, and collaboration between the students, will enhance their judgements applying, communications and learning skills.

Program
Logistics is concerned with the flow of materials in the supply chain, from source through the total industrial process to the customer, and then on to disposal or re-use. The programme will provide a detailed understanding and knowledge of logistics and its place in all types of industrial systems. Evolution in logistics, automated control systems for the transmission of information to process. Automation in manufacturing systems (FMS, robotized cells and lines) and in assembling (FAS) together with automated guided vehicles (AGV) for transport. Design of product, its package and packing, as well as the adaptation and control of the distribution system and the administrative and information systems associated with the processes throughout the whole chain .Systems for handling, storage, control and protection from raw materials to finished products. Automated management of warehouses. Material requirements planning and management with MRP and JIT techniques

Development of the course and examination
LEARNING EVALUATION METHODS
The examination consists of an oral talk. Simple written calculations may be functional for the answer completeness.

LEARNING EVALUATION CRITERIA
A positive examination outcome requires the student to demonstrate a complete understanding of the course pillar concepts.

LEARNING MEASUREMENT CRITERIA

The examination final mark consists of a mark in the range 0 to 30.

FINAL MARK ALLOCATION CRITERIA
To pass the examination 18 marks are essential. An evaluation of 30 marks presupposes a deep knowledge of the topics discussed during the examination. A full marks with honours requires the student to perform the test correctly and thoroughly, highlighting as well a brilliant exposition.

Recommended reading
A. PARESCHI E. FERRARI A. PERSONA A. REGATTIERI, LOGISTICA INTEGRATA E FLESSIBILE, ED.ESCULAPIO 2002 CARON F. MARCHET G. WEGNER R., IMPIANTI DI MOVIMENTAZIONE E STOCCAGGIO DEI MATERIALI: CRITERI DI PROGETTAZIONE, HOEPLI 1997 Tutorials providev by the teacher available un the Univeristy moodle platform

Macchine e Reti Elettriche

Stefano Squartini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Linear Algebra, Mathematics, Physics

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
To know and understand the fundamentals of Circuit Theory and Electrical Machines, and the related applications within the Mechanical Engineering field. In particular, the student is required to know the main concepts of electrical and magnetic circuits, the issues of electrical energy delivery and usage, also from the security perspective, and finally the characteristics and way of working of static and dynamical electrical machines, with special focus on transformers, asynchronous/synchronous/DC machines
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Capability to analyse the properties and functional characteristics of electrical circuits composing a complex mechanical system, taking the security issues into account, and to select a suitable electrical machine for a simple mechanical engineering application
TRANSVERSAL SKILLS:
The studying activities in this course will allow the student improving its ability in correctly evaluating the effectiveness, the efficiency and the suitability of a design choice, and, at the same time, to estimate the economic costs and the security risks, in the light of the related standards and regulations

Program
INTRODUCTION TO ELECTRICAL CIRCUITS LPC CIRCUIT THEORY TIME-DOMAIN CIRCUIT ANALYSIS LAPLACE-DOMAIN CIRCUIT ANALYSIS STEADY-STATE CIRCUIT ANALYSIS POWER AND ENERGY ANALYSIS 1-PHASE AND 3-PHASE ELECTRICAL CIRCUITS ELECTRICAL POWER DISTRIBUTION AND SECURITY MAGNETIC CIRCUITS 1-PHASE AND 1-PHASE TRANSFORMERS ASYNCRONOUS MOTORS AND GENERATORS SYNCRONOUS MOTORS AND GENERATORS DC ELECTRICAL MACHINES

Development of the course and examination
LEARNING EVALUATION METHODS
The exam consists of 2 parts. In the first the student is asked to give written answers to 4 questions on the first 7 topics of the program, in the second to give written answers to 4 questions on the last 6 topics of the program. 1 hour and 30 minutes are given to the students to provide their answer for each part. The two tests can be sit by the students in two distinct sessions, and the second one has to be taken on within the two sessions following the one in which the first test has been passed. Further oral questions can be optionally made by the teacher to integrate the final examination grade.

LEARNING EVALUATION CRITERIA

For each test, the students have to show a sufficient knowledge of the corresponding arguments, for at least 3 out of the 4 proposed questions, and an adequate ability in presenting what the student knows in relationship to the test questions.

LEARNING MEASUREMENT CRITERIA

During the tests, the comprehension and analysis capability of the properties and functional characteristics of the circuits composing a complex electrical system and of electrical machines and networks, taking the electrical security issues into account, will be evaluated. Moreover, the ability to examine and assess the pros and cons of the electrical systems, studied during the lectures, when used in diverse applicative contexts will be also evaluated .

FINAL MARK ALLOCATION CRITERIA

For each test, a score within the 18-30 range is assigned. The minimum score required for each test is 16/30. The arithmetic average between the two scores is applied, with a rounding up strategy, and the result is proposed as final score for official registration. The maximum evaluation score is assigned to those students showing a deep knowledge of the theoretical contents of the course and a remarkable ability in applying those concepts to practical problems in the mechanical engineering field. The minimum score is assigned to students showing a sufficient degree of comprehension of the fundamentals of electrical circuit theory and electrical machines and networks, and of the related applicative issues.

Recommended reading

1- G. Martinelli, M. Salerno, Fondamenti di Elettrotecnica , seconda ed., Vol. I e II, Siderea 1996; 2- M. Guarnieri, A. Stella, Principi ed Applicazioni di Elettrotecnica , Edizioni Progetto Padova, 1998-1999; 3- Teacher s material available at the website https://lms.univpm.it/, and specifically at the pages related to this course.

Macchine e Sistemi Energetici (A/L)

Flavio Caresana

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Basic concepts of technical physics and fluidynamics

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course gives the student knowledge and understanding of the working principles of fluid-machines and energy systems. The topics treated in the course are the basis for the understanding of the operation of the main traditional energy conversion systems and of the fluid-machines fitted in these plants, covering positive displacement and dynamic, thermal and hydraulic types thus contributing to the specific education of mechanical engineering in thermal fluid-machines design. This knowledge, integrating that gained in the courses of Fisica Tecnica and Fluidodinamica, permits the student to cope with specific issues of thermodynamics energy conversion systems, environmental effects related to energy production and final use of energy
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will have the ability assess the energy, economic and environmental performance of fluid-machines and choose the best solution for a given application. These capabilities will consist in a series of skills such as: 1. the ability to choose the fluid machine suitable for a given plant; 2. the determination of the operating point of a machine according to load; 3. the evaluation of the overall performance of an energy conversion system
TRANSVERSAL SKILLS:
Since the performance of a fluid-machine involves mechanical, fluid-dynamical, thermal and environmental topics, the course will contribute to the completion of the student s basic technical competence by coordinating concepts from different cultural areas and thus enabling the graduates to choose autonomously the methods and techniques most suitable to identify optimum solutions..

Program
Introduction and classification of energy conversion plants and fluid machines. Reminds on thermo- and fluid-dynamic concepts applied to fluid machines. Steam plants: thermodynamical cycles and methods to increase conversion efficiency; steam generator and basics on the other components of the plant. Turbogas plants: thermodynamical cycles and methods to increase conversion efficiency and specific work; basics on turbogas plant components; basics on combined and cogeneration plants. Hydraulic turbines: hydraulic energy exploitation in hydraulic plants; impulse and reaction turbine types. Hydraulic pumps: centrifugal and positive displacement machines; pump's operative point and control flow methods. Positive displacement compressors: functioning and working cycle. Reciprocating internal combustion engines: ideal and indicated reference cycles; fundamental performance indexes definition; torque regulation methods for both compression and spark ignited engines, torque and power curves and road load matching.

Development of the course and examination
LEARNING EVALUATION METHODS

The assessment of student's learning will take place by means of an oral preceded by a written pre-test consisting of synthetic answers to three or four questions about basic topics; the overcoming of the pre-test is needed for the admission to the oral examination.

LEARNING EVALUATION CRITERIA
The assessment of learning, based on the results of both the written pre-test and the oral exam, consists in verifing: the student's knowledge on the basic concepts connected with the operation of the machines and the energy systems covered during the course, his competence on machine and energy systems configurations and operating conditions, his ability to solve simple numerical problems with correct use of units and order of magnitude.

LEARNING MEASUREMENT CRITERIA
The student knowledge is graded through the attribution of a final mark out of thirty. The passing score is 18/30, the highest score is 30/30, brilliant students may receive in addition a praise. The final evaluation results from the weighted average of the pre-trial written examination (25%) and oral (75%). To pass the exam both tests should be sufficient.

FINAL MARK ALLOCATION CRITERIA
The outcome of the evaluation is positive if the student proves to have knowledge of all the basic subjects covered in the course. The highest score is achieved by demonstrating in-depth knowledge of the course contents. Praise is given to students who are particularlly brilliant in exposure and/or demonstrat particular mastery of the matters treated in the course, being able to analyze topics not explicitly covered or to treat standard topics in alternative ways.

Recommended reading
- Lecturer's notes. - Negri di Montenegro Giorgio, Bianchi Michele, Peretto Antonio, Sistemi energetici e macchine a fluido (1) , Editore: Pitagora.

Macchine e Sistemi Energetici (M/Z)

Leonardo Pelagalli

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Basic concepts of Technical Physics and Fluidynamics

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course gives the student knowledge and understanding of the working principles of fluid-machines and energy systems. The topics treated in the course are the basis for the understanding of the operation of the main traditional energy conversion systems and of the fluid-machines fitted in these plants, covering positive displacement and dynamic, thermal and hydraulic types thus contributing to the specific education of mechanical engineering in thermal fluid-machines design. This knowledge, integrating that gained in the courses of Fisica Tecnica and Fluidodinamica, permits the student to cope with specific issues of thermodynamics energy conversion systems, environmental effects related to energy production and final use of energy
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will have the ability assess the energy, economic and environmental performance of fluid-machines and choose the best solution for a given application. These capabilities will consist in a series of skills such as: 1. the ability to choose the fluid machine suitable for a given plant; 2. the determination of the operating point of a machine according to load; 3. the evaluation of the overall performance of an energy conversion system
TRANSVERSAL SKILLS:
Since the performance of a fluid-machine involves mechanical, fluid-dynamical, thermal and environmental topics, the course will contribute to the completion of the student s basic technical competence by coordinating concepts from different cultural areas and thus enabling the graduates to choose autonomously the methods and techniques most suitable to identify optimum solutions..

Program
Introduction and classification of energy conversion plants and fluid machines. Reminds on thermo- and fluid-dynamic concepts applied to fluid machines. Steam plants: thermodynamical cycles and methods to increase conversion efficiency; steam generator and basics on the other components of the plant. Turbogas plants: thermodynamical cycles and methods to increase conversion efficiency and specific work; basics on turbogas plant components; basics on combined and cogeneration plants. Hydraulic turbines: hydraulic energy exploitation in hydraulic plants; impulse and reaction turbine types. Hydraulic pumps: centrifugal and positive displacement machines; pump's operative point and control flow methods. Positive displacement compressors: functioning and working cycle. Reciprocating internal combustion engines: ideal and indicated reference cycles; fundamental performance indexes definition; torque regulation methods for both compression and spark ignited engines, torque and power curves and road load matching.

Development of the course and examination
LEARNING EVALUATION METHODS

The assessment of student's learning will take place by means of an oral preceded by a written pre-test consisting of synthetic answers to three or four questions about basic topics; the overcoming of the pre-test is needed for the admission to the oral examination.

LEARNING EVALUATION CRITERIA
The assessment of learning, based on the results of both the written pre-test and the oral exam, consists in verifing: the student's knowledge on the basic concepts connected with the operation of the machines and the energy systems covered during the course, his competence on machine and energy systems configurations and operating conditions, his ability to solve simple numerical problems with correct use of units and order of magnitude.

LEARNING MEASUREMENT CRITERIA
The student knowledge is graded through the attribution of a final mark out of thirty. The passing score is 18/30, the highest score is 30/30, brilliant students may receive in addition a praise. The final evaluation results from the weighted average of the pre-trial written examination (25%) and oral (75%). To pass the exam both tests should be sufficient.

FINAL MARK ALLOCATION CRITERIA
The outcome of the evaluation is positive if the student proves to have knowledge of all the basic subjects covered in the course. The highest score is achieved by demonstrating in-depth knowledge of the course contents. Praise is given to students who are particularlly brilliant in exposure and/or demonstrat particular mastery of the matters treated in the course, being able to analyze topics not explicitly covered or to treat standard topics in alternative ways.

Recommended reading
- Lecturer's notes - Negri di Montenegro Giorgio, Bianchi Michele, Peretto Antonio, Sistemi energetici e macchine a fluido (1) , Editore: Pitagora

Marketing

Simona Naspetti

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire knowledge and management methods to support decision-making in marketing management (B2C). Such knowledge will enable the student to gain a clear understanding of marketing techniques and operational management methods and apply them to the marketing policy management .
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to address the issues of market management and marketing function, through the application of knowledge, the student will develop the ability to perceive, understand and predict the market conditions in which companies compete, knowing how to make cost evaluations and price decisions, knowing how to use the marketing tools and management to understand and manage the company's market position, knowing how to present in a clear style, concise and appropriate language of the company's operating results. To this end, students will participate in a business simulation (business game) whose purpose is to apply and test their ability to make strategic choices in the marketing area. The group work will allow students to develop their ability to analyze in detail the many complex interactions that typically occur within a enterprises, including how to divide responsibilities and tasks within a group.
TRANSVERSAL SKILLS:
Participation in various educational activities, and in particular the business simulation, will help students to improve their degree of independence of judgment in interpreting, formulating and solving engineering management problems. At the same time the student will learn how to collaborate in research and development in order to develop a product for consumer markets, by helping to identify the best solutions for its realization, production and marketing.

Program
Introduction to marketing Marketing and marketing management Marketing and strategic planning Analysis of demand and consumer behaviour Market segmentation and product positioning Marketing mix: the 4 Ps (product, price, place, promotion)

Development of the course and examination
LEARNING EVALUATION METHODS
The course grade will be based on Class Contribution, Written Cases, Informal Group Marketing Presentation, Markstrat Presentation, Markstrat Performance, Final Exam.

LEARNING EVALUATION CRITERIA
based on the Association to Advance Collegiate Schools of Business (AACSB) standards. Tests are planned to verify students learning levels as related to: knowledge an comprehension of market

competition in the simulation environmenti ; developing a business strategy una prospettiva di business integrata; applying marketing mix instruments to manage the firm position on the market; Presenting the firm results in a clear style and with an appropriate use of language and marketing terms. team working and decision making during simulation.

LEARNING MEASUREMENT CRITERIA

Attending students: Moodle platform will be used to evaluate on going learning throughout different instru-ments (tests, Forum Use, questions, etc; Group effort wil be measured via oral, in itinere and ex-post tests individual effort wil be measured during the Group Simulation (Business Game) and in oral test both in itinere and ex-post; Results of a written (test) the learning level (objectives) reached Results of peer evaluations (by other team students). NOT attending students: individual Performance on a Simulation (Business Game); Results of a written (test) about the learning level reached; individual effort measured via an oral final exam.

FINAL MARK ALLOCATION CRITERIA

Wieghted mean of the learning measurement scores

Recommended reading

J.P. Peter e J. H. Donnelly jr. Marketing. McGrawHill, last edition (available in english). Business Game simulation MARKSTRAT. Students will be provided additional material and exercise (slides, case studies and relevant links) on the Moodle platform.

Matematica 1 (GEST)

Piero Montecchiari

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Basic elements of Calculus and Analityc Geometry

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide theoretical, methodological and applicative knowledge of mathematical analysis in the differential and integral calculus in order to gain expertise in the application of mathematical methods to real problems. In particular, the course aims to provide students with the knowledge of the basic elements of differential calculus and of the theory of integration for functions of one variable with various applications.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to accustom the student to follow simple concatenation of various arguments and to develop the ability to apply the methods of differential and integral calculus for solving engineering problems, the classical results of mathematical analysis for real functions of real variable, accompanied by many applications, will be introduced. This path will lead the student to the attainment of the following skills: 1. Ability to analyze problems; 2. ability to identify various solution methods; 3. ability to choose the best solving route.
TRANSVERSAL SKILLS:
The skills acquired during the course will be necessary to address the study of future courses. The resolution in the classroom and individually of many problems and exercises will improve the learning ability and independent judgment. The exposure of the learned topics and the specificity of the language of the basic sciences will develop the ability to communicate.

Program
Sets, Relations and Functions. Natural, Integer, Rational and Real numbers. Complex numbers, trigonometric and exponential representation. De Moivre Formula. The Induction principle. Modulus and powers. Exponential, logaritmic and angular functions. Limit of real sequences and its properties. Indeterminate forms. Monotone sequences. The Neper's number and related limits. Asymptotic comparison. Limits of real function of real variale. Properties. Indeterminate forms. Asymptotic comparison. Monotone functions. Continuity; The Weierstrass's and the Intermediate Values Theorems. Derivative and Derivative Formulas. Successive Derivative. The Fermat's, Rolle's, Lagrange's and Cauchy's Theorems. Derivative and monotonicity. Convexity. Primitives. The De L'Hospital's Theorems. Taylor Formulas. Asymptots and the study of the graphs of functions. Riemann integral and integrability. Definite Integral and its properties. Fundamental Theorem and Formula of the Integral Calculus. Indefinite Integral and integration methods: sum decomposition, by parts and sostitution. Improper integral and convergence tests. Series. The Geometric and Harmonic Series. Convergence tests. Absolute convergence. Leibnitz Theorem. Introduction to Taylor series

Development of the course and examination

LEARNING EVALUATION METHODS
The student will be assessed through on a written test and an oral test. The written test will assess the ability to solve problems by using the learned techniques. The oral test will assess the learning of the theory and the exposition skills.

LEARNING EVALUATION CRITERIA
In the exams the student has to prove that he understands the concepts presented in the course, that he knows the results and methods presented in the lectures, and finally that he is able to set a problem and solve it properly through the learned methods.

LEARNING MEASUREMENT CRITERIA
In the written test is evaluated the ability to set up and properly solve the posed problems, using their own methods of the course. In the oral exam it is assessed the knowledge of the concepts and results presented in the lectures, the presentation skills and the ability to make connections between the various concepts introduced.

FINAL MARK ALLOCATION CRITERIA
For each of the tests indicated above it is assigned a score between zero and thirty. The student will be admitted to the oral exam only if he passed the written test. The highest rating, equal to thirty of thirty, is achieved by demonstrating in-depth knowledge of the course contents and full autonomy in the performing the test. The minimum assessment, equal to eighteen of thirty, is assigned to students who manage to solve the proposed problems and who demonstrate sufficient knowledge of the topics of matter.The overall grade, out of thirty, is derived from the comparative evaluation of both tests. The praise is reserved to the students who, having carried out the tests correctly and completely, has shown a special independence and excellence.

Recommended reading
F.G. Alessio e P. Montecchiari, Note di Analisi Matematica uno , Esculapio (ristampa 2015)

Matematica 2 (GEST)

Giovanna Guidone

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
notions from the course of Mathematics I

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
At the end of the course, students will know about the several kinds of functions from R^n to R^m (with n,m=3). In particular, students will handle curves, surfaces, vector fields and functions of two or three real variables. Moreover, they will be able to compute derivatives and integrals related to such functions. Such knowledge (which completes that of Matematica I course) will allow students to model real situations.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
At the end of the course, students will be able to: 1) understand how real situations can be modelled; 2) apply such mathematical models to describe real situations. In particular, they will be able to use vector fields, curves, surfaces and functions of two and three real variable to describe real objects and forecast future behaviour.
TRANSVERSAL SKILLS:
Students will develop their capabilities in analysis, synthesis and independent judgement. This will be favoured by exercises and models included in this course. Finally, all the activities in this course will help the development of abstract thinking in the students.

Program
real functions of many real variables; partial derivatives, differentials and directional derivatives; Taylor's polynomies; extremi of a function in several variables; surface and space integrals; vector fields and properties; curves and surfaces; integral over curves and surfaces; differential operators; Gauss-Green's and Stokes' theorems; Laplace transform.

Development of the course and examination
LEARNING EVALUATION METHODS
Written test followed by an oral test.In the written part, students will solve several exercises where they have to apply tecniques of the multivariable calculus. In the oral test, students will be asked about topics concerning multivariable calculus.

LEARNING EVALUATION CRITERIA
Students will show capability of applying such notions in different exercises. Moreover, students will know about the main topics of multivariable calculus and will show their understanding of applications within the contexts explained during the lessons. .

LEARNING MEASUREMENT CRITERIA
for the minimum standard, student is supposed to be able to apply calculus tecniques to standard exercises. for the maximum standard, student is supposed to master these tecniques and to apply

them in an autonomous way.

FINAL MARK ALLOCATION CRITERIA
The knowledge of the basic notions of the course is necessary together with the capability of applying such notions to standard exercises. Moreover, the student will show their understanding of the meaning of what he has learnt. For excellence levels, the propriety of the mathematical language and of the competence in using theoretical notions within new situations is required.

Recommended reading
. Bramanti, C.D: Pagani, S. Salsa, Matematica, Zanichelli

Materiali Strutturali per l'Ingegneria Civile

Valeria Corinaldesi

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Basic knowledge on chemistry and physics.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire advanced knowledge on the structural behavior of materials, which is an essential basis for the development of applied studies in the field of Environment and Civil Engineering. The course enables students to acquire technical and technological knowledge for the use of construction materials, and for the knowledge of both mechanical characteristics and durability of the most common materials such as: concrete, steel and masonry.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to address advanced design themes and treat the innovation and development of new products and new technological processes through the application of knowledge, the student should be able to interpret in a correct manner the causes of structural and technological behaviors already analyzed in other courses.
TRANSVERSAL SKILLS:
The problem solving will contribute to improve the independent judgment skills of the students as well as their ability to learn and draw conclusions. The oral examination will contribute to develop ability to synthetize and communication skills.

Program
Mix design of concrete for structural use. Self-Compacting Concrete. Fibre Reinforced Concrete. Structural lightweight concrete. Heavyweight concrete. Polymer Impregnated Concrete. Shotcrete. Shrinkage and creep of concrete. Shrinkage compensating concrete. Concrete pavements. High Performance Concrete and Ultra High Performance Concrete. Environmentally friendly concrete. Steel for structural use. Load bearing masonry. Timber and glued laminated timber. Ceramic materials, glass, stone materials. Polymeric materials for building applications. Composite materials. FRP and FRCM systems for structural reinforcement. Durability and sustainability of structural materials.

Development of the course and examination
LEARNING EVALUATION METHODS
The exam will consist of an oral examination, in which the topics of the course will be discussed; it will consist of three questions related to three different topics among them illustreted in the course.

LEARNING EVALUATION CRITERIA
During the oral examination, the candidate should exhibit a proper knowledge of the properties, behaviour, production technology and applications of the different classes of materials.The student will get maximum score if able to show deep knowledge on the varior topics of the course as well as

if able to coherently describe concepts.

LEARNING MEASUREMENT CRITERIA
A score will be attributed to each of the three questions with a grading scheme based on a scale of 30 points: 0 score menas question not answered; 18 score means sufficently answered question, while 30 score means fully answered question; intermediate scores as a consequence.

FINAL MARK ALLOCATION CRITERIA
The final grade (to a maximum scale of thirty) will be the mean value of the scores obtained for each answer. The mean value will be calculated on three answers, but if the difference in the scores is higher than 10, a fourth question will be made and the final score will be the mean value calculated on four scores, the last included.

Recommended reading
M. Collepardi, "The new concrete", Edizioni Tintoretto. PDF-format files of the slides presented during lectures, uploaded on the Moodle platform.

Mathematical Methods for Bioengineering

Neculai Sinel Teleman

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
University courses in Analysis and Geometry.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course will allow : To know the tools and techniques of integration in several variables: line integrals, surface and volume. To know the methods for solving differential equations. To know the tools and techniques of complex analysis and the operational calculus, Fourier and Laplace and of the integral transform in the functioning of the MIR. Ability to apply them insolving scientific and technological problems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
This free-choice course will allow to integrate the basic mathematical knowledge with advanced courses in mathematics related to specific bioengenerering topics.
TRANSVERSAL SKILLS:
Knowlege of anatomy. Knowlegde of analytical and integral techniques as well as techniques of integral calculus.

Program
Introductory topology elements on the right. Introductory elements of topology in Rn. Metrical spaces. Introduction of general topology. Axioms. Open and closed sets. Closure of a set. Important topology spaces. Fourier series. Trasformata Fourier. Distributions. Spazi di Soboloev. Teoria generale of equations with partial derivatives. Teoria matematica which delle machine which perform radiographies.

Development of the course and examination
LEARNING EVALUATION METHODS
Two exams

LEARNING EVALUATION CRITERIA
General verification of assimilation during the presentation of the course.

LEARNING MEASUREMENT CRITERIA
Results of the exams

FINAL MARK ALLOCATION CRITERIA
Results of the exams

Recommended reading
Note notes

Meccanica Applicata alle Macchine

Massimo Callegari

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Basic knowledge on mechanics, geometry and calculus

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course explains the principles that underlie the operation of machinery and describes the most important mechanisms used in industrial applications. The course gives a basic engineering education in the industrial field and the student achieves a basic technical training in mechanics of machines. Such knowledge will be useful for the young graduates to interface with specialists of other engineering fields
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Through the application of the technical knowledge acquired in the class, students will be able to approach the study of the main subjects of machines mechanics, with particular reference to the kinematic, statics and dynamics analysis of machines and of simple mechanical systems. Furthermore, the student will develop the ability to recognize the most important types of mechanical components and to understand the fundamental aspects of their exercise.
TRANSVERSAL SKILLS:
The analytical nature of the most frequent problems in machine mechanics allows the student to develop an aptitude for logical reasoning firmly based on the scientific method, mainly due to the methodological rigor of the subject, as well as to train the ability to concentrate

Program
Kinematics pairs and mechanisms Contact forces and friction Kinematics of planar linkages Statics of mechanisms Dynamics of mechanical systems Mechanical vibrations Mechanics of kinematics pairs Gearings Power transmissions Clutches, brakes and lifting machinery

Development of the course and examination
LEARNING EVALUATION METHODS
The learning achievements of the students are evaluated in two parts, to be undertaken in the same session: - A written test, consisting of the solution of one or two exercises on problems related to the kinematic, static or dynamic analysis of simple mechanical systems; one or two hours are assigned for the solution, depending on the difficulty, and students can consult books or personal teaching materials; - An oral exam, consisting of the exposure of two or more subjects regarding mechanisms or the fundamentals of machines mechanics. During the course of the lectures it is possible to participate in course tests (two partial tests) which, if both positively overcome, allow direct access to the oral session until July included. The delivery of a written test in any examination session cancels the validity of these tests. If the student does not overcome one of the two partial tests or he/she is not satisfied with the result, the test can be recovered at the first written session after the end of classes.

LEARNING EVALUATION CRITERIA
To successfully pass the exam, the student must demonstrate, through the tests described above, having understood the basic concepts of the class and especially to have acquired the basic skills of the kinematics, statics and dynamics of machines (including vibrations) and of the most important mechanisms (kinematics pairs, gears, brakes and lifting machinery). The assignment of the final rating takes into account the knowledge of all the teaching topics, including mechanisms and machines described in the class. The highest rating is achieved by demonstrating a thorough understanding of teaching content in the context of the written and oral tests. Praise is reserved for students who, having done all the tests correctly and completely, present clearly a topic of their own choice on the mechanical subjects treated in Chapter 14 of the textbook.

LEARNING MEASUREMENT CRITERIA
A score between 0 and 30 is assigned to each of the tests indicated above (written, oral or partial tests): the score 0 corresponds to an exercise not performed or a question unanswered; the score 18 corresponds to a topic treated in a just sufficient way; the score 30 is given to students who demonstrate a particular brilliance in the oral presentation or in the preparation of the written part; intermediate scores are assigned accordingly

FINAL MARK ALLOCATION CRITERIA
In order to achieve a positive overall evaluation, the student must achieve at least 16 points (out of 30) in both the oral and written test and at least 18 points (out of 30) in the overall evaluation. The overall grade, out of thirty, is given by the weighted average of the marks obtained in the two tests, with rounding to the integer; the weight given to oral test is double that of the written test. With regard to the partial tests, each of them must be overcome by a vote of at least 16/30 in which case the student is admitted to the oral with a written vote equal to the average of the results achieved in the partial tests.

Recommended reading
Callegari, Fanghella e Pellicano: Meccanica Applicata alle Macchine , Città Studi, 2013

Meccanica Applicata alle Macchine (M/Z)

Matteo Claudio Palpacelli

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Basic knowledge on mechanics, geometry and calculus

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course explains the principles that underlie the operation of machinery and describes the most important mechanisms used in industrial applications. The course gives a basic engineering education in the industrial field and the student achieves a basic technical training in mechanics of machines. Such knowledge will be useful for the young graduates to interface with specialists of other engineering fields
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Through the application of the technical knowledge acquired in the class, students will be able to approach the study of the main subjects of machines mechanics, with particular reference to the kinematic, statics and dynamics analysis of machines and of simple mechanical systems. Furthermore, the student will develop the ability to recognize the most important types of mechanical components and to understand the fundamental aspects of their exercise.
TRANSVERSAL SKILLS:
The analytical nature of the most frequent problems in machine mechanics allows the student to develop an aptitude for logical reasoning firmly based on the scientific method, mainly due to the methodological rigor of the subject, as well as to train the ability to concentrate

Program
Kinematics pairs and mechanisms Contact forces and friction Kinematics of planar linkages Statics of mechanisms Dynamics of mechanical systems Mechanical vibrations Mechanics of kinematics pairs Gearings Power transmissions Clutches, brakes and lifting machinery

Development of the course and examination
LEARNING EVALUATION METHODS
The learning achievements of the students are evaluated in two parts, to be undertaken in the same session: - A written test, consisting of the solution of one or two exercises on problems related to the kinematic, static or dynamic analysis of simple mechanical systems; one or two hours are assigned for the solution, depending on the difficulty, and students can consult books or personal teaching materials; - An oral exam, consisting of the exposure of two or more subjects regarding mechanisms or the fundamentals of machines mechanics. During the course of the lectures it is possible to participate in course tests (two partial tests) which, if both positively overcome, allow direct access to the oral session until July included. The delivery of a written test in any examination session cancels the validity of these tests. If the student does not overcome one of the two partial tests or he/she is not satisfied with the result, the test can be recovered at the first written session after the end of classes.

LEARNING EVALUATION CRITERIA
To successfully pass the exam, the student must demonstrate, through the tests described above, having understood the basic concepts of the class and especially to have acquired the basic skills of the kinematics, statics and dynamics of machines (including vibrations) and of the most important mechanisms (kinematics pairs, gears, brakes and lifting machinery). The assignment of the final rating takes into account the knowledge of all the teaching topics, including mechanisms and machines described in the class. The highest rating is achieved by demonstrating a thorough understanding of teaching content in the context of the written and oral tests. Praise is reserved for students who, having done all the tests correctly and completely, present clearly a topic of their own choice on the mechanical subjects treated in Chapter 14 of the textbook.

LEARNING MEASUREMENT CRITERIA
A score between 0 and 30 is assigned to each of the tests indicated above (written, oral or partial tests): the score 0 corresponds to an exercise not performed or a question unanswered; the score 18 corresponds to a topic treated in a just sufficient way; the score 30 is given to students who demonstrate a particular brilliance in the oral presentation or in the preparation of the written part; intermediate scores are assigned accordingly

FINAL MARK ALLOCATION CRITERIA
In order to achieve a positive overall evaluation, the student must achieve at least 16 points (out of 30) in both the oral and written test and at least 18 points (out of 30) in the overall evaluation. The overall grade, out of thirty, is given by the weighted average of the marks obtained in the two tests, with rounding to the integer; the weight given to oral test is double that of the written test. With regard to the partial tests, each of them must be overcome by a vote of at least 16/30 in which case the student is admitted to the oral with a written vote equal to the average of the results achieved in the partial tests.

Recommended reading
Callegari, Fanghella e Pellicano: Meccanica Applicata alle Macchine , Città Studi, 2013

Meccanica dei Solidi e delle Strutture

Fabrizio Davi'

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
Calculus, Geometry, Physics

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to give the Solid Mechanics basics to understand the mechanical behaviour of skeleton, muscles and biological tissues, with a particular attention to constitutive issues
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
As part of the Engineering Training Base, relating to Industrial Engineering, teaching will provide knowledge about the principles of solid mechanics and structures and their application in biological systems such as ligaments, muscles, bones and blood vessels. This knowledge is acquired through lectures and exercises.
TRANSVERSAL SKILLS:
The theory and exercises of the course will help to improve the degree of autonomy, the ability to learn and to draw conclusions.

Program
Point dynamics as a mechanical model. Balance laws and constitutive relations. Energetics. Static solution and stability. Rigid bodies and systems. Kinematics and statics. Elastic systems. Equilibrium solution and their stability. Mechanics of elastic rods. Kinematics, balance laws and constituive relations. Strings. Energetics and variational formulations. Approximate solutions. Applications to biological systems: tendons, muscles, bones

Development of the course and examination
LEARNING EVALUATION METHODS
the final test consists of a written test and an oral colloquia.

LEARNING EVALUATION CRITERIA
The written test assesses the ability to perform an exact or approximated dynamic analysis of a plane structure with 1 or 2 degree of freedoms. The oral test must verify the ability to solve problems of a theoretical or applicative nature by starting from the equations of mechanics of rigid bodies. It could also require proofs of theorems or deductions of equations, focusing more on the deductive aspects rather than on mnemonic.

LEARNING MEASUREMENT CRITERIA
In the written test the relevance of the obtained results with the solution is checked; in the oral test both the knowledge of the topics and the capability to develop solutions to proposed problem are checked

FINAL MARK ALLOCATION CRITERIA

For the written exam the valuation is performed by assigning to each partial exercise a rating: the sum of these ratings is the final grade of the test. The maximum rating assigned to each exercise is known in advance and shown on the text. In the oral examination, the student can take for granted the result of written test or require an oral examination, in which case the vote is given taking into account the results of the written test (50% of overall assessment) and taking into account the topics knowledge, the capability to apply these knowledges to solve examples and the smartness and neatness of language.

Recommended reading

Note di Meccanica dei Solidi e delle Strutture (downloadable for free from the University website)

Meccanica del Continuo

Stefano Lenci

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Basic knowledge of structural engineering, including: kinematics, statics, material behaviour, linear elastic problem, principle of virtual powers, beam theory, solution of statically undetermined structures, failure criteria.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire advanced knowledge of structural and theoretical mechanics, with the objective to develop and implement original ideas in the field of structural engineering, to solve new design problems and to further enrich the knowledge in the field of machine design and mechanical systems, with particular reference to the structural aspects involved. In-depth knowledge in linear elasticity will be provided, including variational principles and the equations of plates, will be developed the theory of nonlinear elasticity, losing the linearity of equations, and some aspects of mechanics of materials (in particular fracture and plasticity), thus developing the ability to modeling and structural design of mechanical systems of high complexity. Through the comparative analysis of various cases it is acquired an awareness of the wider multidisciplinary context of engineering
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The knowledge gained will provide students with the appropriate understanding and skill in solving new and complex problems, in broad and interdisciplinary contexts. The student will acquire the full knowledge of every structural problem, however complicated, achieving the ability to select and apply relevant analytic and modeling methods, to formulate solutions appropriate for the mechanical engineering expertise, to approach fracture mechanics and plasticity problems, and to properly interpret the roots of the structural behaviours commonly faced in the engineering practice
TRANSVERSAL SKILLS:
The skills acquired during the course will then be applied and further developed in the application-oriented courses, thus promoting cross-disciplinary learning. The knowledge will also be useful for solving problems not typical of mechanical engineering, for example transverse to other branches of engineering

Program
1. Stability of elastic equilibrium 2. Generalized problems of bending 3. Advanced (non linear) kinematics of continuum 4. Advanced statics of continuum 5. Finite elasticity 6. Linear elasticity 7. Plane strain and plane stress problems 8. Variational principles and approximated solutions 9. Plates

Development of the course and examination
LEARNING EVALUATION METHODS
The learing evaluation will be done by means of an interview (oral examination) which will involve all topics discussed during the lectures. There will be at least tre questions, one per each main parts of

the course (topics 1-2, topics 3-5 and topics 6-9).

LEARNING EVALUATION CRITERIA
To get a positive evalution, the student must: - show that he/she understood the topics developed in the lectures; - be able to elaborate the previous concepts in order to solve advanced problems of structural engineering, including the understanding of complex mechanical behaviours.

LEARNING MEASUREMENT CRITERIA
The final evaluation, expressed by a number from 0 to 30 (positive evaluation from 18 to 30), will reflect: - the level of general knowledge of the student; - the capacity of the student to elaborate the general concepts, and his/her skills in applyin them to advanced structural problems typical of the mechanical engineering.

FINAL MARK ALLOCATION CRITERIA
The minimum sufficient score (18/30) is for students that show the understanding of the basic concepts illustrated during the lecturers. The mark will increase as much as the student will show a deep knowledge and his/her ability to elaborate these concepts. The maximum score (30/30) is obtained with a deep knowledge of all the topics and with the ability to apply them to real cases or to exercises proposed by the examinator. The summa cum laude is for students that show special cleverness during the interview.

Recommended reading
Baldacci, Scienza delle Costruzioni , UTET Ciarlet, Mathematical elasticity, vol I , North-Holland Corradi dell Acqua, Meccanica delle Strutture , McGraw-Hill Gurtin, An introduction to continuum mechanics , Academic Press Love, A treatise on the mathematical theory of elasticity , Dover Lenci, Lezioni di meccanica strutturale , Pitagora

Meccanica delle Macchine

Massimo Callegari

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Basic knowledge on the principles of mechanics

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
Students will be able to understand the principles underlying the operation of machines and production systems, also aiming at their management and maintenance. The tools and methodologies for modeling and simulation of machines and mechanical systems. will be introduced too.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Carrying out simple exercises in the classroom and the assignment of a team work will allow students to improve their capacity to apply the acquired skills to the modeling and the study of simple machines and mechanical systems.
TRANSVERSAL SKILLS:
The team work will develop students ability to work in group for the modeling and the development of engineering activities and to report on them. Communication skills will be tested during the final exam.

Program
FUNDAMENTALS OF MECHANICS Kinematics of mechanical systems: joints, kinematic chains and mechanisms Contact mechanics: friction and dissipative phenomena; wear; shocks Static equilibrium of structures and mechanisms: reticular structures; internal actions Energy and work; Efficiency of the machines; Mechanical vibrations MECHANICAL COMPONENTS Journal and rolling bearings; screws Power transmissions: gears, belts, couplings and chains Brakes; lifting machines. Cams, linkages and indexing machines ELEMENTS OF MECHATRONICS Electromechanical actuators. Fluid actuators. Mini-actuators Generation of linear motion Static characteristics; Choice of drive and transmission. SIMULATION OF MECHANICAL SYSTEMS Use of simulation tools for the analysis of mechanical systems Modeling and analysis of simple mechanisms using commercial CAD tools

Development of the course and examination
LEARNING EVALUATION METHODS
The level of student learning is evaluated by an oral examination, which consists of the discussion on one or more topics covered in class; students can present a topic of their choice, previously agreed with the teacher, addressed through the use of a tool for dynamic simulation

LEARNING EVALUATION CRITERIA
To successfully pass the examination, the student must demonstrate to understand the basic concepts of machine mechanics and in particular that it has acquired the basic knowledge on kinematics, statics and dynamics of the most important machines and mechanisms (joints, gears,

brakes and belts). The assignment of the final grade takes into account the knowledge gained on all matters of the class.

LEARNING MEASUREMENT CRITERIA

For each of the two parts indicated before (oral discussion and presentation of a simulation study) is assigned a score between 0 and 30: 0 corresponds to a study not developed or a question not answered; score 18 corresponds to a topic just sufficiently treated; score 30 is awarded to students who demonstrate a particular brilliance in the oral presentation or in the presentation of the case study; intermediate marks are allocated accordingly

FINAL MARK ALLOCATION CRITERIA

n order to have an overall positive evaluation of the examination, the student must achieve at least 16 points (out of 30), in each of the two tests described above and at least 18 points (out of 30) in the averaged evaluation. The overall grade is given by the weighted average of the marks obtained in the two tests; the weight given to the oral test is twice as much the one of the simulation study.

Recommended reading

Callegari, Fanghella e Pellicano: Meccanica Applicata alle Macchine , Città Studi, 2013.
Bernasconi, Filippini, Giglio, Lo Conte, Petrone, Sangirardi. Fondamenti di Costruzione di Macchine, McGraw-Hill, 2002. Nordman, Birkhofer. Elementi di macchine e meccatronica. McGraw-Hill, 2006

Meccanica delle Macchine Automatiche

Luca Carbonari

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
Basics of kinematics and dynamics of mechanical systems

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The multidisciplinary attitude of the Mechanics of Automatic Machinery allows providing the students with knowledge in several fields, which are partially specialized accordingly to the Course of Study. The students will acquire concepts on the modelling techniques of mechatronic systems, via both analytical and numerical algorithms and will be trained in the use of a commercial software for simulation of multibody systems. Moreover, they will learn the fundamentals of control of automatic machines and of mechatronics systems. The Automation Engineering students only will be trained on the methods for the analysis of simple mechanical systems, and for the functional description of the commonly used mechanisms, such as gearing and transmissions
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The students will be able to choose, and correctly use, the appropriate analytical methods for modelling and simulation of mechatronic systems behavior, both in feed-forward and feedback configurations. Moreover, the students will be capable of performing analyses of kinematics, of statics, and of dynamics of mechatronic systems, such as robots or automatic machineries, by means of numerical software tools and of multibody simulation environments, thanks to the acquired ability of critical interpretation of results
TRANSVERSAL SKILLS:
The development of group projects and their presentations during the examination will train the students to solve problems for which personal choices are required, as far as the attitude to work in team, to support and defend their own ideas in a technical environment, to show out the results of their own efforts in a well understandable way, and to be effective and convincing within their technical reports. Moreover, the peculiarity of the course of being populated of both Mechanical Engineering and Automation Engineering students, will address students towards multidisciplinarity, cross-sectorial issues and industrial innovation

Program
he course owns different topics for Automation Engineering (9 CFU, 72 hours of lectures) students and for Mechanical Engineering (6CFU, 48 hours of lectures) students as it follows: 1. KINEMATICS (for Automation Engineering students) Constraints and contact geometry. Mobility of machineries. Position, velocity and acceleration analysis of planar mechanisms. Kinematics of machines in space. 2. STATICS (for Automation Engineering students) Equations of statics. Static characterization of kinematic constraints. Relation between kinematics and statics. Contact forces and dissipative effects. 3. DYNAMICS (for Automation Engineering students) Geometry of masses. Equations of dynamics. Direct and inverse dynamics. Methods for dynamic modelling of mechanical systems. Efficiency of mechanical systems. 4. MECHANISMS (for Automation Engineering students) Gears. Power transmissions. Bearings. 5. CAE TOOLS FOR ANALYSIS OF

MECHANICAL SYSTEMS Kinematics of systems via absolute coordinates. Constraint equations and constraint Jacobian matrix. Basic concepts on algorithms for solution of ODE and DAE systems of equations. Use examples of multibody systems modelling via dedicated software environment: MSC ADAMS. 6. ROBOT MECHANICS Industrial and advanced robotics. Applicative examples and industrial standards. Basic concepts of kinematics in robotics: Denavit-Hartenberg notation, workspace analysis, manipulability ellipsoids. Motion planning: joint space motion planning and trajectories in the workspace. Experiences of industrial robot programming. Architectures of control systems in robotics. Components for automations: electrical motors and speed variators. Criteria for selection of electric motors. Sensors for use in robotic applications. Robot control schemes.

Development of the course and examination

LEARNING EVALUATION METHODS

The level of the student learning will be assessed through two tests: - a presentation and discussion of a project for which the student will be asked to model and analyze a simple mechanical system, defined in agreement with the teacher. - an oral examination, whose object will be the discussion of one or more topics of the course, even through exercises. The project will be carried out in groups of up to 4 people and will be discussed by the simultaneous participation of all students in the group during the oral examination.

LEARNING EVALUATION CRITERIA

Passing the test is subject to demonstration by the student's knowledge of the main contents of the course: methods of modeling and analysis of multibody systems and resolution of dynamic equations, the main mechanical components and their operation. In addition, the student must be able to apply the tools of analysis acquired in the study of simple mechanical systems, showing a sufficient sensitivity in the solution of problems of mechanics and automatics.

LEARNING MEASUREMENT CRITERIA

Passing the exam with a minimum mark requires sufficient knowledge about all the topics of the course. The maximum mark requires a good knowledge of the course content as well as an excellent evaluation of the project. The praise is reserved for students who, having done all the tests so correctly, have demonstrated a particular brilliance in the oral presentation.

FINAL MARK ALLOCATION CRITERIA

Attribution of the final mark in thirtieths. The teacher will be able to verify the knowledge and technical skills acquired by the student through the project evaluation. Then the investigation will be competed with a discussion on the topics of the course. The project and the oral esamination will be considered, respectively, with a weight of 1/3 and 2/3 on the overall evaluation.

Recommended reading

- J.J. Craig. Introduction to Robotics: Mechanics & Control. 3rd Ed., 2004, Pearson Prentice-Hall. - B. Siciliano. L. Sciavicco. L. Villani. G. Oriolo. Robotica. Modellistica, pianificazione e controllo. McGraw-Hill, 2008. For Automation Engineering students it is also suggested the Machine Mechanics textbook: - M. Callegari, P. Fanghella, F. Pellicano. Meccanica applicata alle macchine. Città Studi Edizioni.

Meccanica delle Macchine Automatiche

Luca Carbonari

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Basics of kinematics and dynamics of mechanical systems

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The multidisciplinary attitude of the Mechanics of Automatic Machinery allows providing the students with knowledge in several fields, which are partially specialized accordingly to the Course of Study. The students will acquire concepts on the modelling techniques of mechatronic systems, via both analytical and numerical algorithms and will be trained in the use of a commercial software for simulation of multibody systems. Moreover, they will learn the fundamentals of control of automatic machines and of mechatronics systems. The Automation Engineering students only will be trained on the methods for the analysis of simple mechanical systems, and for the functional description of the commonly used mechanisms, such as gearing and transmissions.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The students will be able to choose, and correctly use, the appropriate analytical methods for modelling and simulation of mechatronic systems behavior, both in feed-forward and feedback configurations. Moreover, the students will be capable of performing analyses of kinematics, of statics, and of dynamics of mechatronic systems, such as robots or automatic machineries, by means of numerical software tools and of multibody simulation environments, thanks to the acquired ability of critical interpretation of results.
TRANSVERSAL SKILLS:
The development of group projects and their presentations during the examination will train the students to solve problems for which personal choices are required, as far as the attitude to work in team, to support and defend their own ideas in a technical environment, to show out the results of their own efforts in a well understandable way, and to be effective and convincing within their technical reports. Moreover, the peculiarity of the course of being populated of both Mechanical Engineering and Automation Engineering students, will address students towards multidisciplinarity, cross-sectorial issues and industrial innovation.

Program
he course owns different topics for Automation Engineering (9 CFU, 72 hours of lectures) students and for Mechanical Engineering (6CFU, 48 hours of lectures) students as it follows: 1. KINEMATICS (for Automation Engineering students) Constraints and contact geometry. Mobility of machineries. Position, velocity and acceleration analysis of planar mechanisms. Kinematics of machines in space. 2. STATICS (for Automation Engineering students) Equations of statics. Static characterization of kinematic constraints. Relation between kinematics and statics. Contact forces and dissipative effects. 3. DYNAMICS (for Automation Engineering students) Geometry of masses. Equations of dynamics. Direct and inverse dynamics. Methods for dynamic modelling of mechanical systems. Efficiency of mechanical systems. 4. MECHANISMS (for Automation Engineering students) Gears. Power transmissions. Bearings. 5. CAE TOOLS FOR ANALYSIS OF

MECHANICAL SYSTEMS Kinematics of systems via absolute coordinates. Constraint equations and constraint Jacobian matrix. Basic concepts on algorithms for solution of ODE and DAE systems of equations. Use examples of multibody systems modelling via dedicated software environment: MSC ADAMS. 6. ROBOT MECHANICS Industrial and advanced robotics. Applicative examples and industrial standards. Basic concepts of kinematics in robotics: Denavit-Hartenberg notation, workspace analysis, manipulability ellipsoids. Motion planning: joint space motion planning and trajectories in the workspace. Experiences of industrial robot programming. Architectures of control systems in robotics. Components for automations: electrical motors and speed variators. Criteria for selection of electric motors. Sensors for use in robotic applications. Robot control schemes.

Development of the course and examination

LEARNING EVALUATION METHODS

The level of the student learning will be assessed through two tests: - a presentation and discussion of a project for which the student will be asked to model and analyze a simple mechanical system, defined in agreement with the teacher. - an oral examination, whose object will be the discussion of one or more topics of the course, even through exercises. The project will be carried out in groups of up to 4 people and will be discussed by the simultaneous participation of all students in the group during the oral examination.

LEARNING EVALUATION CRITERIA

Passing the test is subject to demonstration by the student's knowledge of the main contents of the course: methods of modeling and analysis of multibody systems and resolution of dynamic equations, the main mechanical components and their operation. In addition, the student must be able to apply the tools of analysis acquired in the study of simple mechanical systems, showing a sufficient sensitivity in the solution of problems of mechanics and automatics.

LEARNING MEASUREMENT CRITERIA

Passing the exam with a minimum mark requires sufficient knowledge about all the topics of the course. The maximum mark requires a good knowledge of the course content as well as an excellent evaluation of the project. The praise is reserved for students who, having done all the tests so correctly, have demonstrated a particular brilliance in the oral presentation.

FINAL MARK ALLOCATION CRITERIA

Attribution of the final mark in thirtieths. The teacher will be able to verify the knowledge and technical skills acquired by the student through the project evaluation. Then the investigation will be competed with a discussion on the topics of the course. The project and the oral esamination will be considered, respectively, with a weight of 1/3 and 2/3 on the overall evaluation.

Recommended reading

- J.J. Craig. Introduction to Robotics: Mechanics & Control. 3rd Ed., 2004, Pearson Prentice-Hall. - B. Siciliano. L. Sciavicco. L. Villani. G. Oriolo. Robotica. Modellistica, pianificazione e controllo. McGraw-Hill, 2008. For Automation Engineering students it is also suggested the Machine Mechanics textbook: - M. Callegari, P. Fanghella, F. Pellicano. Meccanica applicata alle macchine. Città Studi Edizioni.

Meccanica Razionale (INF+MECC)

Lucio Demeio

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
Differential and integral calculus of the functions of one and many variables; ordinary differential equations; differential geometry of curves and surfaces. Matrix and vector algebra; orthogonal and hermitean matrices; eigenvalue problems.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The aim of the course is that of providing the fundamental elements of the kinematics, the statics and the dynamics of point-mass systems, with particular regard to rigid bodies and compound systems. The objective is that of modelling, analyzing and solving engineering problems. The basic elements of lagrangian mechanics will be covered.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
On completion of the course, the student will be able to apply the acquired knowledge to real mechnical systems, relevant to control engineering and robotics. In particular, the ability to use the mathematical tools in engineering problems will be developed by the following steps: 1. being able to write the equations of motion for poit-mass systems, particularly for rigid bodies, both using the newtonian and the lagrangian approach; 2. being able to solve the equations of motion in some important cases; 3. being able to determine the equilibrium configurations of the most important mechanical systems and of studying their stability properties; 4. being able to calculate the inertia matrix for a general rigid body and to determine the principal axes of inertia.
TRANSVERSAL SKILLS:
The expertise acquired in this course are essential in order to develop the capability of analyzing and modelling rigid and compound systems, such as those often met in control engineering and robotics, with the tools of mathematical physics. Individual and collective problem-solving sessions will improve the ability to develop independent thought and learning capabilities. Oral presentations of the topics taught in the course, with the language proper of the basic disciplines of the degree course will help developing communication skills.

Program
Vector calculus. Kinematics of the point mass: kinematic variables, plane motion and; other types of motion. Kinematics of the systems of particles, rigid motion and relative motion. Fundamental principles of dynamics. Motion under gravity and oscillatory motion. Statics and dynamics of the unconstrained point particle. Statics and dynamics of systems of particles with constrains. Material geometry and dynamical variables of the systems of particles. Huygens theorem. General theorems of the mechanics of the systems of particles. Balance equations. Analytical mechanics and Lagrangian mechanics. Some elements of equilibrium and stability theory.

Development of the course and examination
LEARNING EVALUATION METHODS
The exam consists of a written test and a colloquium: - both tests will concern the topics of the

current academic year; possible exceptions will be assessed on a case-by-case basis; - registration to the first written test is mandatory, and has to be done on line on the university platform Esse3 (the link is available on the teacher's web page); - the written test consists of a number of problems and questions concerning all topics treated during the course; this test will last two or three hours, and the student will not be permitted the use of any kind of material, not even a pocket calculator; - a minimum score of at least 18/30 in the written test is required for the admission to the oral test; - the list of the names of the students admitted to the oral test will be published by the teacher on his official web page; - the oral test will contain mainly theoretical questions, some of which may have to be formulated in written form, and may contain problems and exercises concerning course topics not covered in the written test or course topics in which the student may have shown weaknesses in the written test; - questions of general comprehension may be asked both in the written and in the oral test and may concern any of the course topics; - in the case of a successful written test, the student may sit for the oral test either in the same session or in the next available session, but not later; - in the case of a successful written test, but a not passing grade in the oral test, the student may try the oral test again in the next available session; in case of another failure, the student will have to sit for the whole exam again; - all written tests must be presented in readable form, with a negligible amount of corrections, which must anyway not mar the esthetics of the text; the exposition must be clear, fluent, well organized and consistent both in the mathematical and in the linguistic aspects; - honor code: each student pledges that the written tests are entirely his/her own work and that no input from other students or sources has been used; demeanors which are deemed unfair or not in line with these principles entail the failing of the exam.

LEARNING EVALUATION CRITERIA
In order to pass the exam, the student must demonstrate understanding of all the topics covered and concepts introduced during the course and published on line as "Final program" or "Exam program" at the end of the course, and to be able to use them in solving typical theoretical mechanics problems. The student must demonstrate deep understanding of the principles of mechanics and of their applications in the mathematical-physics meaning. In particular, the ability of writing the equations of motion for the system of point masses, with special emphasis on rigid bodies and systems of rigid bodies, both in the lagrangian and in the newtonian approach; the ability of solving the equations of motion in the most relevant cases; the ability of determining the equilibrium positions and of studying thir stability in the most relevant mechanical systems; the ability of calculating the inertia tensor and of determining the principal exes of inertia for any rigid body.

LEARNING MEASUREMENT CRITERIA
The highest grade of 30/30 will be given to those students which will have shown deep knowledge and perfect mastering of all the course topics and the ability of working with full independence both in solving the assigned problems and in the oral presentation. The lowest passing grade of 18/30 will be given to the students which will have shown sufficient knowledge and good mastering of all the course topics.

FINAL MARK ALLOCATION CRITERIA
the student must obtain a passing grade in both parts of the exam. The final mark will be the average of the marks in the two parts of the exam.

Recommended reading
1) G. Frosali, E. Minguzzi, "Meccanica Razionale per l'Ingegneria", Ed.Esculapio; 2) M. FABRIZIO, Elementi di Meccanica Classica, Zanichelli Ed. 2002.

Medical Statistics

Luigi Ferrante

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
differential calculus and linear algebra

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to introduce students to the application of biostatistical methods in the study of biomedical phenomena and provide the basic tools to read and interpret the results of a scientific study in biomedical engineering.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
This free-choice course will allow students to learn and apply biostatistical methods to the study of biomedical phenomena and provide the basic tools to read and interpret the results of a scientific study in the field of biomedical engineering. The acquired skills can be applied in the design of experiments and in the statistical analysis of data for epidemiological and clinical purposes. In particular, the student at the end of the course must have acquired adequate knowledge of the basic methodologies of Medical Statistics in order to: - know how to organize and analyze data related to biomedical phenomena including the use of statistical software; - be able to read and interpret statistical results in the Biomedical Engineering literature; - be able to perform data processing and obtain a correct interpretation of the results.
TRANSVERSAL SKILLS:
Making judgements: capability of identify the information needed to design and analyze the results of experimental studies in the field of biomedical engineering. Communications: capability of clearly and exhaustively communicate notions and ideas, relative to study design and data processing, to interlocutors representative of the various and specific competencies involved in the study (engineer, biologist, biostatistician, etc.).

Program
Contents (frontal lessons 32 hours). The design of experimental and observational studies; sampling study; systematic and random error. Statistic units, population, types of variables. Summarizing and presenting data: frequency distributions, tables and graphs. Measures of the central tendency and position of the distribution; measures of variability of the distribution; shapes of frequency distribution. Probability of an event. Properties of probability. Random variables and probability distributions. Binomial, Poisson and Normal distribution. Sampling distribution. Population parameter estimation. Maximum likelihood method. Testing a hypothesis. Principles of significance tests. Significance levels and types of error; the power of a test and sample size. Comparing two means, test t. Comparison of two proportions. Comparing two variances by the F test. Comparing several means using analysis of variance. Assumptions of the analysis of variance. Comparison of means after analysis of variance. Regression and correlation. Linear regression. Logistic regression. Survival data and Cox regression. Practical exercises (16 hours). Basic statistics using R. Applications of statistical methods to the analysis of biomedica data.

Development of the course and examination

LEARNING EVALUATION METHODS

The assessment of student learning consists of solving a practical test with the use of statistical software and a subsequent oral discussion to evaluate his/her ability in the interpretation of the obtained results.

LEARNING EVALUATION CRITERIA

To successfully pass the assessment of learning, the student must demonstrate, through solving the pratical test and his/her answers to the oral discussion, that he/she has fully understood the concepts presented in the course and is able to apply them.

LEARNING MEASUREMENT CRITERIA

Attribution of the final mark up to thirty.

FINAL MARK ALLOCATION CRITERIA

In order to achieve a positive outcome of the overall evaluation, the student must achieve at least a pass mark, amounting to eighteen points, in the practical test. The vote out of thirty is given by the average of the marks obtained in the practical test and in the oral exam. The students who demonstrate personal in-depth analysis and excellent presentation (particular brilliance in the exposition) can pass the exam with distinction.

Recommended reading

An Introduction to Medical Statistics, 4th ed., Martin Bland. Oxford University Press (2015), ISBN: 9780199589920 R and accompanying manuals are available for free download from http://www.r-project.org. Students may wish to download An Introduction to R to keep as a reference.

Metallurgia (A/L)

Stefano Spigarelli

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
There are no mandatory prerequisites for this course, although the knowledge of the fundamentals of Chemistry is highly reccommended

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
At the end of the course, the students will acquire the knowledge on the nature, classification and properties of ferrous metals, with hints on the same issues for aluminium alloys. These subjects constitute a fundamental part of the wealth of knowledge at the basis of mechanical engineering in the fields of mechanical design and materials processing
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
At the end of the course students will be able to identify the main properties of the different groups of steels, cast irons and aluminium alloys. This knowledge will be reflected in the ability to use the following tools: 1. The capacity of selecting the best steel, cast iron or aluminium alloy, and the corresponding initial state, on the bases of the design functional requirements. 2. The ability of correctly analyzing and governing the production stages of mechanical components, taking into account the final properties of the used material.
TRANSVERSAL SKILLS:
Simple exercises will be carried out during the course; the students will have the possibility to individually carry out similar exercises in the moodle platform. These activities will enable students to improve their autonomy, and communication, learning and critical skills

Program
Principles of physical metallurgy. Deformation of metals and strengthening methods in metals. Phase diagrams. Steels: primary steel production (blast furnace, converter), scrap and recycling (electrical furnaces). Heat treatments of steels. Designation and properties of steels. Steels for general use, alloy steels, tool steels, stainless steels. Cast Irons. Light alloys (Aluminium)

Development of the course and examination
LEARNING EVALUATION METHODS
The method for learning evaluation will consist in a written test and in an oral interview. The written test will deal with phase diagrams, CCT and TTT curves, primary metallurgy, steel and aluminum alloys classification and their general features. During the oral examination, the candidate will be interviewed on the rest of the course program.

LEARNING EVALUATION CRITERIA
The candidate must be able to predict the microstructure and/or phases resulting from equilibrium (phase diagrams) and non equilibrium (TTT-CCT curves) transformations, and to properly identify steels and aluminum alloys by their designation according to UNI, AISI and IADS (International Alloy Designation System). During the oral examination, the candidate should exhibit a proper knowledge

of the properties, heat treatments and applications of the different classes of materials.The student must be able to coherently describe concepts

LEARNING MEASUREMENT CRITERIA
Grading scheme is based on a scale of 30 points. Successful completion of the examination will lead to grades ranging from 18 to 30.

FINAL MARK ALLOCATION CRITERIA
The final grade will be the sum of grades obtained in the written and oral parts of the examination. Maximum grade obtained in the written part will be 15 points. Maximum grade attainable in the oral examination will be 18 points.

Recommended reading
Barella, Gruttadauria: Metallurgia e Materiali non Metallici , Esculapio; W. Nicodemi: Metallurgia. Principi Generali e Gli Acciai , Zanichelli. A.Cigada, T.Pastore, Struttura e proprietà dei materiali metallici, McGraw-Hill. Additional contents will be available in the Moodle-page of the course.

Metallurgia (M/Z)

Marcello Cabibbo

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
There are no mandatory prerequisites for this course, although the knowledge of the fundamentals of Chemistry is highly reccommended

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
At the end of the course, the students will acquire the knowledge on the nature, classification and properties of ferrous metals, with hints on the same issues for aluminium alloys. These subjects constitute a fundamental part of the wealth of knowledge at the basis of mechanical engineering in the fields of mechanical design and materials processing
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
At the end of the course students will be able to identify the main properties of the different groups of steels, cast irons and aluminium alloys. This knowledge will be reflected in the ability to use the following tools: 1. The capacity of selecting the best steel, cast iron or aluminium alloy, and the corresponding initial state, on the bases of the design functional requirements. 2. The ability of correctly analyzing and governing the production stages of mechanical components, taking into account the final properties of the used material.
TRANSVERSAL SKILLS:
Simple exercises will be carried out during the course; the students will have the possibility to individually carry out similar exercises in the moodle platform. These activities will enable students to improve their autonomy, and communication, learning and critical skills

Program
Principles of physical metallurgy. Deformation of metals and strengthening methods in metals. Phase diagrams. Steels: primary steel production (blast furnace, converter), scrap and recycling (electrical furnaces). Heat treatments of steels. Designation and properties of steels. Steels for general use, alloy steels, tool steels, stainless steels. Cast Irons. Light alloys (Aluminium)

Development of the course and examination
LEARNING EVALUATION METHODS
The method for learning evaluation will consist in a written test and in an oral interview. The written test will deal with phase diagrams, CCT and TTT curves, primary metallurgy, steel and aluminum alloys classification and their general features. During the oral examination, the candidate will be interviewed on the rest of the course program.

LEARNING EVALUATION CRITERIA
The candidate must be able to predict the microstructure and/or phases resulting from equilibrium (phase diagrams) and non equilibrium (TTT-CCT curves) transformations, and to properly identify steels and aluminum alloys by their designation according to UNI, AISI and IADS (International Alloy Designation System). During the oral examination, the candidate should exhibit a proper knowledge

of the properties, heat treatments and applications of the different classes of materials.The student must be able to coherently describe concepts

LEARNING MEASUREMENT CRITERIA
Grading scheme is based on a scale of 30 points. Successful completion of the examination will lead to grades ranging from 18 to 30.

FINAL MARK ALLOCATION CRITERIA
The final grade will be the sum of grades obtained in the written and oral parts of the examination. Maximum grade obtained in the written part will be 15 points. Maximum grade attainable in the oral examination will be 18 points.

Recommended reading
Barella, Gruttadauria: Metallurgia e Materiali non Metallici , Esculapio; W. Nicodemi: Metallurgia. Principi Generali e Gli Acciai , Zanichelli. A.Cigada, T.Pastore, Struttura e proprietà dei materiali metallici, McGraw-Hill. Additional contents will be available in the Moodle-page of the course.

Metallurgia dei Metalli non Ferrosi

Marcello Cabibbo

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
Fe-C phase diagram, CCT diagrams of steels, classificatipn of steels, base knowledge of cast-irons and aluminum alloys.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
At the end of the course, students will be able to master the production processes, the main mechanical properties and characteristics of non-ferrous alloys and metals presented in the course
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
At the end of the course, students will have to: 1. acquire the skill to assess the main specific properties of the most diffuse non-ferrous metals and alloys; 2. know how justify the failure mechanisms of the non-ferrous alloys; 3. their corrosion resistance attitude and behavior; 4. to know the specific application fields and industrial scope of the non-ferrous alloys presented in the course
TRANSVERSAL SKILLS:
The proposed student reports on specific course topics will develop a self-supporting knowledge of the major arguments of the course, it will also contribute to develop a speak out skill of the students

Program
Solidification of the metallic materials. Production of the Aluminum alloys: Bayer and Hall-Heroult. Classification of the aluminum alloys. Extrusion, forging, drawing, casting of the alloys. Powder metallurgy. Thermal treatments. Major field of use. Recycling processes. Magnesium alloys: production and classification. Mechanical and metallurgical properties of the Magnesium alloys. Industry and application field of the Magnesium alloys. Production of Titanium alloys. Classification of the Titanium alloys. Major application fields of the Titanium alloys. Production of Cupper alloys. European norms for the Cupper alloys. Technological processes for the production of the cupper alloys. Cupper alloys: brass, brinzes, cupraluminum, cupronickel. Major applications of the cupper alloys. Production of the nickel-based, cobalt-based and ODS superalloys. Creep of metallic materials. High temperature properties of the superalloys and comparison to the other metallic materials. Heat treatments of the superalloys. Production of Uranium and its alloys. Physical and Mechanical properties. Main application fields. Hints on nuclear radiation processes. Precious metals (silver, gold, platinum). Historical hints of uses and production. Classification of silver and gold. Mechanical, metallurgical, physical and chemical properties. Major fields of application.

Development of the course and examination
LEARNING EVALUATION METHODS
wrtitten and oral

LEARNING EVALUATION CRITERIA
The student will have to show a sufficient level of knowledge of all the topics included in this course.

LEARNING MEASUREMENT CRITERIA
base 30 points.

FINAL MARK ALLOCATION CRITERIA
The exam mark resuls from an aritmetic mean between the oral and the short report produced by the students during the class. The oral exam consists of 3 queries each of them with a maximum mark of 10 points. Each of the 3 student reports sill be evaluated on a 10-point basis. The "lode" will be assigned to those students that will show excellent knowledge in all the three queries.

Recommended reading
Teacher's notes. I. Polmear: Light alloys, BH - ELsevier publications, 2006. Flinn and Trojan: Engineering Materials and their Applications. Houghton Mifflin Co. Boston, 1990. W.D. Callister: Materials Science and Engineering, an introduction. John Wiley & Sons. Inc. New York, 2002. AA.VV.: Alloying, understanding the basics. ASM international, Materials Park OHIO - USA, 2003.

Metallurgia Meccanica

Stefano Spigarelli

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
The student should know some fundamentals of Chemistry (atomic bond), Metallurgy (steels), Mechanical Design (nature of mechanical properties and their role) and Material Processing Technology

Program
Crystals structures (fcc, bcc and hcp); indexing planes and directions; defects in metals, liquid-solid trasformations, solidification in non-equilibrium conditions, steel transformations. vacancies, dislocations and grain boundaries. Dislocation interaction, bowing of dislocations, dislocation sources. Stress and strain in mono- and poly-crystals. Strenghtening mechanisms (cold working, solid solution, grain refining, precipitation hardening). Fatigue and fracture. Atomic diffusion in metals; recovery and recrystallization; high temperature deformation, creep, superplasticity and diffusion bonding. Metallurgical features of fusion welding. case studies: microstructure control in rolling, hardening mechanisms in Dual Phase, TRIP, Bake hardening, Maraging and Hadfield steels, welding of steels and light alloys. The experimental part will include studies on the heat treatments and welding of steels and light alloys.

Development of the course and examination
LEARNING EVALUATION METHODS
The method for learning evaluation will consist in an oral examination. Each student will be given the chance to enhance learning by self-assesment tests to be accried out in the moodle page of the course.

LEARNING EVALUATION CRITERIA
The candidate will be required to be able to analyise the nature of the mechanisms governing the mechanical properties in metals. The student must be able to qualitatively and/or quantitatively estimate the effect of microstructural features on the required properties.The same subjects will be considered in the self-assessment tests. During the oral examination, the candidate should exhibit a proper knowledge of the course contents..The student must be able to coherently describe concepts introduced during the course and to combine these concepts to solve simple problems describing the effects of microstructure on engineering properties.

LEARNING MEASUREMENT CRITERIA
Grading scheme is based on a scale of 30 points. Successful completion of the examination will lead to grades ranging from 18 to 30.

FINAL MARK ALLOCATION CRITERIA
Maximum grade obtained in the oral examination will be 30 points.Completion of a report illustrating the results of the experimental activity will be evaluated with a maximum of 2 points.

Recommended reading

G.Dieter, Mechanical Metallurgy

Metodi e Modelli per il Supporto alle Decisioni

Fabrizio Marinelli

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Elements of Linear Programming and duality theory. Elements of structured programming.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course introduces to the main theoretical, modeling and methodological issues of the formulation and quantitative solution of decision problems that arise in the management of complex (manufacturing and service) systems, for which the organizational variable plays a quite critical role. In particular, the course illustrates the declarative paradigm of mathematical programming and, in general, the methods and techniques used for the design and the use of quantitative tools for supporting the decision-making process.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student should be able a) to identify and understand decision-making problems even of high complexity, interdisciplinary nature and partially defined b) to analytically formulate such problems by mathematical programming techniques and c) to quantitatively solve such problems with advanced software tools. The student will have the skill of systematically view the decision problems arising in the context of organized systems and will be able to apply quantitative methods for their solution. Given the interdisciplinary nature of these activities, the student will be able to work within cross-functional teams, acting as an interface between the various professional skills.
TRANSVERSAL SKILLS:
The student skills will be checked through modeling exercises and the application of algorithms and solution techniques illustrated in the course, as well as by a final test, in which students must demonstrate sufficient knowledge of the theoretical principles and the quantitative methods for supporting the decision-making process. In general, such activities will contribute to the improvement of both the degree of independence of judgment and the ability of applying mathematical tools for model and control the behavior of complex decision-making processes.

Program
- Introduction to decision-making problems and decision support systems. - Mathematical programming as a declarative paradigm. - Linear programming (LP) and integer linear programming (ILP) models. - Modelling techniques for LP/ILP. - Software optimization tools and Algebraic Modelling Languages (AMPL). - Outline on linear programming and duality theory: main results and applications. - Primer to theory of computational complexity. - Introduction to graph theory and main graph optimization problems. - Problems and models for network optimization. shortest path, max-flow and min cost flow problems. - Implicit enumeration algorithms for Integer Linear Programming. - Discrete models for Scheduling and routing problems. - Applications of mathematical programming.

Development of the course and examination
LEARNING EVALUATION METHODS

The assessment of the level of learning includes both a written and an oral exam. The written lasts 2 hours and is composed by a first part with multiple-choice tests and a second part with one or more exercises on mathematical modeling and/or solution of discrete optimization problems by means of the techniques presented in the course. During the exam students cannot use notes and books. The access to the oral exam is reserved to students that achieve a written rating of at least 18 points. The oral exam consists of the discussion of the written exam and the solution of one or more questions in order to verify the logical deductive skills and the understanding of the course topics.

LEARNING EVALUATION CRITERIA

It is evaluated the ability to clearly and logically explain ideas, concepts and theoretical results of discrete optimization. It is also assessed the ability to independently set and solve decision problems by correctly using appropriate methods, models and tools of mathematical programming and discrete optimization.

LEARNING MEASUREMENT CRITERIA

Knowledge of ideas, concepts and theoretical results is analytically measured by a score assigned to the first part of the written exam that ranges between -7 and 14 points. The ability to formulate and solve decision-making problems by means of the tools of mathematical programming and discrete optimization is analytically measured by a score assigned to the second part of the written that ranges between 0 and 14 points. the capability of synthesis, logical and clear exposition is measured analytically by a score assigned to the oral exam that ranges between 0 and 30 points.

FINAL MARK ALLOCATION CRITERIA

The final grade is equal to half the sum of the scores awarded to the two parts of the written exam and to the oral exam. The maximum grade, equal to thirty points with honors, is awarded to students who demonstrate total mastery of the theoretical and methodological tools of discrete optimization, and full autonomy and logical accuracy in setting and solving the proposed problems. The minimum grade, equal to eighteen, is assigned to students who demonstrate to be able to solve the proposed problems and to sufficiently know of the theoretical and methodological tools of discrete optimization.

Recommended reading

1) C. Vercellis, Ottimizzazione. Teoria, metodi, applicazioni , Mc Graw-Hill, 2008. 2) presentations, exercises and lecture notes

Metodi e Strumenti per la Diagnostica

Gian Marco Revel

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
The students should have basic knowledge of the principal instruments for mechanical and thermal measurements.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course provides knowledge for the design, management and implementation of measurement systems , analysis algorithms and procedures for quality control , industrial and structural monitoring diagnostics
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will know how to choose the appropriate experimental technique diagnostics , both for the instrumental component and for the algorithmic; this is discussed with reference to a number of application cases , both in classroom teaching mode through laboratory exercises
TRANSVERSAL SKILLS:
The course will cover techniques for diagnostics with application examples chosen in different contexts engineering (mechanical , civil / construction , etc .) , as well as in non- engineering context , fostering a multidisciplinary approach to the study

Program
Contents (lectures, 32 hours) The objectives are the design, management and application of measurement systems and diagnostic procedures for quality control, industrial diagnostics and non-destructive testing. Diagnostics and quality control. Signals typologies: acustical, vibrational, images. Elements of data analysis for industrial and clinical diagnostics: Time domain, Frequency domain, Cepstrum domain, Modulated signals and envelope analysis, Joint time-frequency analysis and wavelets, Rotating machinery and order tracking, 2D domains (images). The features for machinery health monitoring with reference to the main components constituting the industrial plants (unbalanced shafts, electrical motors, centrifugal and axial turbomachines, alternative machinery, gears, belt transmission, rolling bearings and lubricated bearings). Measurement instrumentation for the quality control: instrumentation, metrological requirements. Non destructive testing: magnetoscope, ultrasound, shearography, infrared thermography. Feature extraction and signal classification by neural networks. Laboratory experiences (16 hours) Practical experiences with instruments for diagnostics, application to real cases. Signal analysis and classification using Matlab e Labview.

Development of the course and examination
LEARNING EVALUATION METHODS
Oral examination and optional discussion of a final project carried out in the laboratoies of the Department of Industrial Engineering and Mathematical Sciences.

LEARNING EVALUATION CRITERIA

The student, during the oral examination, will have to demonstrate to have the fundamental knowledge of the design, management and application of measuerement systems and procedures for quality control, insutrial diagnostic and non-destructive testing. In order to pass the exam with positive results, the student will have to show an overall knowledge of the course contents, which will have to be exposed with sufficient and correct use of technical terms. The maximum score will be achieved by demonstrating a deep knowledge of the course contents presented with a fully appropriate technical approach

LEARNING MEASUREMENT CRITERIA
Score in a scale with 30 levels (e.g. 27/30) based on knowledge and capacities demonstrated by the student and measured according to the Learning Evaluation Criteria.

FINAL MARK ALLOCATION CRITERIA
For each question (usually 3) posed to the student, a score in the scale with 30 levels will be assigned. The final overall score will correspond to the average of the scores for each single question. The presentation and discussion of the optional final project will substitute one of the questions with a score in the same scale. The Laude will be assigned to the students that, having achieved the maximum score, will also demonstrate an outstanding knowledge in the discussed topics.

Recommended reading
Print of the course slides provided by the professor; For some topics indications on specific references will be given, e.g.: 1. E. Doebelin, Strumenti e metodi di misura , ed. Mc Graw Hill, 2004. 2. Primers e Technical review disponibili sul sito: www.bksv.com 3. L. Furlanetto, Manuale di manutenzione degli impianti industriali e dei servizi , ed. Franco Angeli, 1998. 4. J.L. Semmlow, Biosignal and Biomedical Image Processing - MATLAB-Based Applications, ed. CRC Press, 2004.

Metodi e Tecniche di Simulazione

Anna Maria Perdon

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
The student should know the basic notions of calculus, linear algebra, numerical analysis, and the basic notions of Control Engineering : state space representations of linear, time invariant, finite dimensional dynamical systems, both discrete time and continuous time. He should be able to compute the response to standard inputs. He should be able to analyze stability and existence of steady-state response. He should be able to analyze control problems and to synthesize possible solutions. He should be able to apply identification techniques in order to derive models from experimental data and to validate the models.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The aim of the course is to provide advanced knowledge concerning methods, techniques and tools for modelling, simulation and analysis of dynamic systems performance. In particular the construction of dynamic models and a thorough theoretical and practical knowledge of numerical analysis methods for the solution of the fundamental problems in control theory.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Students develop design skills concerning simulation procedures and systems, and the ability to evaluate the results and choose the most appropriate algorithms and simulation software for the particular application. Students acquire the knowledge and the necessary practice in the use of simulation software and the ability to work in the lab and they learn to produce technical reports.
TRANSVERSAL SKILLS:
Through guided exercises, design projects and lab activities the students develop: the ability to learn by assessing the completeness and adequacy of their preparation; the independence of judgment in analysing data and/or contrasting situations that require their own analysis; the communication skills in formulating and properly describe the solutions to the problems under consideration.

Program
1. Analysis of the error. Representations of the numbers in the computer . 2. Nonlinear equations. The bisection method. The Newton-Raphson method. The multi variate secant method. The fixed point scheme. Algebraic equations. The Sturm's sequence . The Bairstow method. 3. Systems of nonlinear equation. Generalized Fixed point scheme. Generalized Newton Raphson scheme. 4. Systems of linear equation. Rouchè-Capelli Theorem. Gauss method. LU decomposition. 5. Norms of vectors and matrices. Condition index. Estimate k(A). Reachable accuracy. 6. Orthogonal matrices and their properties. Overdetermined systems and least square solutions. Normal equations and QR solution. 7. Gershgorin theorem. Diagonalizable matrices. Generalized eigenvectors, Jordan canonical form. Real Jordan canonical form. Exponential of a matrix. 8. Difference equations. Differential equations. Initial value problems; Euler's method; Crank-Nicolson, Heun, Runge-Kutta methods. Linear multistep methods. Predictor-corrector methods; stability theory; stiff systems. Consistency, zero-stability and convergence. Relative and absolute stability.

Systems of first order ODE. 9. Modelling of linear and nonlinear dynamical systems. 10. Modelling of discrete event dynamical systems. 11. Simulation environments and software (Matlab/Simulink, , Virtual Reality Toolbox,...) 12. Design and realization of software simulators.

Development of the course and examination

LEARNING EVALUATION METHODS

The learning evaluation will consist of a written test divided into two parts , each one to be completed in an hour. The first part consists of four questions of a theoretical nature, on the topics discussed in class and contained in the materials provided to the students. The second part, that takes place immediately after the first, consists of three problems to be solved with the use of Matlab . It Each student must also complete a practical project on one of the topics discussed in class and present a report on this activity. The project can also be done in groups , with a maximum of three students . In this case , the discussion of the project must take place with the participation of all students in the context of the same group. In the case of a negative result of one of the tests, the student can repeat only that part, provided this is done within the same academic year.

LEARNING EVALUATION CRITERIA

Correctness, completeness and clarity in answering the questions in the theory test. Accuracy and completeness in solving the exercises. As for the project, the student must prove that he can apply the concepts learned in the course, to properly use the tools and appropriate technologies and to write a clear technical report.

LEARNING MEASUREMENT CRITERIA

The first test consists of 4 groups of questions on the various parts of the program, each group contains a question which is assigned a score between 0 and 10, and a question which is assigned a score between 0 and 6. The student must answer a question in each group, choosing two questions for 10 points and two for 6 points. The second test consists of three questions, each of which is assigned a score between 0 and 10. A test is considered sufficient if the score is greater or equal to 15. The practical project is assigned a score from 0 to 30 and is sufficient only if the score is greater or equal to 18.

FINAL MARK ALLOCATION CRITERIA

The overall grade is given by the arithmetic mean, rounded up to the whole, the sum of the scores obtained respectively in the test and in the project if all are sufficient. The overall grade required to pass the exam is 18 points. Otherwise the overall grade is Not sufficient . The student who in addition to getting a score greater than or equal to 30 has demonstrated complete mastery of the topics addressed, and clarity of exposition will have a 30 e lode .

Recommended reading

Analisi Numerica, A.M. Perdon Pitagora Editrice 2006 Lectures slides and exercises can be found on the web site ESSE3Web

Metodi e Tecniche per l'Automazione

Leopoldo Ietto

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Elements of linear algebra, Rudiments of linear matricial algebra., elements of mathematical analysis, Laplace transform. Basic elements of linear system theory.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The purpose of the course is to provide the students with basic and advanced techniques for the analysis and synthesis of digital control systems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will be able to analyse the technical specifications for the control systems, to choose the most appropriate approach to the synthesis problem, to realize the controller through the implementation of an algorithm.
TRANSVERSAL SKILLS:
A deep study of theoretical preliminaries and guided exercitations of laboratory, will provide the student with the necessary tools to face apparently different problems, in the same general framework. This didactic approach will increase the capability of critical analysis of the student, allowing him to evidence the main features of a class of problems which do not strictly belong to the classical control area. In this regard is enough to think to disciplines like: management of industrial production and to environment and biomedical engineering.

Program
I -Structure and components of a discrete-time control system. -S-Z mapping -Stability analysis. -Transient and steady-state output response. -Design methods based on a discrete-time equivalent of an analog controller. -Design methods based on diophantine equations. -Eigenvalue assignment with state feedback and dynamic output feedback. - Elements of fuzzy theory with application to PID design

Development of the course and examination
LEARNING EVALUATION METHODS
The exam consists of written and oral parts. The written part concerns the analysis and/or design of an industrial control system, possibly using software packages. Lecture notes and books are allowed to be looked at. The oral part consists in a deep discussion on the most important theoretical notions concerning analysis and design of a digital industrial control system.

LEARNING EVALUATION CRITERIA
The primary goal of the exam is to verify the student capability to autonomously evaluate the essential features of a control problem and to recognize the most appropriate tools to solve it.

LEARNING MEASUREMENT CRITERIA
The learning degree is evaluated through the grasp of the basic principles governing the classical

approach to the analysis and synthesis of industrial control systems.

FINAL MARK ALLOCATION CRITERIA

The maximum score is 30/30 and is assigned to students solving the given control problems in fully correct way and show a complete awareness oft the methodologies. The minimum score to overcome the exam is 18/30 and is assigned to students possessing the above requisites in a sufficient level. .

Recommended reading

Lecture notes. -Isidori: Sistemi di Controllo , Siderea, Ro K.J. Astrom, B. Wittenmark, Computer Controlled Systems , Prentice-Hall Englewood-Cliffs,N.J.1984. -K. Ogata, Discrete-Time Control System , Prentice-Hall, Englewood-Cliffs,N.J., 1987. -R. Isermann: Digital Control Systems , Vol 1 e 2, Springer Verlag, Berlino,1989. -M.L. Corradini, G. Orlando, Controllo Digitale di Sistemi Dinamici , Franco Angeli, Milano, 2005. -D.Dubois, H. Prade, Possibility Theory- An Approach to Computerized Processing of Uncertainty , Plenum Press, N.Y., 1980.

Metodi Matematici

Matteo Franca

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
Basic instrument of the mathematical analysis in one and more real variables, and of one complex variable. Olmorphic functions theory in one variable. Basic instruments of linear algebra

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The student should know the theory of complex functions of one variable (limits, continuity, differentiability, intagration along paths), of basic properties of holomorphic functions, of Laplace and Fourier transform, as well as their applications to the solutions of concrete problems. Students should be able to apply notions and theorems to solve real problems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student must develop the ability of solving concrete problems by applying theorems, tools and methods.
TRANSVERSAL SKILLS:
The student will be able to critically evaluate different practical solutions in order to identify the most appropriate objectives to be pursued.

Program
Lebesgue spaces. Fubini and Tonelli theorems, Lebesgue theorem. Fourier series: meaning and evaluation of the coefficients. Bessel inequality, simple, uniform and L^2 convergence of the series. Fourier transform. Algebraic and differential properties. Duality formula. Schwartz spaces and Plancherel theorem. Laplace transform and signals in complex fields. Convergence abscissa. Connection between Fourier and Laplace transform. Linear partial differential equation. First order equation: Fourier and characteristics methods. Second order PDE Elliptic, parabolic and hyperbolic

Development of the course and examination
LEARNING EVALUATION METHODS
The exam consists of a written and an oral part.

LEARNING EVALUATION CRITERIA
The exam is meant to verify the capability of solving exercise and the knowledge of theorical instrument for them useful, and to evaluate the skill in connecting the objects described in the course, and to use an appropriate technical language.

LEARNING MEASUREMENT CRITERIA
To access the oral part it is necessary to pass the written one. To pass the written test is necessary to get an evaluation equal or superior to 15 and equal or superior to 18 for the oral test. To pass the tests the student needs to have understood the basic concepts introduced in the course, and their use to solve standard exercises. To reach a better evaluation he/she needs to know the proofs given in the course and to solve less standard exercises.

FINAL MARK ALLOCATION CRITERIA
The final mark is the result of written tests, modified by the evaluation of the oral test. If the student fails this latter test he has to redo the exam, and if the evaluation is negative the final mark could decrease, while if it is positive it could increase at most of 7 points.

Recommended reading
In the web page at the following address https://dipmat.univpm.it/~franca/didattica/didattica.html the student can find the main part of the topics discussed. For the part concerning Fourier and Laplace transform we suggest the book G. C. Barozzi, "Matematica per l'Ingegneria dell'Informazione", Zanichelli, Bologna, 2001.

Metodi Numerici per la Geotecnica

Evghenia Sakellariadi

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
Solid mechanics: stress, strain, linear elasticity theory. Soil mechanics: soil description and classification; strength and compressibility. Geotechnical engineering: settlement analysis, stability of shallow foundations. Soil hydraulics, groundwater f

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables to acquire basic understanding of the Finite Element method, focusing on specific requirements regarding geotechnical applications studied in previous courses. Futher aspects will focus on understanding the principles and techniques of material behaviour modelling applied to soil mechanics.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Students will develop the capacity to find a solution to typical geotechnical problems using specific software, through the guided solution of targeted exercises. After course completion students will be able to effectively setup and run a finite element analysis, making all the required choices and correctly understanding and interpreting the results obtained.
TRANSVERSAL SKILLS:
In the working-out of proposed exercises, in which some typical geotechnics cases are studied through available software applications, students will learn to deal with the various aspects relative to putting theory into practice, which will enhance the capacity for making correct choices and independent learning. Communication skills will be improved through the intermediate assessment discussions, in which the student illustrates and reviews the progress of the exercises.

Program
haracteristics of soil behaviour and modelling. Field equations for saturated porous media; seepage and consolidation. Constitutive models appropriate for soil mechanics. Numerical methods and models for solving typical geotechnics problems and interpretation of the results obtained. The Finite Element method. Verification and validation of numerical analyses. Elementary elasto-plastic constitutive models. Methods and principles for interpretation of numerical analysis results and for comparison with results obtained through traditional methods. Choice of appropriate values for geotechnical parameters to be used in numerical analyses. Finite element analysis of some typical problems (settlement and stability of foundations, seepage, consolidation).

Development of the course and examination
LEARNING EVALUATION METHODS
Final assessment is via an oral examination. The topics discussed vary depending upon the specific learning option chosen by the student. In the first learning option (continuous assessment) students are required to attend lectures and practical sessions and to work out the proposed exercises, discuss the results obtained and make all corrections and modifications, during term time and alongside the course advancement. These discussions of the work in progress are considered an

integral part of the course. In this case the oral examination will be held immediately after the end of the lecture period and will merely consist in a sum-up discussion of the work carried out during the course. In the second learning option students must still work out the exercises proposed during the course, but may do so in their own time. In the oral examination two or three topics regarding the course subjects will be discussed. Among these may be included some aspect referring to the practical exercises. The two learning options are equivalent with regard to final assessment.

LEARNING EVALUATION CRITERIA

Students must demonstrate basic understanding of the Finite Element method and how an analysis for solving typical problems of geotechnical engineering should be set up. In particular they must show a good comprehension of the basic assumptions and limitations, and they must be able to make all necessary choices for setting up an analysis and be conscious of the consequences these choices have on the final results; finally, they must be capable of understanding and interpreting correctly the results obtained, and must know how to usefully compare them to the results of traditional calculation methods.

LEARNING MEASUREMENT CRITERIA

The final mark is assigned taking into consideration the degree of attainment of the following goals: -- general knowledge: the Finite Element method for typical geotechnics problems, modelling techniques and specific models for geotechnics; -- skills: setting up a FE analysis, modelling choices, interpretation of results, comparison with results obtained through traditional analysis. For students who have chosen continuous assessment a separate mark will be given for the discussion of each guided exercise introduced during the course, while the final oral exam will only serve as a confirmation. For the remaining students a separate mark will be given for each topic discussed during the exam.

FINAL MARK ALLOCATION CRITERIA

The minimum grade (corresponding to a mark of 18/30) is given to students exhibiting a basic understanding of the course subjects. Higher marks reflect the amount to which students will integrate theoretical aspects discussed during the course into their work on the exercises, and will be able to independently and correctly set up a numerical analysis and comment on the results obtained. Maximum marks or the cum laude credit will be assigned to students who exhibit thorough understanding and command of all course topics, a particular awareness of the implications of all analysis choices, and excellent capacity for understanding and interpreting the results obtained, expressing concepts in articulate and technically correct language. The working-out of the proposed exercises, even though a necessary condition for passing the examination, is not in itself appointed a separate mark. Likewise, producing written papers to illustrate the solution of the exercises, though useful as a learning tool and as such suitable for study enhancement, is always considered an optional activity and can convey no contribution towards the final mark.

Recommended reading

I.M. Smith and D.V. Griffiths, Programming the Finite Element Method , 3rd edition, John Wiley & sons. R. Nova, Fondamenti di meccanica delle terre , McGraw - Hill D.M. Wood, Geotechnical modelling , Spon Press Taylor & Francis Group D.M. Potts and L. Zdravkovic, Finite element analysis in geotechnical engineering , Thomas Telford GEO-SLOPE: Training and support documentation for GeoStudio products SIGMAW and SEEPW (http://www.geo-slope.com)

Metodologie Metallografiche

Marcello Cabibbo

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
None.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
At the end of the course, students will be able to master the metallographic sample preparation procedures and some of the metal microstructure stereology methods
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
At the end of the course, students will have to: 1. acquire the skill to select a specific thermal treatment for steels or cast irons intended to optimize given mechanical properties; 2. Acquire the skill of the specimen preparation for optical microscopy; 3. To master the application of stereology methods to the acquired optical micrographs; 4. Acquire the ability to perform hardness and micro-hardness tests
TRANSVERSAL SKILLS:
The proposed student reports on the laboratory experiences will develop a self-supporting knowledge of the major arguments of the course, it will also contribute to develop a synthesis skill of the students.

Program
pecimen preparation for optical and electron microscopy. Optical microscopy. Atomic force microscopy (AFM). Scanning electron microscopy (SEM and FEGSEM). Transmission electron microscopy (TEM). Hardness and micro-hardness tests. Nanoindentation. Thermal treatments. Elements of Stereology.

Development of the course and examination
LEARNING EVALUATION METHODS
Oral and with a Laboratory Report. Students, divided in groups, are asked to write a laboratory report on the basis of the laboratory guided experience. This will be evaluated, and the overall mark is the average of the oral and this report mark.

LEARNING EVALUATION CRITERIA
Lab report evaluation and oral exam on the class topics.

LEARNING MEASUREMENT CRITERIA
The student have to show a full ability to solve problens to which he will be faced during the laboratory experience, it will have to learn how to write a lab report, and will have to show a full knowledge of the course topics (for the oral exam).

FINAL MARK ALLOCATION CRITERIA
The lab report will be evaluated on a 30 point basis. The oral part of the exam will be organized on a

3 query basis. Each query will be evaluated from 0 to 10 points. The overall mark is the average between the lab report mark and the oral mark.

Recommended reading

G. Zlateva, Z. Martinova, Microstructure of Metals and Alloys, CRC Press. J.L Goldstein, D.E. Newbury, J.W. Colby, H. Yakowitz, E. lifshin, J.R. Coleman, Practical scanning electron microscopy, Plenum Press. P.J. Goodhew, F.J. Humphreys, Electron microscopy and analysis, Taylor & Francis. R.L. Higginson, C.M. Sellars, Worked examples in quantitative metallography, Maney Pub..

Micro e Nano Elettronica

Claudio Turchetti

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Basic Electronics, Physics of Semiconductor

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide the necessary knowledge for designing the CMOS integrated circuits. To this end the fundamental technological processes for the fabrication of Si devices, the current and high performance low frequency amplifier topologies, the main low frequency filtering techniques will be studied.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The course is intended to train the students so that they acquire the capability of applying the knowledge on electron devices to the design specifications, to the selection and sizing of circuits to obtain the desired performance, to the using of CAD software tools.
TRANSVERSAL SKILLS:
The course provides a multidisciplinary background on semiconductor physics, analog circuits, analog filtering techniques, which can be spent in the fields of biomedical engineering, telecommunications, automatic control and information technology in general.

Program
Elements of semiconductor physics for device electronics: fundamental equations, p-n junction, MOS transistor, drain current of the MOSFET and small signal model. Processes for the fabrication of Silicon devices: wafer production, Lithography, Etching, Diffusion, Ion implantation, Front-end, Back-end, CMOS technology. SPICE MOSFET model: second order effects. Design elements of elementary CMOS analog circuits: single stage amplifiers, differential amplifier, circuits for biasing, Operational amplifiers single-stage and two-stage. Design elemnts of analog filters.
Switched-capacitor Filters: bilinear transformation, SC-filters low-Q and high-Q, CMOS switch, non-ideality of switch and Op-Amp.

Development of the course and examination
LEARNING EVALUATION METHODS
oral examination

LEARNING EVALUATION CRITERIA
To pass the exam the student will show to know all the metodologies and techniques for designing CMOS integrated analog circuits.

LEARNING MEASUREMENT CRITERIA
A score in the range 18-30 will be given as a final grade.

FINAL MARK ALLOCATION CRITERIA

The oral examination will be focused on questions concerning the course topics and the discussion of a specific design with refernece to the approach used and the results obtained.

Recommended reading

B. Razavi, Design of analog CMOS Integrated Circuits , McGrawHill, 2001. R.J.Baker, CMOS, Circuit Design, Layout, and Simulation , Wiley, 2010. R.Schaumann, M.S.Ghausi, K.R.Laker,, Design of Analog Filters , Prentice Hall, 1990. P.E.Allen,D.R.Holberg, CMOS analog Circuit DEsign , Oxford University Press,2010. M.Liu, Demystifying Switched Capacitor Circuits , Elsevier,2006. R.Gregorian, G.C.Temes. Analog MOS Integrated Circuits for Signal Processing , John Wiley,1986.

Misure e Controlli Ambientali

Giorgio Passerini

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course will give in-deep knowledge about emissions, transport, chemical fate and depletion of airborne pollutants. Above all, the students will know how to estimate emissions, how to model atmospheric physics and chemistry, and how to estimate pollutant depletions.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Students will be given the knowhow and the practice to realize airborne-pollutant emission estimates and emission inventories, to choose and to employ diffusive models, to choose and to employ photochemical models, and to quantify airborne-pollutant depletion mechanism.
TRANSVERSAL SKILLS:
Scale analysis applied on different spatial ranges and time ranges will give students an instrument to evaluate in deep all the aspects of environmental decision making. Analysis and prognosis techniques by means of scenarios are applicable in a plethora of matters. Numerical methods and sensitivity analyses represent strong overall approaches.

Program
Introduction to dynamic meteorology in Free Atmosphere. Introduction to Planetary Boundary Layer meteorology; Turbulent Transport; Taylor s Hypothesis, Virtual Potential Temperature; Height and Structure of PBL; Evolution of Virtual Potential Temperature; Spectrum of Turbulence; The Spectral Gap; Turbulent Kinetic Energy; Cinematic Flux; Eddy Flux; Turbulent Strain and Stress; Application of Fundamental Equations to a Turbulent Flux; Reductions Approximations and Scale Analysis; Environmental Models for Air-Quality Management and Control; Model Classifications; Application of Models on Various Scenarios; Application of Models in Complex Valley-Coastal Environments

Development of the course and examination
LEARNING EVALUATION METHODS
Oral Exam (three questions)

LEARNING EVALUATION CRITERIA
Evaluation of candidate's answers

LEARNING MEASUREMENT CRITERIA
score up to 10/10 for each answer

FINAL MARK ALLOCATION CRITERIA
Sum of above scores

Recommended reading

Lecture notes, in Italian language, are available for the whole course

Misure e Controlli Industriali

Nicola Paone

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
Knowledge of main measurement techniques for mechanical and thermal quantities and of static and dynamic performance of measurement instrumentation.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course provides students with knowledge of mechanical engineering on control systems to the standard feedback (PID and fuzzy) and machine vision systems used for measurement, diagnosis, control. Of them will learn the hardware and algorithms and software
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student of mechanical engineering will be educated to the choice and integration of a standard industrial controller, PID and / or fuzzy, in a feedback controlled system. He also learn how to choose the components of a vision system and integrate them in order to develop measurement systems based on acquisition and processing of images. They will discuss examples of applications for quality control and process, both through lectures and laboratory exercises
TRANSVERSAL SKILLS:
Application examples will be chosen in the context of industrial engineering, and in other fields of application of its experimental

Program
The course provides knowledge on the principles of operation and the choice and use of standard feed-back controllers (PID and fuzzy) and on vision systems for measurement applied to process and quality control. The following main parts will be developed. Classroom lessons (38 hours) 1) Elements of feed-back control. The role of the sensor in feed-back loops. Tranfer function and analysis of system dynamic response, poles, asymptotic stability. The PID control algorithm. The fuzzy controller. Industrial controllers: PID and fuzzy, analog and digital. Examples of industrial controls. 2) Image acquisition and processing for measurement, automation and control. Elements of geometrical optics and diffraction. Image formation. Illumination, colour, industrial illuminators. Image sensors CCD and CMOS. Cameras, digital cameras, smart cameras, fast cameras. Digital image acquisition systems. main algorithms for image processing: hystograms, LUT, spatial filters, thresholhd, morphologic operators, spatial frequency domain, image correlation, pattern matching. Application examples. Exercises/training sessions in classroom and in laboratory (10 hours) The following training sessions will be organized: 1) one training session in laboratory on standard feed-back control systems; 2) one training session on dynamic analysis of systems by software; 3) one laboratory training session on hardware of vision systems; 4) one guieded visit to the laboratories of DIISM on application of vision systems; 5) one guided visit to a company active in development/application of vision systems for measurement.

Development of the course and examination
LEARNING EVALUATION METHODS

Laboratory exercise on a topic of the course and oral exam with one question on standard feed-back control and one on vision systems for measurements.

LEARNING EVALUATION CRITERIA
Knowledge of the topics, demonstrated through a clear, correct and complete oral presentation. During the oral exam it will be evaluated the capacity to present the topic and to describe it correctly also with the support of graphics and schemes.

LEARNING MEASUREMENT CRITERIA
Outcome will be published in thirtieth.

FINAL MARK ALLOCATION CRITERIA
The maximum mark is obtained by those students who demonstrate a) have developed and presented a laboratory exercise with optimum correctness and clarity and b) complete optimum mastering of the two topics, exposing them clearly, in depth and correctly by producing also schemes and graphics. The minimum mark is attributed to those students who a) have developed and presented a laboratory exercise at sufficient level and b) demonstrate a sufficient knowledge of at least one of the two topics and at least a partial knowledge of the second. The final mark will be obtained by summing the marks of the colloquium with the marks of the laboratory project work. Up to 15 points are attributed to the colloquium as well as to the laboratory project work.

Recommended reading
During the course specific references will be provided for each subject. As guidance, the following books and web-sites will be useful. - E.Doebelin, Strumenti e metodi di misura, ed. McGrawHill, - K.J.Gasvik, Optical metrology, ed. John-Wiley & Sons, - Machine vision algorithms and applications, C.Steger, M.Ulrich, C.Wiedemann, ed. Wiley-VCH- - G.F.Franklin, J.D.Powell, A.Emani-Naeini, Feedback control of automatic systems, Addison Wesley; - web www.ni.com - web www.edmundoptics.com - web www.mellesgriot.com - web www.dantecdynamics.com - web www.tsi.com - web www.polytec.com - web www.flir.com

Misure e Controlli Termotecnici (A/L)

Enrico Primo Tomasini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Knowledge of main measurement techniques for mechanical and thermal quantities and of static and dynamic performance of measurement instrumentation.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course illustrates advanced instrumentation for mechanical and thermal measures, for process and quality control and product development, with particular reference to measurement techniques without contact, optical and acoustic. The student at the end of the course will know the principles of operation of complex measurement systems, including laser Doppler anemometry Particle Image Velocimetry, laser Doppler vibrometry, thermal imaging cameras and infrared sensors, acoustic measuring techniques (intensimetry acoustics and beam forming)
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will be educated through lectures and laboratory exercises to the use of complex measurement systems for experimental research, product development, testing machines and equipment, quality control and diagnosis of systems, products and processes
TRANSVERSAL SKILLS:
The student will be trained to the use of complex measurement systems in different application contexts, both engineering that of other experimental disciplines

Program
Contents (lectures, 52 hours) 1 - Signal Analysis: time and frequency domain analysis. Spectral and cross-spectral density distributions, signal acquisition, sampling and quantization, sampling errors (aliasing and leakage). 2 Laser Doppler Vibrometry: Doppler effect, acusto-optic modulation. Michelson and Mach-Zender interferometers, optical signal processing (demodulation, tracking filter), optical access, optical surface properties. LDV: single-point, scanning, differential, in-plane, rotational, continuous scanning. Uncertainty. 3 Vibration measurements: dB, displacement, velocity, acceleration. Vibration testing (exciters, sensors, mounting problems). Modal analysis theory (1 dof system). Experimental modal analysis. 4 Acoustic measurements: Sound theory, sound field parameters, sound propagation. Sound pressure measurement: sound level meter, microphones. Acoustic intensity measurement. Microphone array techniques: Near filed acoustic holography, Beamforming. 5 Non destructive Diagnostics: Ultrasound methods, US parameters, US propagation, US beam, damage detection, non contact US. 6 Flow measurement: Particle Image Velocimetry and Laser Doppler Anemometry. PIV: theory, measurement procedure, seeding methods, signal processing. 3D PIV. LDA: architecture, fringe model, eterodyne, differential LDA. 7 Spectroscopy and colorimetry. 8 IR temperature measurement: IR thermal exchange, sensors and optics. Pyrometers. IR thermography: sensor, software. IR thermography calibration. 9 Indoor comfort measurement: Subject and enviroment variables. Thermo-igrometric confort. 10 Interferometric measurement: ESPI-Shearography. Laboratory experiences (20 hours) Practical exercises on instrumentation discussed and signal processing

Development of the course and examination
LEARNING EVALUATION METHODS
An experimental project concerning one of the course subjects has to be carried out during the course. The examination consists in an oral discussion and the presentation of the experimental project.

LEARNING EVALUATION CRITERIA
Evaluation of the understanding of topics discussed

LEARNING MEASUREMENT CRITERIA
Discussion of test cases

FINAL MARK ALLOCATION CRITERIA
Evaluation of the understanding of topics discussed

Recommended reading
Technical material provided during the course. Reference books: - E. O. Doebelin, Strumenti e Metodi di misura, Mc Graw Hill; - - Righini, Tajani, Cutolo, Introduction to optoelectronic sensors, ed. World Scientific Xavier P. V. Maldague, Theory and practice of infrared technology for nondestructive testing, Wiley Interscience; F. Durst, A. Melling, J. H. Whitelaw, Principles and practice of laser Doppler Anemometry, Academic Press; Raffael, Wilert, Wereley, Kompenhans, Particle Image Velocimetry, ed. Springer. - Xavier P. V. Maldague, Theory and practice of infrared technology for nondestructive testing, Wiley Interscience; On-line material, some web-sites: - sito web www.edmundoptics.com - sito web www.mellesgriot.com - sito web www.dantecdynamics.com

Misure e Controlli Termotecnici (M/Z)

Paolo Castellini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Knowledge of main measurement techniques for mechanical and thermal quantities and of static and dynamic performance of measurement instrumentation.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course illustrates advanced instrumentation for mechanical and thermal measures, for process and quality control and product development, with particular reference to measurement techniques without contact, optical and acoustic. The student at the end of the course will know the principles of operation of complex measurement systems, including laser Doppler anemometry Particle Image Velocimetry, laser Doppler vibrometry, thermal imaging cameras and infrared sensors, acoustic measuring techniques (intensimetry acoustics and beam forming)
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will be educated through lectures and laboratory exercises to the use of complex measurement systems for experimental research, product development, testing machines and equipment, quality control and diagnosis of systems, products and processes
TRANSVERSAL SKILLS:
The student will be trained to the use of complex measurement systems in different application contexts, both engineering that of other experimental disciplines

Program
Contents (lectures, 52 hours) 1 - Signal Analysis: time and frequency domain analysis. Spectral and cross-spectral density distributions, signal acquisition, sampling and quantization, sampling errors (aliasing and leakage). 2 Laser Doppler Vibrometry: Doppler effect, acusto-optic modulation. Michelson and Mach-Zender interferometers, optical signal processing (demodulation, tracking filter), optical access, optical surface properties. LDV: single-point, scanning, differential, in-plane, rotational, continuous scanning. Uncertainty. 3 Vibration measurements: dB, displacement, velocity, acceleration. Vibration testing (exciters, sensors, mounting problems). Modal analysis theory (1 dof system). Experimental modal analysis. 4 Acoustic measurements: Sound theory, sound field parameters, sound propagation. Sound pressure measurement: sound level meter, microphones. Acoustic intensity measurement. Microphone array techniques: Near filed acoustic holography, Beamforming. 5 Non destructive Diagnostics: Ultrasound methods, US parameters, US propagation, US beam, damage detection, non contact US. 6 Flow measurement: Particle Image Velocimetry and Laser Doppler Anemometry. PIV: theory, measurement procedure, seeding methods, signal processing. 3D PIV. LDA: architecture, fringe model, eterodyne, differential LDA. 7 Spectroscopy and colorimetry. 8 IR temperature measurement: IR thermal exchange, sensors and optics. Pyrometers. IR thermography: sensor, software. IR thermography calibration. 9 Indoor comfort measurement: Subject and enviroment variables. Thermo-igrometric confort. 10 Interferometric measurement: ESPI-Shearography. Laboratory experiences (20 hours) Practical exercises on instrumentation discussed and signal processing

Development of the course and examination
LEARNING EVALUATION METHODS
An experimental project concerning one of the course subjects has to be carried out during the course. The examination consists in an oral discussion and the presentation of the experimental project.

LEARNING EVALUATION CRITERIA
Evaluation of the understanding of topics discussed

LEARNING MEASUREMENT CRITERIA
Discussion of test cases

FINAL MARK ALLOCATION CRITERIA
Evaluation of the understanding of topics discussed

Recommended reading
Technical material provided during the course. Reference books: - E. O. Doebelin, Strumenti e Metodi di misura, Mc Graw Hill; - - Righini, Tajani, Cutolo, Introduction to optoelectronic sensors, ed. World Scientific Xavier P. V. Maldague, Theory and practice of infrared technology for nondestructive testing, Wiley Interscience; F. Durst, A. Melling, J. H. Whitelaw, Principles and practice of laser Doppler Anemometry, Academic Press; Raffael, Wilert, Wereley, Kompenhans, Particle Image Velocimetry, ed. Springer. - Xavier P. V. Maldague, Theory and practice of infrared technology for nondestructive testing, Wiley Interscience; On-line material, some web-sites: - sito web www.edmundoptics.com - sito web www.mellesgriot.com - sito web www.dantecdynamics.com

Misure e Strumentazione per l'Automazione

Alessandro Freddi

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The module aims to provide knowledge and skills on instrumentation for measuring different physical quantities for the control and supervision of automation systems. It includes both the theoretical elements for the design of supervision systems, and the description of the key components in data acquisition systems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will be able to apply the acquired knowledge and competence to design systems for measuring physical quantities for control and supervision of automation systems, and to manage data acquired by existing systems for supervision purposes. These skills will integrate those acquired in other modules, thus granting the student the capability to design intelligent automation systems, taking into account both efficiency and safety.
TRANSVERSAL SKILLS:
The module provides in-depth analysis in the form of exercises, case studies or projects which the students can carry out during the exam preparation. In this way the students can develop judgment skills through a critical analysis of data and / or problems arising from the real world. The in-depth analysis in the form of collaborative projects also requires team work and reporting, thus helping to enhance both communication and teamwork skills.

Program
Lecture (66 hours) This course aims to provide a deep knowledge in the fields of management and design of data acquisition systems for measuring several physical quantities required for control and supervision of automated systems. The main subjects are stated in the following. - Basic principles of supervision and diagnosis systems. - Fault detection techniques. - Fault diagnosis and fault tolerant systems. - Sensors for automation. - Signal conditioning, transmission and processing. Practical (6 hours) The students can practice with acquisition systems and signal processing.

Development of the course and examination
LEARNING EVALUATION METHODS
Evaluation consists in both a written and oral examination. During the written examination the student must solve a problem, while during the oral examination the student must answer questions on the different subjects of the course. The written examination can be replaced by the presentation and discussion of a project, agreed upon in advance and carried out by the student autonomously.

LEARNING EVALUATION CRITERIA
During the examination, the student should prove to possess knowledge and competence to: design and develop fault detection, diagnosis and fault-tolerant systems; choose, size and

manage data acquisition systems for automation; analyse and design signal conditioning and transmission systems.

LEARNING MEASUREMENT CRITERIA

In order to positively pass the examination, the student should prove a comprehensive knowledge of the subjects addressed within the course, expressed with a proper technical vocabulary, together with the competence to analyze data and/or problems derived from the real world. The highest mark is attained by proving an exhaustive knowledge, expressed with a complete technical vocabulary, together with a critical analysis competence.

FINAL MARK ALLOCATION CRITERIA

The final mark is out of 30. The written examination requires the student to solve a problem. The oral examination requires the student to answer to two questions. Both the problem and each of the two questions have the same weight. The presentation and discussion of a project replaces the written examination. The highest mark with honour will be attained by students who prove a complete knowledge of the subjects addressed within the course.

Recommended reading

The course material is available on the University Learning Management System (LMS). Students interested to deepen the topics of the course can refer to the following textbooks. - R. Isermann, Fault-Diagnosis Systems: An Introduction from Fault Detection to Fault Tolerance , Springer-Verlag Berlin, 2006. - J. Fraden, Handbook of Modern Sensors Physics, Designs and Applications , Springer, 2010. - G. Magnani, G. Ferretti, P. Rocco, Tecnologie dei sistemi di controllo , McGraw-Hill, Milano, 2007. - G. Bertoni, M. E. Penati, S. Simonini, I componenti dell'Automazione , Esculapio, 2001. - G. Cariolaro, A. Molinari, Elaborazione Numerica dei Segnali-Sistemi , Edizioni Scientifiche Telettra, 1979. - R. Isermann, Fault-Diagnosis Applications: Model-based Conditon Monitoring: Actuators, Drives, Machinery, Plants, Sensors, and Fault-tolerant Systems , Springer, 2011. - L. H. Chiang, R. D. Braatz, E. L. Russell, Fault Detection and Diagnosis in Industrial Systems , Springer-Verlag London, 2000. - W. Boyes, Instrumentation Reference Book , Butterworth Heinemann, 2009. - B. Siciliano, L. Sciavicco, L. Villani, G. Oriolo, Robotica, modellistica, pianificazione e controllo , McGraw-Hill, Milano, 2008. - A. V. Oppenheim , R. W. Schafer, Elaborazione numerica dei segnali , Franco Angeli Editore, 2010.

Misure Elettroniche

Stefano Pirani

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
Know and understand the techniques and the most relevant measurement and analysis tools and their interactions with the system under measurement.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Being able to successfully carry out measurements on signals, electronic devices and circuits.
TRANSVERSAL SKILLS:
The course will help to develop the ability to critically evaluate data obtained from measurement systems

Program
Metrology fundamentals: units of measurement and standards. Measure uncertainty and its propagation. Counters and Frequency meters. AD and DA converters. TRMS-to-DC converters. Digital voltmeter, ammeter, ohmmeter, multimeter and the accessories necessary to expand their measure field. Methods for the measurement of the parameters of electrical components both in dc and ac (LF and HF) supply. Digital oscilloscope and spectrum analyser. Virtual Instruments. Transducers.

Development of the course and examination
LEARNING EVALUATION METHODS
Written and oral exam.

LEARNING EVALUATION CRITERIA
Student has to demonstrate his knowledge on the topics.

LEARNING MEASUREMENT CRITERIA
Numeric mark up to 30/30 for both exam (minimum sufficient mark is 18/30).

FINAL MARK ALLOCATION CRITERIA
Mean value of marks (minimum sufficient mark is 18/30).

Recommended reading
Reference bibliography: Norma UNI-UNIPREA 4546 "Misure e misurazioni: termini e definizioni fondamentali. Helpful bibliography: - P.H.Sydenham, N.H.Hancock, R.Thorn: "Introduction to measurement science and engineering", John Wiley & Son's, New York - J.R.Taylor: "Introduzione all'analisi degli errori. Lo studio delle incertezze nelle misure fisiche", Zanichelli, Bologna - B.M.Oliver, J.M.Cage: "Electronic measurements and Instrumentation", McGraw-Hill / Kogakusha, Tokyo - M.Savino: "Fondamenti di scienza delle misure", NIS - La Nuova Italia Scientifica, Roma - S.Leschiutta: "Misure elettroniche. Strumentazione e telecomunicazioni", Pitagora, Bologna

Misure Meccaniche e Strumentazione Biomedica

Enrico Primo Tomasini

Seat Ingegneria
A.A. 2016/2017
Credits 12
Hours 96
Period E

Prerequisites
Fundamentals of math and physics.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course has the aim to provide to the student with fundamental knowledge of correct design and use of the measurement systems, with particular attention to the area of the biomedical instrumentation and measurement procedures for human health.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
For the sector of the biomedical engineering, this course will provide the knowledge for the design and correct use the measurement devices for mechanical, thermal and flu dynamical fields, with specific attention to the biomedical instrumentation and human health sector. The course will have a frontal lessons and laboratory/seminars.
TRANSVERSAL SKILLS:
The student will develop the skill to analyze the fundamental measurement systems and main transducers The didactic activity will also include the laboratory sessions/seminars and the preparation of a project aiming to analyze and present a standard biomedical system.

Program
1. Basic concepts of biomedical instrumentation: General concepts on the measurement systems and biomedical instrumentation. General requirements for the medical devices. Static and dynamic characteristics of measurement systems. 2. Basic sensors and principles of use in biomedical instrumentation. Displacement sensors used in biomedical instrumentation. (potentiometers, strani-gages, ultrasonic transducers, encoder, etc.). Velocity and acceleration sensors (piezoelectric ed ICP, accelerometers and ultrasounds). Force sensor used in biomedical instrumentation (straingages, dynamometers and force platform). Pressure and acoustic sensor used in biomedical instrumentation (manometer, elastic transducers, microphones, stethoscope, phonocardiograph, etc). Fuid velocity and flow sensors (Pitot tube, hot-wire and hot-film anemometers, ultrasound, turbine meters) used in biomedical instrumentation (blood flow meters, plethysmograph, etc). Temperature sensors (Thermocouples, thermometers, thermistors, infrared thermography). 3. Chemical biosensors: Electrochemical transducers. Sensors for the measurement of the PO2, PCO2 and pH. Fiber optics biosensors. Fluorescence sensors. ISFET and IMFET biosensors. 4. Biopotentials and biopotential amplifiers: Polarization and depolarization of the cell. Bio-potentials. Measurement of biopotential. Design of bio-amplifier. 5. Electrocardiography and elettroencephalography: Electrical activity of the heart. The Einthoven triangle. Augmented limb leads. Frontal and transverse plane ECG/EKG. Analogue and digital ECG/EKG systems. Holter. Electroencephalographic signals. EEG equipment and normal settings. 6. Blood pressure measurement and cardiac sounds. Indirect measurement of blood pressure. Sphygmomanometer. Oscillometric method. Ultrasound method. Phonocardiography. Direct measurement of blood pressure. 7. Measurements of the respiratory system: Fluid dynamics of the respiration.

Measurement of the gas-flow rate. Plethysmograpy. Spirometer. Pneumotachograph. Introduction to medical imaging systems. 8.Information content of an image. Ecography. Radiography. TAC. MRI. 9. Introduction to devices for therapy, surgery and electrical safety. Cardiac pacemaker. Defibrillators. Laser for surgery and therapeutic use. 10. Laboratory activity. Design and preparation of measurement systems. Data acquisition and processing. Biopotential measurement. Force measurement: Force platform and dynamometer

Development of the course and examination

LEARNING EVALUATION METHODS

All of the students have to discuss an experimental project concerning one of the course subjects. This project can be developed individually or in groups of max. 3 students. The examination consists in an oral discussion and the presentation of the experimental project and in an oral discussion of the subjects discussed during the course.

LEARNING EVALUATION CRITERIA

Presentation of the final mark expressed in thirtieths, evaluating the answers on the basis of accuracy, completeness, deepening, exposure method and the experimental project according to diligence and deepening level.

LEARNING MEASUREMENT CRITERIA

The student, during the thesis discussion and the oral exam, has to prove to know the program arguments. To pass the exam successfully, the student has to demonstrate to have a global knowledge of the teaching contents, exposed correctly with the usage of suitable technical terminology, with the formal and graphic engineering instruments, that is schemes, block diagrams, analytical formulations, exc With regard to the experimental project, the student has to prove to have accurately carried out the consigned task and to have a deep knowledge on that argument, on the laboratory instrumentation and to be able to use the multimedial presentation instrument, useful for the future career. The best mark will be obtained proving a deep knowledge of the teaching contents, exposed with perfect mastery of the technical language.

FINAL MARK ALLOCATION CRITERIA

The exam consists of three questions and the discussion of the experimental project, the mark will be expressed in thirties. The final mark is the mean value of the marks of each question and it represents an overall rating of the exam. Full mark with honours will be granted to the students who will demonstrate a great mastery of the subjects.

Recommended reading

Francesco Paolo Branca, Ingegneria Clinica , Springer-Verlag J.W. Webster, Medical Intrumentation: Application and Design , Houghton. R.S. Khandpur, Biomedical Instrumentation , McGraw-Hill J.D. Bronzino, The Biomedical Engineering - Handbook Vol I & II, CRC Press E.A. Cromwell, F.J. Weibell, E.A.Pfeiffer, Biomedical Instrumentation and Measurements , Prentice-Hall

Misure Meccaniche e Termiche (A/L)

Paolo Castellini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
It is required that the student knows the fundamental concepts of mathematical analysis, physics, mechanics, fluid dynamics, thermodynamics and electromagnetism.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire basic knowledge on measuring instruments for mechanical and thermal quantities , providing the elements necessary to the understanding of the measurement process , the interaction between the object of measurement and the meqasuring system, static and dynamic characteristics of measuring systems, the uncertainty, the working principles of sensors and transducers, their use in the laboratory and in industry
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will learn through examples and exercises in the classroom and the laboratory , how to apply this knowledge to experimental research , product development , testing of machines and systems , quality and process control , diagnosis and management and maintenance of products and production departments , as well as monitoring , evaluation and technical assistance
TRANSVERSAL SKILLS:
The discussion of application examples in various industries and of various components and products will provide the student with a clear awareness of the transversal nature of the science of measurement in the wider multidisciplinary context of engineering , through a constant reminder to cross-cutting aspects of measurement systems and technologies

Program
Contents (lectures, 62 hours) The course presents the basic knowledge of mechanical and thermal measurements and testing methodologies. The measurement principles of the quantities of interest for industrial applications are shown through theoretical lectures and practical examples. General concepts on measurement systems and procedures. Instrument utilization in industrial application and on-line testing. Static and dynamic calibration. Elements of signal analysis and digital data processing, including basics concepts for analysis in the frequency domain. Traditional and innovative systems for the measurement of: dimension, displacement, strain, velocity of solids, velocity of fluids, acceleration, force, torque, power, pressure, flow rate, temperature. Basics on data acquisition systems and digital devices (sampling, quantizing, coding, main devices). Laboratory experiences (10 hours) Static Calbration, dynamic calibration, application of strain gages, signal acquisition and analysis using LabView.

Development of the course and examination
LEARNING EVALUATION METHODS
The examination consists in an oral discussion of the subjects of the course and of the laboratory exercises. 3 questions will be posed (maximum 4 in case of doubts in the evaluation): one on general metrological characteristics, one on the measuring principles of instruments and one on

signal acquisition. The students may also prepare and discuss a report on the experiments performed during the lectures.

LEARNING EVALUATION CRITERIA
The student, during the oral examination, will have to demonstrate to have the fundamental knowledge of mechanical and thermal measurements, data acquisition and digitalization and testing methods. In order to pass the exam with positive results, the student will have to show an overall knowledge of the course contents, which will have to be exposed with sufficient and correct use of technical terms. The maximum score will be achieved by demonstrating a deep knowledge of the course contents presented with a fully appropriate technical approach.

LEARNING MEASUREMENT CRITERIA
Score in a scale with 30 levels (e.g. 27/30) based on knowledge and capacities demonstrated by the student and measured according to the Learning Evaluation Criteria.

FINAL MARK ALLOCATION CRITERIA
For each question posed to the student, a score in the scale with 30 levels will be assigned. The final overall score will correspond to the average of the scores for each single question. The Laude will be assigned to the students that, having achieved the maximum score, will also demonstrate an outstanding knowledge in the discussed topics.

Recommended reading
1) Print of the course slides provided by the professor; 2) Measurement systems: application and design, E.Doebelin, ed. Mc Graw Hill; OTHERS 2) Les capteurs en instrumentation industrielle, G. Asch, ed. Dunod; 3) Instrumentation for engineering measurements, J.W.Dally, W.F.Riley, K.G.Mc Connell, ed. John Wiley & sons; 4) Theory and design for mechanical measurements, R.S.Figliola, D.E.Beasley, ed John Wiley. 5) Handbook of measurement science, P.H.Sydenham, vol.1, 2, ed. John&Wiley; 6) Il digitale, R.Giometti, F.Frascari, ed. Calderini.

Misure Meccaniche e Termiche (M/Z)

Gian Marco Revel

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
It is required that the student knows the fundamental concepts of mathematical analysis, physics, mechanics, fluid dynamics, thermodynamics and electromagnetism.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire basic knowledge on measuring instruments for mechanical and thermal quantities , providing the elements necessary to the understanding of the measurement process , the interaction between the object of measurement and the meqasuring system, static and dynamic characteristics of measuring systems, the uncertainty, the working principles of sensors and transducers, their use in the laboratory and in industry
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will learn through examples and exercises in the classroom and the laboratory , how to apply this knowledge to experimental research , product development , testing of machines and systems , quality and process control , diagnosis and management and maintenance of products and production departments , as well as monitoring , evaluation and technical assistance
TRANSVERSAL SKILLS:
The discussion of application examples in various industries and of various components and products will provide the student with a clear awareness of the transversal nature of the science of measurement in the wider multidisciplinary context of engineering , through a constant reminder to cross-cutting aspects of measurement systems and technologies

Program
Contents (lectures, 62 hours) The course presents the basic knowledge of mechanical and thermal measurements and testing methodologies. The measurement principles of the quantities of interest for industrial applications are shown through theoretical lectures and practical examples. General concepts on measurement systems and procedures. Instrument utilization in industrial application and on-line testing. Static and dynamic calibration. Elements of signal analysis and digital data processing, including basics concepts for analysis in the frequency domain. Traditional and innovative systems for the measurement of: dimension, displacement, strain, velocity of solids, velocity of fluids, acceleration, force, torque, power, pressure, flow rate, temperature. Basics on data acquisition systems and digital devices (sampling, quantizing, coding, main devices). Laboratory experiences (10 hours) Static Calbration, dynamic calibration, application of strain gages, signal acquisition and analysis using LabView.

Development of the course and examination
LEARNING EVALUATION METHODS
The examination consists in an oral discussion of the subjects of the course and of the laboratory exercises. 3 questions will be posed (maximum 4 in case of doubts in the evaluation): one on general metrological characteristics, one on the measuring principles of instruments and one on

signal acquisition. The students may also prepare and discuss a report on the experiments performed during the lectures.

LEARNING EVALUATION CRITERIA
The student, during the oral examination, will have to demonstrate to have the fundamental knowledge of mechanical and thermal measurements, data acquisition and digitalization and testing methods. In order to pass the exam with positive results, the student will have to show an overall knowledge of the course contents, which will have to be exposed with sufficient and correct use of technical terms. The maximum score will be achieved by demonstrating a deep knowledge of the course contents presented with a fully appropriate technical approach.

LEARNING MEASUREMENT CRITERIA
Score in a scale with 30 levels (e.g. 27/30) based on knowledge and capacities demonstrated by the student and measured according to the Learning Evaluation Criteria.

FINAL MARK ALLOCATION CRITERIA
For each question posed to the student, a score in the scale with 30 levels will be assigned. The final overall score will correspond to the average of the scores for each single question. The Laude will be assigned to the students that, having achieved the maximum score, will also demonstrate an outstanding knowledge in the discussed topics.

Recommended reading
1) Print of the course slides provided by the professor; 2) Measurement systems: application and design, E.Doebelin, ed. Mc Graw Hill; OTHERS 2) Les capteurs en instrumentation industrielle, G. Asch, ed. Dunod; 3) Instrumentation for engineering measurements, J.W.Dally, W.F.Riley, K.G.Mc Connell, ed. John Wiley & sons; 4) Theory and design for mechanical measurements, R.S.Figliola, D.E.Beasley, ed John Wiley. 5) Handbook of measurement science, P.H.Sydenham, vol.1, 2, ed. John&Wiley; 6) Il digitale, R.Giometti, F.Frascari, ed. Calderini.

Misure per la Gestione della Qualità

Nicola Paone

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
The student should know basic cocepts of mathematics and physics as wello as elements of mechanics, fluid dynamics, thermodynamics and electromagnetism.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course provides the students with the skills necessary for the selection and use of measuring systems for mechanical and thermal quantities used in quality control and process . In particular it provides the elements for an understanding of the measurement process , the interaction between measuring and metering system , static and dynamic characteristics of measuring systems , uncertainty . These elements are presented in the context of measuring operations aimed to determine consequent decisions . They then illustrate the principles of operation of sensors and transducers , and describes their use in the industrial context . The concepts of quality and the practical problems of control and management will be an integral part of the course .
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student at the end of the course will know the functioning of measuring systems for mechanical and thermal quantities . He will also be able to choose the measuring instrument suitable for the process of interest , considering both the uncertainty , the static and dynamic response . Finally he will incorporate measurement systems in an industrial process and perform measurements interpreting the results critically .
TRANSVERSAL SKILLS:
The student will be able to apply the lessons learned on measuring instruments in various industrial contexts , both for the quality control of products , as well as for the control of processes , wit application to multiple sectors.

Program
The course provides knowledge on the principles of operation and the choice and use of sensors and transducers for industrial measurement of mechanical and thermal quantities, with particular reference to their application for quality. The following main parts will be developed. Classroom lessons (62 hours) 1) The concept of measurement. Functional representation of measurement instruments. Examples. 2) Static characteristics of measurement instruments. Precision, bias, sensitivity, resolution, impedance, threshold, hysteresis. Uncertainty budget according to GUM. Static calibration. Dynamic characteristics. Generalized mathematical model of an instrument. Instruments of 1st and 2nd order; response to standard inputs, periodic inputs, transients and random inputs. Frequency response functions. 3) Sensors and transducers for measurement of: displacement, deformation and strani, velocità, acceleration, force, torque, mechanical power, flow velocità, flow rate, pressare, temperature. 4) Digital acquisition systems: main architecture and analog and digital electronic components of a multichannel data acquisition system. Amplifiers, filters, AD and DA converters. All instruments are discussed highlighting: basic operation principles, static and dynamic performance, field of application, choice criteria, use of data output.

Exercises/training sessions in classroom and in laboratory (10 hours) The following training sessions will be organized: 1) static calibration of a transducer in classroom; 2) one training session of measurement of dynamic quantities in classroom; 3) one training session in laboratory of informatics on the programming language Labview; 4) one training session on DAQ systems; 5) one guieded visit to the laboratories of DIISM.

Development of the course and examination
LEARNING EVALUATION METHODS
Oral exam composed by three questions, respectively on a) static and dynamic characteristics of instruments, b) description of a specific transducer and c) digital acquisition systems.

LEARNING EVALUATION CRITERIA
Knowledge of the topics, demonstrated through a clear, correct and complete oral presentation.

LEARNING MEASUREMENT CRITERIA
During the oral exam it will be evaluated the capacity to present the topic and to describe it correctly also with the support of graphics and schemes.

FINAL MARK ALLOCATION CRITERIA
The maximu mark is obtained by those students who demonstrate complete mastering of the three topics, exposing them clearly, in depth and correctly by producing also schemes and graphics. The minimum mark is attributed to those students who demonstrate a sufficient knowledge of at least two of the three topics and at least a partial knowledge of the third.

Recommended reading
1. Strumenti e metodi di misura, E.Doebelin, ed. Mc.Graw-Hill; 2. Misure meccaniche e termiche, G.L.Rossi, ed. Carocci 3. Measurement systems: application and design, E.Doebelin, ed. Mc Graw Hill; 3. Theory and design for mechanical measurements, R.S.Figliola, D.E.Beasley, ed John Wiley. 4. Instrumentation for engineering measurements, J.W.Dally, W.F.Riley, K.G.Mc Connell, ed. John Wiley & sons; 5. Handbook of measurement science, P.H.Sydenham, vol.1, 2, ed. John&Wiley;

Modelli per la Gestione della Produzione

Ornella Pisacane

Seat Ingegneria
A.A. 2016/2017
Credits 3
Hours 24
Period II

Prerequisites
Fundamentals of Linear Programming and of duality theory.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course allows students to acquire the necessary skills for designing, evaluating and using the automatic tools of mathematical optimization. In particular, they will study and examine in depth the algebraic languages for mathematically modeling and the main solvers (both commercial and not) of linear programming and integer linear programming, focusing attention on their use for solving problems of logistic production management. Such skills, by integrating the ones acquired during the course of Operations Research, will develop the knowledge in the field of Industrial Engineering (with regard to the production management, the sector of logistic and transport).
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The knowledge acquired during the course will be expressed through a set of professional skills, among which: 1. the capability to properly model the optimization problems; 2. the capability to identify the solver to use; 3. the capability to interpret the obtained results and to perform sensitivity analysis.
TRANSVERSAL SKILLS:
The exercise to solve a problem, developed (eventually) in a group, will lead to the writing of a report by the students. In this way, the students will improve: 1) their degree of autonomous judgment and of presenting (also in a written form) the obtained results; 2) their communication skills (derived from the work done in group); 3. their autonomous capability of both learning and of concluding.

Program
Review of Linear Programming (LP). Examples of LP models: the product mix problem, the transportation problem, the assignment problem. Models of Mathematical Programming (MP) for production planning and for optimal recource allocation. Models of MP for production scheduling and for lot sizing. Models of MP for facility location and for distribution. Models of MP for project management. Optimization software: LINGO and Solver of electronic spreedsheets.

Development of the course and examination
LEARNING EVALUATION METHODS
The learning evaluation is based on the discussion of an essay and on an oral test. The essay, individually elaborated, concerns a specific argument addressed during the course, with application to a case study inspired by industrial contexts. The oral test consists of a discussion on two or more arguments addressed during the lessons.

LEARNING EVALUATION CRITERIA
In order to positively pass the learning evaluation, the student has to show to have better

understood the arguments addressed during the course: on the mathematical models of problems concerning the production management, on reticular techniques for project management, on the use of optimization software.

LEARNING MEASUREMENT CRITERIA
The mark assigned to the discussion of the individual essay and the one given to the oral test vary between zero and thirty. The final mark, expressed in thirtieths, is obtained by rounding up the arithmetic mean of these two marks.

FINAL MARK ALLOCATION CRITERIA
The learning evaluation is positive if the student reaches a sufficient level, equal to a score of eighteen, in both the discussion of the essay and the oral test. The evaluation equal to a score of thirty is reached by showing a detailed comprehension of the arguments addressed during the course. The laude is, instead, given to the students who show a particular clarity during the oral test and during the organization and presentation of the essay.

Recommended reading
F.S. Hillier, G.J. Lieberman, Ricerca operativa 9/ed Fondamenti , McGraw-Hill (Italia), 2010; C. Vercellis, Ottimizzazione- Teoria, Metodi, Applicazioni , McGraw-Hill, 2008; F. Pezzella, E. Faggioli, Ricerca Operativa: problemi di gestione della produzione , Pitagora Editrice, Bologna.

Modellistica e Identificazione dei Processi Dinamici

Anna Maria Perdon

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
The student should have a good knowledge of the notions provided by basic courses in Mathematics and in Automatic Control. It 'also useful to know how to use programming tools

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The aim of the course is to provide the student with basic theoretical knowledge and practical methods for developing mathematical models from experimental data, techniques for the identification and methodologies for the analysis of models properties. The student will acquire the basics notions on the construction of models for linear dynamic processes and on prediction methods for parameters estimation.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Students will develop the skills needed to implement the methods and techniques learned in theory, they will learn to design a data collection experiment, to process them up to the identification of a suitable model and its validation. They will acquire the skills to work in the laboratory and to use dedicated software tools.
TRANSVERSAL SKILLS:
Through guided exercises the students develop: the ability to learn by assessing the completeness and adequacy of their preparation; the independence of judgment in analysing the behaviour of economic and production processes and formulate and propose solutions to problems inherent in the representation and management of such models; the communication skills in formulating and properly describe the solutions to the problems under consideration.

Program
Introduction and generalities about model construction and systems identification from experimental data. Models and parametric identification. Data collection and related problems. Best model and identification techniques (LS, ML, recursive methods). Model validation. Systems in state space form. Structural properties and relations between state space representations and external I/O representations. Realization of transfer function in state space form. Generalities on Neural Networks. An outline of identification by Neural Networks. Implementation of identification methods by Matlab System Identification Toolbox. Lab with NI myDAQ and NI myRIO, low-cost portable data acquisition (DAQ) devices that uses NI LabVIEW-based software instruments. Participation in laboratory activities is mandatory

Development of the course and examination
LEARNING EVALUATION METHODS
The learning evaluation will consist of a written test consisting consists of four questions of a theoretical nature, on the topics discussed in class and contained in the materials provided to the students. Each student must also complete a laboratory activity. report on the practical project on one of the topics discussed in class and present a report on this activity. In case of negative results

of the written examination, the student can repeat it, during the same academic year.

LEARNING EVALUATION CRITERIA
Correctness, completeness and clarity in answering the questions in the theory test. Accuracy and completeness in solving the exercises. In the report on the laboratory activity the student must prove that he can apply the concepts learned in the course, to properly use the tools and appropriate technologies and to write a clear technical report.

LEARNING MEASUREMENT CRITERIA
The written test consists of 4 groups of questions on the various parts of the program, each group contains a question which is assigned a score between 0 and 10, and a question which is assigned a score between 0 and 6. The student must answer a question in each group, choosing two questions for 10 points and two for 6 points. The test is considered sufficient if the score is greater or equal to 15. The report on the laboratory activity is assigned a score from 0 to 30 and is sufficient only if the score is greater or equal to 18.

FINAL MARK ALLOCATION CRITERIA
The overall grade is given by the arithmetic mean, rounded up to the whole, of the sum of the scores obtained in the written test and in the report on the laboratory activity if both are sufficient. The overall grade required to pass the exam is 18 points. Otherwise the overall grade is Not sufficient . The student who in addition to getting a score greater than or equal to 30 has demonstrated complete mastery of the topics addressed, and clarity of exposition will have a 30 e lode .

Recommended reading
Identificazione dei Modelli e Controllo Adattativi, S. Bittanti Pitagora Editrice Bologna Slides and exercises can be found on the web site Esse3 Web

Modellistica e Ottimizzazione per i Processi Industriali

Leopoldo Ietto

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Elements of linear algebra, Rudiments of linear matricial algebra., elements of mathematical analysis, Laplace transform. Basic elements of linear system theory.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The purpose of the course is to provide the students with basic and advanced techniques for the analysis and synthesis of digital control systems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will be able to analyse the technical specifications for the control systems, to choose the most appropriate approach to the synthesis problem, to realize the controller through the implementation of an algorithm.
TRANSVERSAL SKILLS:
The general approach adopted for the analysis and synthesis of the control systems will provide the student with the ability of facing different applications within the same methodological framework. In this way, the acquired competence can be also applied to problems relative to fields like e.g. industrial production management, environment and biomedical engineering.

Program
I-Structure and components of a discrete-time control system. -S-Z mapping -Stability analysis. -Transient and steady-state output response. -Design methods based on a discrete-time equivalent of an analog controller. -Design methods based on diophantine equations. -Eigenvalue assignment with state feedback and dynamic output feedback. - Linguistic description of complex plant dynamics - PID design through fuzzy inference

Development of the course and examination
LEARNING EVALUATION METHODS
The exam consists of written and oral parts. The written part concerns the analysis and/or design of an industrial control system, possibly using software packages. Lecture notes and books are allowed to be looked at. The oral part consists in a deep discussion on the most important theoretical notions concerning analysis, linguistic description and design of an industrial control system.

LEARNING EVALUATION CRITERIA
The primary goal of the exam is to verify the student capability to autonomously evaluate the essential features of a control problem and to recognize the most appropriate tools to solve it.

LEARNING MEASUREMENT CRITERIA
The learning degree is evaluated through the grasp of the basic principles governing the classical approach to the analysis and synthesis of industrial control systems.

FINAL MARK ALLOCATION CRITERIA
The maximum score is 30/30 and is assigned to students solving the given control problems in fully correct way and show a complete awareness oft the methodologies. The minimum score to overcome the exam is 18/30 and is assigned to students possessing the above requisites in a sufficient level. .

Recommended reading
Lecture notes. -Isidori: Sistemi di Controllo , Siderea, Ro K.J. Astrom, B. Wittenmark, Computer Controlled Systems , Prentice-Hall Englewood-Cliffs,N.J.1984. -K. Ogata, Discrete-Time Control System , Prentice-Hall, Englewood-Cliffs,N.J., 1987. -R. Isermann: Digital Control Systems , Vol 1 e 2, Springer Verlag, Berlino,1989. -M.L. Corradini, G. Orlando, Controllo Digitale di Sistemi Dinamici , Franco Angeli, Milano, 2005. -D.Dubois, H. Prade, Possibility Theory- An Approach to Computerized Processing of Uncertainty , Plenum Press, N.Y., 1980.

Models and Control of Biological Systems

Francesco Di Nardo

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course will allow: to know and understand and apply advanced methods for the description and interpretation of the functioning of the physiological systems of control using mathematical models. Case studies will address the hormonal secretion and the regulation of glycemia
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
This teaching is characterizing for the Bioengineering sector (ING-INF / 06) and will provide knowledge about advanced methods for the description and interpretation of physiological control systems operation by means of mathematical models, in particular hormone secretion and the regulation of blood glucose.
TRANSVERSAL SKILLS:
The attempt of solving a problem will be made in groups and will provide a report; it will be useful to help the student in improving the overall autonomy in judgement, the ability in communication, the capability in learning and in drawing conclusions.

Program
Linear and non-linear compartmental models and control. Structural identification of linear mathematical models: transfer-matrix method. Structural identification of non-linear mathematical models: Taylor series expansion method. Parameter estimation: least-squares and maximum likelihood methods. Design and analysis of identification experiments. Models of glucose kinetics and of C-peptide secretion and kinetics. Model-based characterization of glucose regulation system by indexes of insulin sensitivity and beta-cell responsivity. Relationship between insulin action and secretion. Model-based assessment of hepatic insulin degradation. Applications in clinical and experimental settings. Computer exercises: use of SAAM II Software System for interpretation of insulinemia and glycemia data by models of glucose kinetics.

Development of the course and examination
LEARNING EVALUATION METHODS
The assessment of student learning develops through two tests: a written test, which consists in solving exercises and theoretical questions about the topics covered in the course, to be completed in two hours; an oral exam which is divided into two parts: 1) the presentation of a paper prepared by the student on the basis of laboratory scheduled for the course; 2) an optional discussion on topics covered in the course. The written test is preparatory for the oral exam. Students must obtain at least a pass mark in the written test to access the oral exam. The oral exam must be performed in the same call of the written test. In case of failure of the oral exam, the student will have to repeat the written test.

LEARNING EVALUATION CRITERIA
To successfully pass the assessment of learning, the student must demonstrate, through the trials described above, of knowing advanced model-based methods for the description and interpretation of the functioning of the physiological control systems. The student must also demonstrate that they are able to apply these methodologies in order to achieve the optimal assessment of the parameters characterizing the considered physiological system and to discuss the results, through the submission of the project mentioned above.

LEARNING MEASUREMENT CRITERIA
Attribution of the final mark out of thirty

FINAL MARK ALLOCATION CRITERIA
In order to achieve a positive outcome of the overall evaluation, the student must achieve at least a pass mark, amounting to eighteen points in both the written test and in the the Part 2 of the oral test (optional discussion on topics covered in the course) and must submit their paper focused on laboratory experience (part 1 of the oral examination) The vote out of thirty is given by: the average between the marks achieved in the written test (± 3 points achieved in the Part 1 of the oral examination) and the marks achieved in the Part 2 of the oral exam. Exam is passed cum laude when students exceed the total vote of 30/30.

Recommended reading
Cobelli C., Carson E. Introduction to Modelling in Physiology and Medicine, Elsevier, 2008. ISBN:978-0-12-160240-6 Carson E., Cobelli C. and Finkelstein L. The mathematical modelling of metabolic and endocrine systems. Wiley & Sons, New York, 1983. Cobelli C., Bonadonna R. (Ed.) Bioingegneria dei Sistemi Metabolici. Bologna: Patron, 1998. Lecture notes. Scientific papers.

Motori a Combustione Interna

Flavio Caresana

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Basic concepts of thermodynamics, fluidynamics and combustion chemistry

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire advanced knowledge on the thermo-fluid dynamic processes taking place in volumetric internal combustion engines. Topics covered in the course will form the basis for an in-depth knowledge of the architecture and the main components of internal combustion engines. In this way, students enrich their knowledge on energy machines
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will have the ability to undertake the evaluation of the thermal and energy performance of the components of an engine and will be able to choose the engine selection criteria on the basis of the application field. These capabilities will consist in a series of professional skills, such as: 1. ability to organize the modeling and design of an internal combustion engine; 2. ability to assess the engine performance in a given application 3. ability to properly understand the formation mechanisms of the main pollutants in the exhausts of an engine and choose the methodologies for their removal
TRANSVERSAL SKILLS:
Since the performance of the engine depend on mechanical, fluid-dynamical, thermal, and environmental choices the course will contribute to the completion of the basic technical training, with contributions from various cultural areas that contribute to the culture and professional role of an engineer. The in depth knowledge of such a machine will allow students to test their ability in integrating their knowledge and interfacing with specialists of different areas

Program
Brief historical introduction Internal combustion engines classification Engine design and operating parameters Internal combustion engines operating cycles Torque and power curves, road load application Air inlet and exhaust processes in two- and four-strokes cycle engines Supercharging and turbocharging Ignition plants Fuel metering in spark- and compression-ignited engines Combustion in spark- and compression ignited engines Pollutants formation and control Engine cooling Friction losses and lubrication

Development of the course and examination
LEARNING EVALUATION METHODS
The exam procedure consists in an oral examination. At least three main topics addressed in the course will be discussed during the oral. The starting topic is at student's choice.

LEARNING EVALUATION CRITERIA
The evaluation consists first in verifing the student's knowledge and understanding of the basic functioning of an internal combustion engine. Then the student will be required to demonstrate his

in-depth knowledge on the thermo-fluidodynamic processes taking place both in spark ignited and compression ignited engines with particular attention to gas exchange processes, fuel metering, charge motion in the cylinder, combustion, pollutant formation and pollutant control techniques.

LEARNING MEASUREMENT CRITERIA
The student knowledge is graded through the attribution of a final mark out of thirty. The passing score is 18/30, the highest score is 30/30, brilliant students may receive in addition a praise.

FINAL MARK ALLOCATION CRITERIA
The outcome of the evaluation is positive if the student proves to have knowledge of all the basic subjects covered in the course. The highest score is achieved by demonstrating in-depth knowledge of the course contents. Praise is given to students who are particularlly brilliant in exposure and/or demonstrat particular mastery of the matters treated in the course, being able to analyze topics not explicitly covered or to treat standard topics in alternative ways.

Recommended reading
- G. Ferrari, Motori a Combustione Interna , Il Capitello, Torino - John B. Heywood, Internal Combustion Engine Fundamentals , McGRAW-HILL INTERNATIONAL EDITIONS

Opere Geotecniche Speciali

Francesco Mazzieri

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Basic concepts of soil mechanics and geotechnics

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course proposes the regulatory framework of geotechnical design in Italy and integrates the concepts (from basic course) concerning the geotechnical characterization (in situ and lab) of construction sites. The main geotechnical issues of construction yards (shoring, groundwater lowering, management of excavated soils, waterproofing) are illustrated. The course illustrates the main geotechnical issues of construction sites and the methods of analysis and/or solution (slope stability, seismic design, liquefaction risk, ground improvement, retaining walls, reinforced soils, use of geosynthetics, anchors, monitoring of ground movement).The course finally deals with the design and construction of some unconventional geotechnical works (land reclamation, landfills, large pipelines, special foundations).
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Through the analysis of actual or hypothetical situations proposed both in class practice and during the exam the course aims at providing the student with the ability of: 1) selecting the most appropriate investigation techniques; 2) recognizing the geotechnical issues posed by the situation at hand; 3) individuating the most appropriate approach to analyze and deal with the issues; 4) proposing and developing a design solution also based on the consideration of costs/benefits ratio.
TRANSVERSAL SKILLS:
Cooperative learning and study groups for some subjects are encouraged. Whenever easily accessible building yards are available, technical visits and on-site team practice are organized. This adds also to the improvement of communication skills, autonomous assessment and learning ability of the students.

Program
Il Regulations and recommendations on geotechnical design. Geotechnical carachterization of building sites. Excavations and drainage works. Management of excavated soils. Structural waterproofing. Use of geosynthetics. Soil improvement techniques. Reinforced soils. Slope stability. Inclinometers. Sesmic design of geotechnical structures. Landfills. Land reclamation. Buried pipes. Reinforcement of existing foundations.

Development of the course and examination
LEARNING EVALUATION METHODS
he exam consists in oral questions. The student shall answer questions regarding at least three different topics of the course program. If the answer requires short calculations, these shall be carried out in written form during the exam.

LEARNING EVALUATION CRITERIA

To pass the exam, the student must be able to demonstrate adequate knowlegde of the course subjects by correctly answering to the questions using an adequate technical terminology. The highest grade will be attributed to the students who will demostrate deep knowledge and understanding of the course content as well as the abililty to make links with the contents of basic and related courses.

LEARNING MEASUREMENT CRITERIA
The final grade will be attributed in /30

FINAL MARK ALLOCATION CRITERIA
Each group of answers regarding a given topic will be marked with a score ranging between 0/10 and 10/10. It is not admitted to score less than 6/10 (the student will have to resit the exam) on a given topic. The distinction grade (30/30 e lode) will be attributed to the students who will demostrate complete mastery of the subjects.

Recommended reading
Course materials made available on the Moodle platform

Organizzazione del Cantiere (EA)

Berardo Naticchia

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 90
Period 1s

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course explores the architectural design in relation to the technologies that can be adopted on construction sites; the methods and tools for the design and programming of construction sites, that will be relative to new construction, recovery and restoration; machines and equipment; safety issues and prevention of injuries and fatalities.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
All the technical issues will be practiced within tutorials and practical exercises relative to the organization and planning of construction sites relative to a multi-storey building.
TRANSVERSAL SKILLS:
Students will be able to make decisions about complex situations, where concurrent targets involving cost, time, safety and other issues must be balanced. They will be able to effectively search technical documents (e.g. ISO, EN specifications) and can manage autonomously documents pertaining site programing and organization.

Program
ectures (60 hours): Introduction to Construction Management: Key Concepts, organizational structure for the construction, the process for works execution, the regulatory framework of the construction works, acts and duties of the site engineer and site manager. interactions and mapping of processes. Development of the construction plan: analysis of the project information structure, definition of execution contexts, development of the WBS, analysis of technical, operational and economic interrelationships during all phases of construction. Techniques of construction quality management: Definition of performance specifications, defining the structure of the quality checks. Planning of construction time: Defining the scheduling of activities, defining the structure of the feed controls. Techniques of construction cost management: Structure of the construction costs, cost analysis and allocation. Techniques of construction risk management: identification, qualitative and quantitative analysis of the risks. Communication Management with Building Information Modeling: Introduction to BIM, key concepts for the management of the construction information system, the multi-dimensional structure of BIM data, key applications for modeling, organizing workset, the use of on field BIM information system. Classroom practice (30 hours): Application of methodologies and techniques of BIM modeling to a case of construction management for building construction.

Development of the course and examination
LEARNING EVALUATION METHODS
Oral examination. The students are required to carry out analysis and technical insights arising from the annual theme of exercise.

LEARNING EVALUATION CRITERIA
Evaluation of the student's autonomous ability to apply methodologies and analysis models and technical management of the projects presented during the lessons of the course.

LEARNING MEASUREMENT CRITERIA
Learning is measured by assessing the methodological correctness and adequacy of the analysis and modeling techniques developed during the examination session.

FINAL MARK ALLOCATION CRITERIA
The highest rating is awarded to students who demonstrate mastery of methodologies and modeling techniques presented in the lectures of the course getting complete and technically correct results while the minimum rating is assigned to students who apply with sufficient control the methodologies explained obtaining acceptable methodological consistency but incomplete results.

Recommended reading
Teaching materials are provided by the professor during the course

Organizzazione dell'Impresa

Donato Iacobucci

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course will enables students to acquire knowledge about the main organizational structures of firms,the relationships bewteen information technologies and organization, and the factors affecting the choice of different organizational forms and the related management processes. Specific attention is paid to vertical integration choices (make or buy) and the management of innovation processes. This knowledge contributes to enrich students knowledge about the factors affecting the strategic and organizational choices of firms and the contractual relations within the supply chain. The course also provide students with basic knowledge about internationalization processes and the role of these processes in the context of business growth strategies.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
After completing the course students will be able to master the methodology used in choosing the appropriate organizational form. Moreover students will be able to evaluate the costs and benefits of make or buy decisions and of the different contractual relations within the supply chain. Students will acquire several specific skills, such as: 1. the ability to evaluate the cost and benefits of vertical integration choices taking into consideration both production and transaction costs; 2. the ability to assess the costs and benefits of different forms of internationalization according to the company's strategic decisions; 3. the ability to evaluate costs and benefits of innovative projects.
TRANSVERSAL SKILLS:
During the course students are required to solve a variety of organizational issues, referring to organizational choices, make or buy decisions or the evaluation of innovation projects. Students are required, in team, to write a business plan for a new venture. They are therefore required to present and discuss the results of their work in class. These activities will contribute to improve independent judgment, communication skills and autonomous learning.

Program
Firms and organizations. Organization theories. Strategy, Organization design and effectiveness. Organizaional structures: unitary form, multi divisional form, matrix form. The firm as an open system and the interorganizational relations. Make or buy decisions and supply chain management. Designing organization for the internazional environment. Innovation and organizational change.

Development of the course and examination
LEARNING EVALUATION METHODS
The assessment of students' learning is made by: 1. A written test, consisting of five/six questions about the topics covered in the course. 2. An oral part, consisting in the discussion of the results of the written test and further questions on the topics covered in the course. Students cannot access the oral part of the exam if they have not passed the written test.

LEARNING EVALUATION CRITERIA
To successfully pass the final assessment, students must demonstrate to know the concepts and models illustrated in the course. Students must also demonstrate the ability to solve exercises related organization problems.

LEARNING MEASUREMENT CRITERIA
A score is assigned to each question. The sum of the points awarded to the questions is equal to thirty. Scores will be based on the following criteria: a) the completeness and accuracy of the answer b) the development of arguments, c) the use of the appropriate terminology. The result obtained in the written test can be increased or decreased in the oral test.

FINAL MARK ALLOCATION CRITERIA
The outcome of the evaluation is positive when the student reach at least eighteen points out of thirthy. The highest rating is achieved by demonstrating a thorough knowledge of the content of the course.

Recommended reading
Richard L. Daft - Organization Theory and Design - 12th Edition - 2015

Ottimizzazione degli Impianti dell'Ambiente

Francesco Fatone

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
Elements of hydraulic

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The student will develop detailed knowledge of management technologies and optimization of processes for the treatment municipal and industrial wastewaters and drinking water. Such knowledge will allow scientific approach to solve complex and applied engineering problems with clear reference to the management and implementation issues typical of chemical and environmental engineering.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire advanced technical knowledge for the interpretation of the projects, the identification of systems and the measurement and optimization techniques for management the plants for treatment of urban and industrial wastewaters and drinking water. The use of advanced methods to solve applied problems will allow approach comparable to that commonly used in the advanced labor market.
TRANSVERSAL SKILLS:
The approach to the optimization of engineering works and environmental and chemical plant will increase the degree of independence in terms of the critical choices in the management phase and of learning ability in the phase of full-scale data analysis.

Program
Law analysis in force, in matters of: drinking waters, waters protection from pollution, waste and treatmement sludge with particular care to role state waters company; Measure systems of operating parameters (mass and hydraulic load): on-line measure systems for macro and micro pollutants and process parameters. special test for process control (sour, aur, nur, etc); Mass balances of hydraulics, carbon, solids , energy, nitroigen; Control and management of drinking water treatment plants (membrane processes, ionic exchange, coagulation, filtration, sedimentation and disinfection); March tables of the waste water treatment plant. Management data analysis for waste water treatment plant in full scale; calculation of the operating parameters of processes, calculation of the specific parameters for each operative units

Development of the course and examination
LEARNING EVALUATION METHODS
The evaluation will be written and following possible oral examination during which it is expected to be discussed the topics related to management and optimization of wastewater and wastes treatment plants

LEARNING EVALUATION CRITERIA
To successfully pass the evaluation of learning, the student must demonstrate the understanding of

the concepts presented in class and the acqusition of the principles of management and optimization of wastewater and wastes treatment plants

LEARNING MEASUREMENT CRITERIA
During the examinations will be evaluated the understanding of the theoretical and experimental principles of the treated topics and the ability to management and optimization of wastewater and wastes treatment plants

FINAL MARK ALLOCATION CRITERIA
The final mark is attributed with minimum grade of 18/30 associated with complete knowledge of the treated topics. Additional points up to 30/30 will be awarded based on the general and specific skills. The evaluation "cum laude" will be given to students with elevated outstanding and critical exposition of the arguments.

Recommended reading
Course notes; Metcalf and Eddy, Wastewater engineering treatment disposal and reuse , Ed. Mc Graw Hill (Hoepli inter); Beccari et al., Rimozione di azoto e fosforo dai liquami , Ed. Bibliotece Tecnica Hoepli; Masotti, Depurazione delle acque , Ed. Calderoni; Sirini P., Ingegneria sanitaria ambientali , Ed. Mc Graw Hill; Henze, Harremoës, La Cour Jansen Arvin, Wastewater treatment Biological and chemical processes , Sec. Ed. Springe

Pavimentazione e Materiali Stradali e Aeroportuali

Francesco Canestrari

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course intends to provide to the students the basic and advanced knowledge concerning the mechanical behavior (e.g. visco-elastic) characterization of construction materials used in road and airport pavements. Theoretical and methodological aspects helpful for pavement structures design will be studied as well.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The course will provide students with specific and qualified skills to analyze and characterize road materials and structures in the context of road and airport constructions. Theoretical background and technical skills will be acquired through classroom lectures inclusive of tutorial.
TRANSVERSAL SKILLS:
Analytical and technical skills acquired will allow a detailed understanding of applied sciences and technological productive processes typical of civil engineering to be achieved. Moreover, the analysis process discussed during the tutorial sessions will favor the development of decision-making and communication skills of the students.

Program
Rheology of road materials: elasticity and plasticity of solid materials, viscosity of liquid and solid materials. Linear viscoelasticity: mechanical behaviour of viscoelastic materials, Boltzmann super-position principle, creep and relaxation tests, creep compliance and relaxation modulus. Linear rheological models: Maxwell model, Kelvin-Voight model, relaxation time and delay time spectrum, complex modulus and complex compliance. Dynamic measurements: complex modulus and dissipation, viscoelastic parameters as function of frequency (standard linear solid). Molecular mechanisms: Time-Temperature Superposition Principle (TTSP), Arrhenius equation and WLF model, master curves. Basics of material plasticity. Plastic and viscoplastic behaviour. Basics of damage analysis. Strategic Highway Research Program (SHRP): equipments and test methods, analysis criteria, interpretative models and technical standards. Rheological classification of bitumens based on the Performance Grade (PG). Chemistry of bitumen. Polymer modified bitumens. Mechanical properties of bituminous mixtures. Laboratory evaluation of stress-strain response of bituminous mixtures. Fatigue and rutting resistance of flexible pavements. Rational methods for designing road and airport pavements. Adoption of the elastic multi-layers model for the structural analysis of flexible pavements. Correct determination of loadings (traffic and weather conditions). Degradation prediction models: assignments of adequate mechanical properties to the constitutive materials of each pavement layer as function of their own intrinsic characteristics and external loading conditions. Calculation of stress and strain conditions of time and thermo dependent materials such as bituminous pavement layers on the basis of loading conditions. Analysis of pavements with cement-treated materials (two-phase behaviour). Linear damage

accumulation: Miner's law. Fatigue and rutting criteria for evaluating the service life of flexible pavements.

Development of the course and examination

LEARNING EVALUATION METHODS

the learning evaluation consists of an oral exam focused on the discussion of topics covered in class related to the mechanical behaviour (theoretical and experimental) of bituminous materials and the application of these concepts to the rational design of road and airport pavements.

LEARNING EVALUATION CRITERIA

In order to pass positively the exam, the student needs to prove a complete understanding of the topics covered in class and to have learned the theoretical and practical notions behind the mechanical behaviour of bituminous materials, as well as the procedures to measure the main representative parameters and the laws which control the failure criteria to be applied for the rational design of pavements modeled as elastic multi-layers.

LEARNING MEASUREMENT CRITERIA

During the oral exam, the student understanding of theoretical and experimental fundamentals which constitute the basis of the topics covered in class is evaluated, as well as the student ability to appropriately use equipments, models and technologies adopted in the engineering field of road construction for the rheological characterisation of bituminous materials, in addition to the tools necessary for the rational design of pavements.

FINAL MARK ALLOCATION CRITERIA

the final score is assigned out of 30. In order to pass the exam with a minimum score (18/30), the student needs to know sufficiently each topic covered in class. Higher score will be assigned based on the general and specific skills demonstrated by the student. The maximum score (30/30) will be achieved by proving an extensive knowledge of the topics covered in class. The score cum laude will be assigned to students who, having achieved the maximum score, will prove a strong competence on the subject as well as brilliance in the oral presentation.

Recommended reading

Santagata, Bocci, Canestrari, Cardone, Ferrotti, Graziani, Virgili, et al. Strade - Teoria e Tecnica delle Costruzioni Stradali , Ed. Pearson. Slides available on the professor's webpage inside Allegati - download menu (downloading through password provided by the professor).

Physiological Signal Processing and Modelling in Cardiology

Adrianus Swenne Cornelius

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
General knowledge of human biology and of the mathematical background of signal processing; some experience in MATLAB programming.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
To obtain an overview of and insight in the modelling and signal processing techniques that are used in clinical cardiology for diagnostic and for therapeutic purposes. Standard patient care as well as experimental procedures are covered. Also, the clinical and physiological background of these procedures is addressed, to stimulate the development of a critical attitude towards the clinical rationale of biomedical engineering projects in this medical specialty.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
This teaching characterizes the Bioengineering sector (ING-INF / 06) and provides knowledge about the main theoretical and practical tools for the acquisition and numerical processing of biomedical data in cardiology. Examples are procedures like cardiac catheterization, imaging techniques like MRI, SPECT and echocardiography, signals like the electrocardiogram and intracardially obtained electrograms, techniques and algorithms for cardiac anti-bradycardia and anti-tachycardia pacing and cardiac resynchronization, arrhythmia ablation (manual and robotic). Also models are addressed, amongst others a model of the circulation, including blood pressure, cardiac output, filling status of the arterial and venous compartments, and applied to problems like sudden loss of consciousness, circulatory shock and intensive care. This variety of techniques and applications necessitates a variety of active learning forms in which the students can demonstrate that they are able to apply their knowledge. This subject is taught by lectures, illustrated by site visits, and active learning is stimulated by journal clubs, computer practicals and programming assignments.
TRANSVERSAL SKILLS:
Understanding of medicine as a discipline and a profession Cooperation skills / teamwork Critical reviewing skills Multidisciplinary reasoning and formulating Presentation skills Programming skills Synthesizing skills Writing skills

Program
Frontal teaching, 41 hours. Lectures about cardiovascular physiology/pathophysiology underlying cardiovascular signals and images, concerning electrical heart function (action potential, pacemaking and conduction, genesis of the electrocardiogram, arrhythmias, ECG lead systems and vectorcardiogram, ECG measurements), mechanical heart function (contraction mechanism, excitation-contraction coupling, pump function) and circulation (physical concepts, arteries / capillaries / veins, neural control, humoral control and autoregulation, exercise and orthostasis, atherosclerosis and infarction, heart failure). Lectures about signal and image processing, concerning electrocardiography (ECG), intravascular and intracardiac pressure measurement, blood pressure and pulse oximetry, coronary angiography, echocardiography, single photon emission computed tomography (SPECT) and positron emission tomography (PET), magnetic resonance

imaging (MRI), computed tomography (CT), ECG monitoring, intracardiac electrograms and novel diagnostic and therapeutic procedures. Lectures about modelling and simulation of electrical heart activity (with a focus on the ECGSIM simulation program) and about modelling and simulation of the circulation (with a focus on the APLYSIA simulation program), including introductions to the ECGSIM and APLYSIA simulation and MATLAB programming assignments. Also included: frontal teaching during site-visits of the hospital. Student activities in lab/aula (31 hours). Initial simulation experiments with ECGSIM and with APLYSIA, and first ECG processing experiments with MATLAB. Plenary individual poster presentations of simulation assignments with ECGSIM and with APLYSIA, and of the Matlab solution for the ECG processing assignment (which is the same for all students). Plenary presentations, by teams of 2-3 students, in a journal club setting, of their litterature review assignments regarding the signal and image processing topics (electrocardiography, intravascular and intracardiac pressure measurement, blood pressure and pulse oximetry, coronary angiography, echocardiography, single photon emission computed tomography and positron emission tomography, magnetic resonance imaging, computed tomography, ECG monitoring, intracardiac electrograms, and novel diagnostic and therapeutic procedures); every student takes part in two different presentations on different subjects.

Development of the course and examination
LEARNING EVALUATION METHODS
The theoretical knowledge is tested by two multiple choice examinations, one about physiology/pathophysiology of the cardiocascular system, and one about the signal and image processing techniques. The journal club presentations (each student participates in two different presentations) are judged by a rubric; the presenters should also produce a short written report (2000-3000 words) that is graded by a mark. The ECGSIM and APLYSIA simulation assignments, and the MATLAB ECG processing assignment are presented in the form of posters, and are graded by marks.

LEARNING EVALUATION CRITERIA
In total, each student has five individually obtained marks (two for the multiple choice exams, V1 and V2, and three for the posters reporting about the ECGSIM simulation assignment, V3, the APLYSIA simulation assignment, V4, and the MATLAB ECG processing assignment, V5). Additionally, the student gets four scores that are obtained in a journal club team (two marks for the reports accompanying the journal club presentations, V6 and V7, and two rubric scores for the actual presentations, R6 and R7). Grades are on the Italian 0-30 scale. The rubrics yield a pass or a fail; when a team fails for the presentation, the presentation should be improved and should once more be held.

LEARNING MEASUREMENT CRITERIA
The various tests in this course should assert that the biomedical engineering student understands the major clinical issues in cardiology and that the student understands how the various signal and image processing methods meet/support specific diagnostic or therapeutic needs in this medical specialty. The student has also to demonstrate to have a critical attitude towards the litterature (journal club activities), and to be able to convey his/her ideas clearly by an oral presentations, by posters and by writing. Finally, by the simulations and signal processing assignments, the student is tested on insight, inventiveness, and creativity.

FINAL MARK ALLOCATION CRITERIA
The final mark for the course, V, is computed by: V = [1.5*V1 + 1.5*V2 + (the best two grades of V3-V5) + V6 + V7] / 7

Recommended reading
1) Klabunde - Cardiovascular Physiology Concepts, 2nd Edition; 2) Goldberger & Ng - Practical

Signal and Image Processing in Clinical Cardiology; 3) selected scientific publications, individually assigned, for the journal club activities; 4) various internet resources (free). Educational simulation software: 1) ECGSIM (free; http://www.ecgsim.org/); 2) Aplysia Cardiovascular Lab (http://www.aplysia.se/aplysiacardiovascularlab.htm); 3) MATLAB

Pianificazione dello Sviluppo Territoriale

Roberta Angelini

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
The course allows the student to develop interdisciplinary studies in the fields of the environment, territory and socio-economic development in collaboration with other disciplinary sectors of the University Course through an integrated teaching.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims at introducing to the critical knowledge of the nature and complex structure of the territory, highlighting the different disciplinary approaches that contribute to defining the settlement forms and structures of the territory and provide knowledge and in-depth interdisciplinary studies in the environmental, territorial and socio-economic development sectors. The aim of the course is to allow the student to gain basic professional training, providing in-depth technical knowledge in urban planning-territorial design and planning.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student must be able to correctly interpret urban and territorial phenomena, identify critical aspects and the potential of the systems analysed, propose alternative intervention scenarios of structure and spatial organisation, prepare reports and regulations.
TRANSVERSAL SKILLS:
The course allows the student to develop interdisciplinary studies in the fields of the environment, territory and socio-economic development in collaboration with other disciplinary sectors of the University Course through an integrated teaching. As regards, cross-disciplinary skills in the fields of environmental protection, risk protection, regeneration of the unexpressed potential of the territory and interdisciplinary economic and territorial analyses will be developed.

Program
The educational objective of the course is to introduce the student to critical knowledge of the characteristics and the complex structure of the territory, highlighting the different disciplinary approaches which combine to define the structure and settlement patterns and provide knowledge and interdisciplinary studies in the field of environment and territory. Content of lectures (32 hours) The course is structured in communications with insights on best practices and practical examples. They will also be invited to participate in experts from different disciplines that integrate the communications of lecturer. The main topics of the course: The principles of the territorial Planning and their evolution - The levels of planning, types of plans and entities responsible - Multi levels of spatial planning: municipal, local, regional - The main innovations on the territorial government - Case studies and good practices. Exercises (16 hours) The student must know how to correctly interpret the urban and territorial complexes phenomena, and highlight critical and potential elements of the systems analyzed, propose alternative intervention scenarios of spatial organization, produce reports and urban planning regulations.

Development of the course and examination

LEARNING EVALUATION METHODS
The student is assessed with reference to two ways: evaluating the papers drawn up during the class exercises and evaluation of exam questions. The papers are closely related to the exercises of the course topics with the aim to implement an application trial of the same topics. The next written test shall be subject to the delivery of the papers arranged during exercises in the classroom and to having obtained a judgment at least sufficient in the group work. The written test to be completed in two hours, is divided into five questions on topics covered in the course; in case of negative results of the written examination, students must repeat the test,

LEARNING EVALUATION CRITERIA
The student must demonstrate that they understand the concepts presented in the course through exercises and through the answers to exam questions. The drafting of the documents takes place with constant revisions with the teacher of the course, with urban planning workshops and a plenary seminar comparison between different working groups.

LEARNING MEASUREMENT CRITERIA
Each working group engaged in exercises receives a qualitative synthetic judgment. Each individual student for the written test receives a score ranging from eighteen to thirty. The final score, expressed out of thirty points, is given a final overall assessment relates to the commitment demonstrated during the course, the skills acquired by the student, the score of the work done during exercises and the marks obtained in the written test.

FINAL MARK ALLOCATION CRITERIA
The student must achieve a positive final judgment on the elaborate of exercises and at least sufficiency in the written test. The final grade is given by the qualitative and quantitative sum of the written test with a rating between 18 and 30, with the weighted qualitative result of exercises of products on a scale of five values (sufficient, fair, good, very good, excellent). The overall evaluation of the written exam has a weight of 60% while the qualitative result of the exercises has a weight of 40%.

Recommended reading
Bronzini F., Bedini M.A., Imbesi P. The measure of the Urban Plan , Vol 1 e Vol 2 , Gangemi, Roma, 2014. The teacher will identify texts by mutual agreement with the teachers of the reference sectors targeted by the program, in order to highlight the most interesting examples of reference under the interdisciplinary aspect.

Privacy and Security of Biomedical Data

Marco Baldi

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
Basic concepts of telecommunications.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course will allow students to achieve an advanced knowledge of the principles and practices of digital data security, with a special reference to biomedical data. Such a knowledge, built upon the theoretical and practical principles provided by the courses in the area of telecommunications, will bring the student a wide awareness about classical as well as modern approaches and methods to achieve transmissions and storage of digital data able to guarantee confidentiality, authentication, integrity and non-repudiation
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Through this free-choice course, The student will become able to apply his knowledge to face advanced design challenges concerning the analysis and the use of algorithms for encryption, authentication and digital signing of messages, as well as protocols and systems for secure transmissions and storage of digital data, with a special reference to biomedical data. Such an ability will be translated into some professional skills, like the ability of assessing the security level which is necessary for data relevant to some specific applications and of identifying the critical elements in the design of protection systems for biomedical data.
TRANSVERSAL SKILLS:
Students will perform group exercises based on the use and development of software for implementing and validating techniques for digital data security. This will contribute to improving their autonomous judgment skills in defining the path to the solution of problems. Communication skills will also be refined by group work. Also their learning abilities will be improved by group work and by the use of software tools which will integrate didactic materials.

Program
Principles of information theory. Principles of data reliability. Principles of security and cryptography. Symmetric and asymmetric cryptography. DES, AES, RSA, ElGamal cryptographic systems. Hash functions and digital signatures. Protocols for networks security. Privacy, safety and security in biomedical information systems. Software exercises on security techniques.

Development of the course and examination
LEARNING EVALUATION METHODS
The exam consists of an oral test, in which the student will be asked to explain the basic concepts and describe the main techniques concerning privacy and security of biomedical data. It will also be proposed to each student to perform an in-depth analysis by carrying out a project or, at the option of the student, preparing a paper on one of the topics of the course.

LEARNING EVALUATION CRITERIA

The student, during the oral test, will have to present and discuss the project or paper and demonstrate the theoretical and practical knowledge of techniques for ensuring privacy and security of biomedical data. To successfully pass the oral exam, the student will have to demonstrate an overall knowledge of the contents of the course, presented in a sufficiently correct way and with the use of proper technical terminology. The highest rating is achieved by demonstrating a thorough understanding of the course contents, exposed with mastery of the technical language.

LEARNING MEASUREMENT CRITERIA

The ability and autonomy of the student in facing and solving theoretical and practical problems related to privacy and security of biomedical data will be assessed during examinations.

FINAL MARK ALLOCATION CRITERIA

The final mark will be computed by summing the evaluation of the oral examination to that of the project or paper prepared by the student. The student will be able to achieve up to a maximum of 10 points through the presentation and discussion of the project or the paper. The oral exam will be divided into two or three questions, depending on whether or not the student will present the project or paper. Each question will be evaluated with a score ranging from 0 to 10 points. Honors students will be those who achieve the highest rating and also demonstrate full mastery of the subject.

Recommended reading

Lecture notes provided by the teacher. W. Trappe, L. C. Washington, Introduction to Cryptography with Coding Theory , Pearson - Prentice Hall. W. Stallings, Cryptography and Network Security: Principles and Practice , Pearson - Prentice Hall. A. Holzinger, Biomedical Informatics: Discovering Knowledge in Big Data , Springer.

Probabilità e Statistica Matematica

Giovanna Guidone

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
Elementary algebra. Differential and integral calculus of the functions of one and more variables.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The aim of the course is that of providing the theoretical, methodological and practical elements of probability theory and statistics. The objective is that of solving typical problems of engineering management and of industrial engineering, including problems of high complexity, incomplete definition or contradicting characteristics. Also important is the acquisition of knowledge about analyzing and solving problems related to new and emerging areas of businness management. In particular, the course aims at providing the student with the basic elements of probability distributions and of some standard problems of statistics, suche as parameter estimation and hypothesis testing.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to develop the student s ability to use statistical methods towards the formulation of models, the analysis and the solution of problems, the main classical results of probability and statistics will be introduced, accompanied by numerous applications. This path will lead the student to achieving the capability of using the elements of probability theory and the tools of descriptive and inferential statistics, in order to model quantitatively the problems and to generate decision support systems.
TRANSVERSAL SKILLS:
Individual and collective problem-solving sessions, aimed at detecting, formulating and solving engineering management problems, will improve the ability to develop independent thought and learning capabilities. Oral presentations of the main topics introduced in the course will help developing communication skills.

Program
1. Probability spaces. 2. Discrete random variables. 3. Continuous random variables. 4. Convergence and approximation: law of large numbers and central limit theory. 5. Mathematical statistics: estimates, sampling, regression, hypothesis tests.

Development of the course and examination
LEARNING EVALUATION METHODS
The exam consists of a written test and a colloquium: - both tests will concern the topics of the current academic year; possible exceptions will be assessed on a case-by-case basis; - registration to the first written test is mandatory, and has to be done on line on the university platform Esse3 (the link is available on the teacher's web page); - the written test consists of a number of problems and questions concerning all topics treated during the course; this test will last two or three hours, and the student will not be permitted the use of any kind of material, but for a pocket calculator; - a minimum score of at least 18/30 in the written test is required for the admission to the oral test; - the

list of the names of the students admitted to the oral test will be published by the teacher on his official web page; - the oral test will contain mainly theoretical questions, some of which may have to be formulated in written form, and may contain problems and exercises concerning course topics not covered in the written test or course topics in which the student may have shown weaknesses in the written test; - questions of general comprehension may be asked both in the written and in the oral test and may concern any of the course topics; - in the case of a successful written test, the student may sit for the oral test either in the same session or in the next available session, but not later; - in the case of a successful written test, but a not passing grade in the oral test, the student may try the oral test again in the next available session; in case of another failure, the student will have to sit for the whole exam again; - all written tests must be presented in readable form, with a negligible amount of corrections, which must anyway not mar the esthetics of the text; the exposition must be clear, fluent, well organized and consistent both in the mathematical and in the linguistic aspects; - honor code: each student pledges that the written tests are entirely his/her own work and that no input from other students or sources has been used; demeanors which are deemed unfair or not in line with these principles entail the failing of the exam.

LEARNING EVALUATION CRITERIA
In order to pass the exam, the student must demonstrate understanding of all the topics covered and concepts introduced during the course and published on line as "Final program" or "Exam program" at the end of the course, and to be able to use them in solving typical problems of probability and statistics.

LEARNING MEASUREMENT CRITERIA
The student must demonstrate to have acquired deep knowledge on the fundamental principles and techniques of probability and statistics and on the solution of typical problems arising within the topics covered during the course.

FINAL MARK ALLOCATION CRITERIA
The highest grade of 30/30 will be given to those students which will have shown deep knowledge and perfect mastering of all the course topics and the ability of working with full independence both in solving the assigned problems and in the oral presentation. The lowest passing grade of 18/30 will be given to the students which will have shown sufficient knowledge and good mastering of all the course topics.

Recommended reading
Sheldon M. Ross, "Probabilità e statistica per l'ingegneria e le scienze" (a cura di F. Morandin), Apogeo 2008; T. T. Soong, Fundamentals of Probability and Statistics for Engineers, Wiley 2004

Progettazione agli Elementi Finiti

Edoardo Mancini

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
For the comprehension of the subject covered in the course, the student need to have the knowledge acquired in machine design , reliability and safety of mechanical systems and the courses that are preparatory.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to give students basic and advanced knowledge on the finite element method, about its use in mechanical design and, in general, in all problems of engineering interest. The course will integrate the knowledge acquired in machine design , reliability and safety of mechanical systems and the courses that are preparatory. The course will enrich the student's ability in understanding and identifying problems and, accordingly, in formulation of solutions. In addition, the knowledge acquired will allow the student to select and apply methods of modeling based on the numerical analysis in order to simulate the behavior of mechanical components, and improve their performance
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to address advanced design themes, even of considerable complexity, and treat the innovation and development of new products through the application of knowledge, students must demonstrate that they acquired the ability of creating finite element models of mechanical components or simple assemblies. This ability will be assessed through a number of vocational skills, such as: 1. the ability of understanding how the component can be modeled numerically; 2. the ability of identifying whether the problem can be properly simplified or divided into more basic problems; 3. the ability of assigning the correct boundary conditions and loading, and interpreting properly the results of finite element analyses
TRANSVERSAL SKILLS:
The student will be required to solve an engineering problem using the finite elements method, the project will be carried out individually and will lead to the drafting of a report. This will improve the degree of independence of judgment and communication skills of students, as well as the ability to learn independently and to draw conclusions

Program
The couse is divided in a theoretical part, where the basic Finite Element theory is presented, and an practice part, where the student is trained on the use of commercial FE codes. Theoretical part. Matrix strucutral analysis, concept of shape or displacement function, deformation matrix, elasticity matrix, stiffness matrix. Assembly of the stucture stiffness matrix. Loads and constraints application. Element types: truss, beam, three and four node plane elements. Plane stress, plane strain, and axialsymmetric formulation. Isoparametric elements. 3D elements. Outline on non-linear solution preocedures: contact, geometric and material non-linearity. Eigenvalue analysis, dynamic problems and buckling. Evaluation of mesh quality. Practice part. Training on commercial FE codes (Ansys Workbench, MSC/Marc). Case studies and practice exercises in the classroom.

Development of the course and examination

LEARNING EVALUATION METHODS

two tests will be used: - oral examination on the theoretical topics explained during the course - the discussion of a report where the student explain how to solve a complex engineering problem using the finite element method. The project will be carried out individually and will lead to the drafting of a report.

LEARNING EVALUATION CRITERIA

The student will be evaluated according to his comprehension of the Finite Element Method and his ability of apply it to complex problem usign a commercial software. Therfore, the ability will be assessed through a number of vocational skills, such as: 1. the ability of understanding how the component can be modeled numerically; 2. the ability of identifying whether the problem can be properly simplified or divided into more basic problems; 3. the ability of assigning the correct boundary conditions and loading, and interpreting properly the results of finite element analyses.

LEARNING MEASUREMENT CRITERIA

The learning measurement will be done on the basis of the confidence and the understanding shonw by the student during the exam

FINAL MARK ALLOCATION CRITERIA

The final mark will be the average of the mark given to the report and the one given to the oral examination

Recommended reading

.D. Cook, D.S. Malkus, M.E. Plesha, R.J. Witt, "Concepts and Applications of Finite Element Analysis , Wiley G. Belingardi, "Il Metodo degli Elementi Finiti nella Progettazione Meccanica , Levrotto&Bella G. Santucci, "Dispense del Corso di Costruzione di Macchine O.C. Zienkiewicz, The Finite Element Method , McGraw-Hill."

Progettazione Assistita da Calcolatore dei Sistemi di Controllo

Valentina Orsini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Automatic Control, Fundamentals of Automatic

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to know and learn the use of some of the most prominent Computer Aided Control Systems Design (CACSD) tools for the analysis of dynamic systems and the design of MIMO control systems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will be able to use CACSD tools for solving problems of analysis and synthesis of MIMO control systems.
TRANSVERSAL SKILLS:
Solving problems of analysis and design of control systems using IT tools will contribute to improve both the independence in judgment in general and the communication expertize, resulting also from team-work, and the student autonomous learning.

Program
Elements of control system design Elements of linear time invariant systems Stability of MIMO uncertain linear systems Basic elements of Matlab, Sedumi Use of Matlab for the analysis of SISO and MIMO systems Elements of MIMO Control Systems Synthesis Use of Matlab and Sedumi for MIMO modal synthesis: the tracking problem of external signals and the disturbance rejection Elements of robust control for politopic uncertain systems and automated procedures for a numerically efficient solution (LMIS).

Development of the course and examination
LEARNING EVALUATION METHODS
oral exam and exam to be performed on the computer

LEARNING EVALUATION CRITERIA
accurate knowledge of theoretical topics and of main informatic tools for automatized problem solution

LEARNING MEASUREMENT CRITERIA
mastery of concepts, clarity of exposition, ability to use Matlab and Sedumi

FINAL MARK ALLOCATION CRITERIA
final mark is espressed in 30/30 partitioned as follows: 20/30 (test computer), 10/30 oral examination

Recommended reading

-Ruberti, Isidori: Teoria dei Sistemi. Bollati-Boringhieri -Isidori: Sistemi di controllo. Siderea -Cavallo, Setola, Vasca: La nuova guida a MATLAB, SIMULINK e Control Toolbox. LiguoriBiran, Breiner: MATLAB for engineers. Third edition - Prentice Hall

Progettazione dei Sistemi di Controllo

David Scaradozzi

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
The student is required to be familiar with the basic elements of Systems Theory, Control Theory, Probability theory, Linear Algebra; Math Analysis; Physics.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course has the aim to increase the knowledge learnt in the base courses, related to the problems of automatic control of engineering interest, referred to more general operative situations. Students will learn theorical elements for the planning and optimization of advanced control systems with high performance in case of complex real operative situations.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The course, even it is more aimed at increasing theorical knowledge, will provide experiences in applying the elements learnt in analysis and planning of complex automatic control systems. The considered case studies will provide experience to introduce measure indexes and optimization in real situations with high presence of noise. At the end of the course, students will be able to autonomously model and design dynamic systems.
TRANSVERSAL SKILLS:
In the course are strengthened the competences that leads to identifying and solve in a better way, complex problems of engineering nature. Besides, it is increased the problem solving capacity and the identification of suitable optimization indexes.

Program
essons (52 Ore) - Elements of probability theory and stochastic processes. - Minimum variance estimate. Orthogonal projection Lemma - Kalman filter. Optimal smoothers and predictors. - Dynamic programming equations. LQ and LQG control problems. - Optimal stabilization and tracking over finite and infinite time intervals. - Minimum variance control of industrial processes- - Adaptive control Laboratory (20 Ore) LabVIEW and Matlab use for advance control systems design.

Development of the course and examination
LEARNING EVALUATION METHODS
The final examination consists of an oral test. Usually, the first question concerns the discussion of a case study

LEARNING EVALUATION CRITERIA
Knowledge assessment of a number of topics of the course.

LEARNING MEASUREMENT CRITERIA
Measurement of the mastery of at least two of the course topics.

FINAL MARK ALLOCATION CRITERIA

Average between the two discussed arguments.

Recommended reading

Lessons (52 Ore) - Elements of probability theory and stochastic processes. - Minimum variance estimate. Orthogonal projection Lemma - Kalman filter. Optimal smoothers and predictors. - Dynamic programming equations. LQ and LQG control problems. - Optimal stabilization and tracking over finite and infinite time intervals. - Minimum variance control of industrial processes- - Adaptive control Laboratory (20 Ore) LabVIEW and Matlab use for advance control systems design.

Progettazione di Edifici

Marco D'Orazio

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Knowledge of structural technologies and building construction technologie

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
Students will acquire knowledge about methodologies useful to design green buildings. Students will integrate previous knowledges regarding building construction (Architectural Engineering and Building construction) in order to acquire consciousness of environmental impacts related to building design and construction.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Students will be able to promote the innovation and the development of buildings considering environmental issues related to the production and to the use of buildings. At the end of the course, students will be able to design green buildings, considering the environmental impact of buildings and components. Considering acquired professional abilities, the students will be able to: 1) choose materials and technologies considering measured environmental impacts; 2) identify and measure environmental impacts; 3) interpret results coming from methodologies previous defined, working in group.
TRANSVERSAL SKILLS:
An exercise of problem solving, that will be carried out in groups will lead to the drafting of a report. It will help the students to improve their independence of judgment, their ability to work in team, to learn independently and to draw conclusions.

Program
Contents (Lessons, 24 hours) Environmental sustainability of building constructions: Theoretical basis, laws and regulamentations in Europe and Italy, calculation methods (LCA, Environmental protocols); Sustainability of building technologies and building meterials (EPD and related evaluation criteria); The connection between construction sustainability and the building design process considering use and safety necessities specifically on complex buildings; Practical activity (building design, 48 hours) Definition of the functional layout of a public commercial and office buildings with an internal car parking; Definition of the foundation technology; Definition of the volumetric organization of the building and of the structural layout; Functional layout of an office building with commercial spaces and car parking considering structural characteristics and evacuation problems. Definition of the construction elements and of their connection considering a performance based approach and sustainability issues too; External space organization.

Development of the course and examination
LEARNING EVALUATION METHODS
The evaluation will be developed in a two stage process. Firstly the Teacher will evaluate results obtained during the practical activity (annual activity) . Secondly the teacher will evaluate during an oral examination the knoledge acquired by the student on the sustainability in the construction

process.

LEARNING EVALUATION CRITERIA
Ability to apply acquired knowledges on the design of a building

LEARNING MEASUREMENT CRITERIA
Ability and autonomy of the student to solve problems related to this specific area. Ability regarding the use of methdologies and tools related to the sustainability

FINAL MARK ALLOCATION CRITERIA
The final mark will be comprises between 30 with laude and 18. The highest evaluation will be assigned to students autonomous and able to solve problems related to sustainable design. The lowest evaluation will be assigned to students adequately able to solve problems related to sustainable design.

Recommended reading
Lectures on: http://lms.univpm.it; Books: Architecture in a climate of change, Architectural Press, USA, 2005; Architectural science, the basis of sustainable design, Szokolay, 2004, Elsevier press.; Materials for sustainable sites, Calkins, 2009, Wiley and sons ed.; Life cycle assessment in edilizia. Progettare e costruire in una ottica di sostenibilità ambientale,M.Lavagna, 2008, Hoepli Ed., Milano

Progettazione di Impianti di Climatizzazione

Paolo Principi

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Heat and mass transfer, thermodynamics, fluid dynamics

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The aim of the course is to provide students with advanced knowledge on components of heating and cooling systems, ventilation and air conditioning systems and to refine their ability in system typologies, design procedures, in the graphic representation of the components of a project and, at the end, on application to several types of building. This knowledge, by integrating those already gained in thermodynamics , heat and mass transfer, thermal systems, fluid dynamics, will enhance the expertise in the field of air conditioning systems for the achievement and maintenance of the environmental comfort conditions
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
With the purpose to address and develop knowledgeably advanced design techniques, even complex, and proceed to the development of innovative products and system components, of new technological processes through the application of knowledge, the student will know how to design the air conditioning systems of buildings with optimization criteria. This capacity will be expressed through a number of professional skills, such as: 1. the ability to carried out the numerical analysis to evaluate the building envelope energy behavior in the different seasonal phases 2. the ability to perform the design of the components of air conditioning systems 3. the ability to proceed to optimized choices of systems in function of the use of the building 4. the ability to graphically return the plant schemes in accordance with standards, rules and laws relating to the design.
TRANSVERSAL SKILLS:
The use of computer aided design (CAD) and software tools improve the knowledge related to the design process and the project documentation. The use of software for the integrated design of both the building and the related HVAC (Heating Ventilating and Air Conditioning) systems will improve the assessment of the energy performance of the whole system. The awareness of the acquired knowledge enhance students autonomous judgement and team working skills

Program
Design and contract. Thermophysical characteristics of the building envelope. Environmental conditions of the project. Calculation of the winter heat loss. Estimation of heat loads in summer. Energy-saving patics. Elements of psychrometers: psychrometric variables, psychrometric charts, transformations termodibnamiche moist air. Comfort termoigrometico: energy balance of the human body, thermal power scattered by the human body, environmental variables influencing the comfort, method of measurement of variables. The noise emitted by plants. Types of plants. Hydronic networks: open and closed loop, types of distribution pipes, pipe thermal insulation, fixings, sizing of the lines and equipment related to them. Circulation pumps. Systems of regulation and supervision. Safety systems: open and closed expansion vessels, safety valves sizing. Terminal units: fan coil unit, radiant heaters. Air handling units : supply fans, humidifiers, chilled water and direct expansion

coils, heating coils, filters, motor and drives, air to air heat recovery. Air duct design: ducts: sheet metal, insulated, textile, flexible thermal insulation of the channel, special parts, dampers, attenuators acusrtici, fire dampers. The diffusion of air. The air handling units, components, heat recovery, thermal stations: characteristics of the plant room, boilers, burners, chimneys, distribution manifolds, propulsion systems. Chiller and cold storage, cooling towers. Heat pumps.Patterns of plant. Selection criteria for air conditioning systems. Main techniques for the thermal and hydraulic performance and design pratics. Hot water production by solar collector plant. Design of air conditioning systems for industrial and service sectors

Development of the course and examination
LEARNING EVALUATION METHODS
: During the oral exam the student must demonstrate knowledge of the topics of heating, ventilating and air conditioning systems. The exam questions will cover the various thematic areas discussed in class by the teacher.

LEARNING EVALUATION CRITERIA
During the examination of the project, student must demonstrate that they have executed it in accordance with current standards and laws , to have properly sized components and graphically returned the air conditioning system of plans and cross section drawing. With the answers to the questions, students must demonstrate that she/he have mastered the issues of the entire teaching program.

LEARNING MEASUREMENT CRITERIA
The course final grade is expressed in thirtieth with a threshold of 18/30. Students showing thorough preparation and insightful analysis will be awarded the highest grade with honors (30 cum laude).

FINAL MARK ALLOCATION CRITERIA
The final grade is computed by adding the evaluation of the answers to the questions posed during the oral exam and the quality of project of HVAC. Honors (30 cum laude) will awarded to the students who demonstrates to have fully mastered the subject and shows the ability to apply the acquired knowledge in different items of course.

Recommended reading
Luca Stefanutti - Manuale degli Impianti di Climatizzazione- Tecniche nuove Carrier Air Conditioning Company, Handbook of Air Conditioning System design . McGraw Hill. Files in pdf of the power point slide and the tool used during the course, downloaded from lms.univpm.it portal, using the university's credentials for access and password given during the course.

Progettazione di Impianti Industriali

Maurizio Bevilacqua

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course allows the students to learn and understand relevant concepts in Production and Operation Management as well as in Project Management. Tackled topics complete students know-how in the field of industrial engineering so that to better face industrial engineering multidisciplinary concepts
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
A correct production systems management requires to deeply analyse the introduction of new management processes ant tools. The students will thus be able to: 1. Define and formulate Master Production Schedules; 2. Select appropriate inventory management policies (MRP, reorder point, reorder interval)l; 3. Application of lean management tools to production systems; 4. Schedule and control complex projects
TRANSVERSAL SKILLS:
Classroom exercises to be developed under the teacher supervision will enhance their judgements applying, communications and learning skills

Program
The course helps the student to familiarize with modern production and operation management techniques and methods as well as with Project Management tools and techniques. Aggregate and master production scheduling. Inventory management methods, Material Requirement Planning. Just in Time production systems. Job Shop Scheduling. Project Scheduling and control tools. Resource planning and estimating. Time estimating techniques. Cost estimating techniques.

Development of the course and examination
LEARNING EVALUATION METHODS
The examination consists of an oral talk. Simple written calculations may be functional for the answer completeness.

LEARNING EVALUATION CRITERIA
A positive examination outcome requires the student to demonstrate a complete understanding of the course pillar concepts.

LEARNING MEASUREMENT CRITERIA
The examination final mark consists of a mark in the range 0 to 30

FINAL MARK ALLOCATION CRITERIA
To pass the examination 18 marks are essential. An evaluation of 30 marks presupposes a deep

knowledge of the topics discussed during the examination. A full marks with honours requires the student to perform the test correctly and thoroughly, highlighting as well a brilliant exposition.

Recommended reading

T. E. Vollmann, W. L. Berry, D. C. Whybark, Manufacturing planning and control systems , Irwin Mc Graw Hill, New York, 1997. J. S. Martinich, Production and operations management , John Wiley, New York, 1997. R. J. Tersine, Principles of inventory and materials management , North Holland, New York, 1988Archibald R. D. (1996) Project Management. La gestione di progetti e programmi complessi , Franco Angeli. Caron F., Corso A. Guarrella F. (1997) Project Management in Progress , Franco Angeli. Harold Kerzner (2000) Project Management: a systems approach to planning, Scheduling and control, John Wiley & Sons. Tutorials provided by the professor available on the University moodle platform

Progettazione di Impianti Industriali Termomeccanici

Giancarlo Giacchetta

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims at giving students the advanced knowledge about the design of pipelines for transport of solid/liquid/gaseous fuels from the location of extraction to the one of use with particular focus on their operation and maintenance. The course also provides design and optimization tools to analyze process and service plants in the industrial sector with particular focus on environmental issues and prevention tools. The course completes the previous engineering education and provides the students with the awareness of the multidisciplinary context of the mechanical engineering
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to apply the acquired knowledge, students should be able to critically analyze the design problems and to suggest solution to complex problems in the field of industrial plants. The main skills acquired in the course are: 1. Ability to face complex projects in the field of industrial plants; 2. Ability of planning and manage the fulfillment of a project; 3. Ability to monitor the environmental aspects related to the operation of a manufacturing plant
TRANSVERSAL SKILLS:
The deepen knowledge of industrial plants will improve the judgement autonomy of students and their communications skills with particular regard to the use of a proper, high level, engineering terminology. The study of industrial plants under a technical and economic point of view provide the students with the awareness of the multidisciplinary context of the mechanical engineering so that they will be able to communicate and cooperate in different context both with engineers and non-engineers

Program
Basic concepts for multiphase pipeline calculations. Energy equation for two-phase flow gas-liquid mixtures. Predication of flow patterns.. Liquid holdup effect. Pressure drop calculation for two phase pipelines. Approach to pipeline design calculations. Refrigeration plants. Refrigeration processes and refrigeration systems. Approach to design calculation. Concentration of liquid foods. Single and multiple stages evaporator systems. Thermo-compression systems. Natural and forced circulation concentrators.. Drying of solids: principles, classification and selection of dryers. Industrial gas cleaning. Centrifugal separators. Filtration by fibrous filters. Electrostatic precipitation. Industrial furnaces. Approach to design calculation.

Development of the course and examination
LEARNING EVALUATION METHODS
The evaluation of the students learning is assessed through a written test and an oral examination. In the written examination, students must realize the concept design of two complex systems with

assigned data input, a process plant and service facility. The criteria and models developed during the course of Industrial thermomechanical plants will be used to solve the problems. In the oral examination, after a critical analysis of the written test, questions about innovative design methods and the design criteria will be asked. All topics covered during the course will be evaluated.

LEARNING EVALUATION CRITERIA
During the exams the students have to demonstrate the knowledge of specific criteria and corresponding analytical methods governing the choice, design and implementation of defined process equipment and service facilities. It must also be able to critically analyze and propose measures and innovative and cost-effective solutions.

LEARNING MEASUREMENT CRITERIA
During the exams, the critical capacity, the autonomy and the student capability to critically analyze and propose innovative solutions to solve complex problems will be evaluated. It will also be assessed the ability to articulate and implement, with appropriate terminology, original ideas in technical and other contexts.

FINAL MARK ALLOCATION CRITERIA
The minimum vote of eighteen thirty, is awarded to students who demonstrate sufficient capacity to solve problems of a certain complexity and sufficient knowledge of methods and criteria explained during the course. The vote of thirty thirtieths is assigned to students who, in both examinations, have demonstrated full independence, mastery, high critical sense in solving the proposed problems. Praise is reserved for those who also showed particular of language ability and synthesis capability.

Recommended reading
A.Monte. Elementi di Impianti Industriali. Vol. 2° - Ed. Libreria Cortina , Torino 1994 O.Pierfederici Corso di Impianti Meccanici . Pitagora editrice , Bologna 1980 S. Fabbri Impianti meccanici Vol.1° - Ed. Patron , Bologna 1985 A.Pareschi Impianti meccanici per l'industria - Progetto Leonardo Bologna

Progettazione di Sistemi Embedded

Claudio Turchetti

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Programmable digital systems,basic electronics,digital signal processing.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide the necessary hardware and software knowledge for designing embedded system in general and computer vision systems in particular. To this end the fundamental ARM architectures, the programming languages for embedded systems will be studied.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The course is intended to train the students so that they acquire the capability of applying the knowledge to the design specifications of an embedded system, to the selection of devices to obtain the desired performance, to the definition and implementation of algorithms for computer vision.
TRANSVERSAL SKILLS:
The course provides a multidisciplinary background on emebedded microcontrollers and microprocessors, computer vision techniques, which can be spent in the fields of biomedical engineering, telecommunications, automatic control and information technology in general.

Program
ARM Embedded Systems ARM Architecture; The RISC design philosophy; Instruction Set for Embedded Systems; Embedded System Hardware; ARM Bus Technology; AMBA Bus Protocol; ARM Processor Fundamentals Registers; Banked Registers; Exceptions, Interrupts, and the Vector Table; Introduction to the ARM Instruction Set; Introduction to the Thumb Instruction Set; ARM Assembler Structure of assembly language modules; Directives; Processors STM32F4(Cortex-M4/ARMv7_M); Raspberry PI(ARM1176JzF-S/ArMv6); MC1322x (ARM7TDMI-S, ARMv4T); Introduction to C programming of ARM processors. Embedded system for monitoring of physiological signals: ECG, PPG, EMG. Embedded Systems for Navigation in Mobile Robots Localization; Dynamics and Control. Embedded Systems for Computer Vision in Mobile Robots: Image Processing; Matrix theory results; Random signals; Stationary processes; Estimation theory; Mean Square Estimation; Orthogonality Principle; Image Transforms; Outer Product Expansion and Singular Value Decomposition; Image Filtering and Restoration; Image formation models; Inverse Filter; Wiener Filter; Filtering using image transform; Bayesian Signal Processing; Recursive filtering; Single-stage Wiener-Kalman Filter; Multi-stage Wiener Kalman Filter; Non-linear Bayesian tracking; Grid-based method; Particle Filters; Sequential Important Sampling (SIS) Algorithm; Digital Image Processing with MATLAB; Video Tracking; The basic equations of motion field; Estimating the motion field from image sequences; An optical flow algorithm; Feature tracking; Simultaneous Localization and Mapping (SLAM). Embedded Systems for Machine Learning Introduction to statistical learning

Development of the course and examination
LEARNING EVALUATION METHODS

oral examination

LEARNING EVALUATION CRITERIA
To pass the exam the student will show to know all the metodologies and techniques for designing an embedded system

LEARNING MEASUREMENT CRITERIA
A score in the range 18-30 will be given as a final grade

FINAL MARK ALLOCATION CRITERIA
The oral examination will be focused on questions concerning the course topics and the discussion of a specific design with refernece to the approach used and the results obtained

Recommended reading
A.N.Sloss,D.Symes,C.Wright, ARM System Developer s Guide , Elsevier, 2004;
P.Coke, Robotics, Vision and Control , Springer,2013. K.Jain, Fundamentals of Digital Image Processing , Prentice Hall; J.V.Candy, Bayesian Siganl Processing,Wiley,2009.
E.Maggio,A.Cavallaro, Video Tracking ,Wiley,2011. Appunti del docente.

Progettazione di Sistemi Integrati

Massimo Conti

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
knowledge of the basic elements of electromagnetism and of the kirchhoff laws

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course provides the knowledge and the understanding the issues and methodology for the design of high-level complex electronic systems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The students will apply the knowledge and will be able to apply the methodology for the design of high-level complex electronic systems.
TRANSVERSAL SKILLS:
During the course the student will develop a comprehensive project in group or alone and he will develop a report describing in full the project. This will stimulate the ability to work in groups, and to prepare a project report.

Program
System Level Design System on Chip IP reuse SystemC: System Level Design Language Communication and synchonixzation in SystemC, events and kernel, module, ports, signals, process, method. TLM: Transaction Level Modeling. Low power systems: chip temperature control, power management techniques, battery model, Dynamic Power Management, System Level Power Estimation, SystemS power analysis methodologies, system level power estimation, system level power models, examples: I2C, AMBA, DPM in SystemC. Bluetooth and 802.15.4 wireless protocols: specifications, stack bluetooth. SystemC modeling of bluetooth protocol. Low power wireless sensor networks. Energy Harvesting devices RFId and NFC: applications on Ambient Assisted Living, food traceability and vehicle to grid connection. System on chip busses: bus AMBA AHB. Network on Chip, topologie di NoC topologies, comparison with bus NoC: flux control, routing algorithms, arbitering, physical and virtual channels. Yield: statistical design, parametric yield, models of statistical variation of parameters, application examples, system level yield estimation. Modeling and simulation of heterogeneous systems: SystemC-WMS

Development of the course and examination
LEARNING EVALUATION METHODS
The examination consists of a discussion of a project developed by the student and an oral exam on the course topics. The project can also be done in groups, with a maximum of four students. The topic of the project will be agreed with the teacher. The student should discuss with the teacher during the progress of the project.

LEARNING EVALUATION CRITERIA
The student, in the course of the oral examination, will present and discuss the project developed and he will demonstrate the knowledge and the methodology and technical expertise in the design

of electronic systems. The teacher will assess the complexity, completeness and correctness of the project, the study of the state of the art on the subject, the results obtained and the clarity in the presentation of the work.

LEARNING MEASUREMENT CRITERIA
Attribution of the final mark out of thirty

FINAL MARK ALLOCATION CRITERIA
Attribution of the final mark out of thirty

Recommended reading
#NOME

Progettazione di Strutture Antisismiche

Laura Ragni

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Elements of Linear Algebra, Mathematical Analysis, Differential Equations, Laplace Transform.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide the student with the basic theoretical knowledge and practical skills of the seismic engineering, necessary to design buildings with an established seismic hazard risk level with reference to both ultimate and service conditions. In particular, basic concepts for the correct conception and structural design of new buildings are provided, with particular reference to reinforced concrete structures and hints to other structural systems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Disciplinary knowledge gained in the topic of seismic engineering allows the student to design structural complex systems making use of appropriate design solutions. The necessary skills, critical judgment and capacity for choice, are developed through lectures, including specific practical tutorials.
TRANSVERSAL SKILLS:
The individual practical exercises help to improve the self-learning skill, the ability to communicate results and to generalise the acquired knowledge. Furthermore, an active involvement of the student is developed.

Program
Feedback in biological systems. References on Time Invariant Linear Systems. Non-linear Systems. Negative feedback systems. Step response and frequency response identification. Parametric identification.

Development of the course and examination
LEARNING EVALUATION METHODS
The assessment of student learning consists of an oral exam, which consists of answering three of the topics covered in the course.

LEARNING EVALUATION CRITERIA
To successfully pass the assessment of learning, the student must have a competence of all the mathematical tools needed to understand the topics covered in the course. Moreover, he must know the system models studied, both linear and non-linear models, negative feedback models, and how to use them in the study and in the identification of biological systems.

LEARNING MEASUREMENT CRITERIA
Each of oral questions is graded with a score between zero and ten. The overall evaluation is the sum of the three scores and is marked out of thirty.

FINAL MARK ALLOCATION CRITERIA
In order to have a positive evaluation, the student must achieve an overall score of at least eighteen, with the constraint that in each of the three oral questions the evaluation must be at least six. Full marks cum laude are given to students who have achieved the highest rating in the oral exam, and have shown a particular brilliance.

Recommended reading
C. Cosentino, D. Bates, Feedback Control in Systems Biology , CRC Press, Taylor & Francis Group. Lecture notes available at: https://lms.univpm.it/course/view.phpid=388

Progettazione e Gestione della Catena Logistica

Maurizio Bevilacqua

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The supply chain management course explore design, analysis and methodological tools for a better understanding of supply chain actors interactions. In more detail distribution systems design, transportation planning and supply chain level inventory management will be discussed and analysed.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The acquired students core competencies can be summarized as in the following: 1. Supply chain strategy evaluation, analysis and design; 2. Distribution systems planning and design; 3. Supply chain inventory management; 4. Supply chain goods provision and transportation management.
TRANSVERSAL SKILLS:
Classroom business game sessions will enhance students interest inn team working improving thus their judgements applying, communications and learning skills

Program
Building a strategic framework to analyze supply chains. Performance indicator in the supply chain. Designing the supply chain network. Planning demand and supply in a supply chain. Designing the automated storage systems. Planning and managing inventories in a supply chain. Sourcing, trasporting, and pricing products. Coordination and technology in the supply chain. World Class Manufacturing. Lean production systems applied to supply chain management

Development of the course and examination
LEARNING EVALUATION METHODS
he examination consists of an oral talk. Simple written calculations may be functional for the answer completeness.

LEARNING EVALUATION CRITERIA
A positive examination outcome requires the student to demonstrate a complete understanding of the course pillar concepts.

LEARNING MEASUREMENT CRITERIA
The examination final mark consists of a mark in the range 0 to 30.

FINAL MARK ALLOCATION CRITERIA
To pass the examination 18 marks are essential. An evaluation of 30 marks presupposes a deep knowledge of the topics discussed during the examination. A full marks with honours requires the student to perform the test correctly and thoroughly, highlighting as well a brilliant exposition.

Recommended reading

Chopra S., Meindl P.:Supply chain management, Pearson Prentice Hall - Pietro Romano, Pamela Danese. Supply Chain Management, McGraw-Hill - Tutorials provided by the teacher available on the University moodle platform.

Progettazione Funzionale

Massimo Callegari

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Basic knowledge on machine mechanics, geometry and calculus

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide advanced knowledge in the field of machine mechanics so that students have the skills necessary to study machines and complex mechanical systems. In particular the students will acquire knowledge of functional analysis and design of machines and complex mechanical systems, such as machine tools, devices and robotic systems and vehicles; the class will also deal with the problems of vibrations, actuation systems and transmissions.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will be able to develop kinematic, static and dynamic models of mechanisms and machines, to study their behavior by simulation and to deal with their functional design. In addition, he will develop the skills for the analysis and synthesis of machines and complex mechanical systems; he will know how to appropriately select and apply relevant analytic and modeling methods, based on the mathematical and numerical analysis, to be able simulate system s behavior in order to predict and improve its performance.
TRANSVERSAL SKILLS:
The student will improve its ability to logical reasoning through the resolution of problems of analysis typical of functional design; moreover he will have the opportunity to develop its communication skills in group exercises, where he will be required to explain and support his ideas to colleagues and to the teacher

Program
KINEMATICS AND DYNAMICS Kinematics of multi-loop linkages and spatial chains. Linear vibrations of multi dof's systems. Bending and torsional vibrations. Rotordynamics Design of flywheels. MECHANICAL TRANSMISSIONS AND MECHANISMS FOR MOTION GENERATION Gearings and gearboxes. Belts and chains Linear modules Linkages. Cams. Mechanisms for intermittent motion. MECHATRONICS Actuators for automated machinery. Servo mechanisms: drive selection, laws of motion. Closed-loop systems. SIMULATION TOOLS Introduction to the simulation environment. Solving of common problems in the study of the machines Modeling and analysis of simple dynamic systems. MACHINE DESIGN Design process Laws and standards CAE design tools Examples of design: the I.Ca.Ro. robot Design tutorials CASE STUDIES Parallel kinematics machines Half-car model of car dynamics Dynamic analysis and balancing of i.c.e. Design of the gearbox of a motor vehicle Torsional vibrations analysis of the driveline of a marine engine Functional design of a mechanical lift transmission

Development of the course and examination
LEARNING EVALUATION METHODS

The learning achievements of the students are evaluated in two or three parts: - A written test, consisting of the solution of an exercise; - An oral exam, consisting in the discussion of one or more topics; - The presentation of the project of a simple mechanical system (optional). The projects are optional and are normally carried out in groups of 2-4 students; the projects are presented by the students in one / two days specially set by the teacher at the end of the lessons. Their assessment remains valid until the beginning of the lessons of the same course in the next academic year, also in case of unsuccessful oral session.

LEARNING EVALUATION CRITERIA
To successfully pass the exam, the student must demonstrate, through the tests described above, that he/she understands the basic concepts of the lectures and especially to have acquired the basic skills of the functional design of machines and mechanisms. The assignment of the final rating takes into account the knowledge of all teaching topics. The highest rating is achieved by demonstrating a thorough understanding of lectures throughout the written, oral and design parts. Praise is reserved for students who, having played all three tests in a correct and complete way, have demonstrated the ability to investigate independently the fundamental contents of the lectures

LEARNING MEASUREMENT CRITERIA
For each of the tests indicated above a score between 0 and 30 is assigned: the score 0 corresponds to an exercise not performed or a question unanswered; the score 18 corresponds to a topic treated just sufficiently; the score 30 is given to students who demonstrate a particular brilliance in the oral presentation or in the preparation of the project; intermediate scores are assigned accordingly

FINAL MARK ALLOCATION CRITERIA
The overall evaluation is positive if the student achieves at least 16 points (out of 30) in each of the tests described above and at least 18 points (out of 30) in the overall evaluation. The overall grade, out of thirty, is given by the weighted average of the marks obtained in the tests passed, with rounding to the integer; in the case the project has been presented, the assigned weights are the following: 30% project, 30% written exercise, 40% oral discussion; if the project has not been developed, the weights are attributed as follows: 40% written exercise, 60% oral discussion.

Recommended reading
Callegari, Fanghella e Pellicano: Meccanica Applicata alle Macchine , Città Studi, 2013.
Handouts of the course (available on the Moodle site)

Progettazione Geotecnica

Giuseppe Scarpelli

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Basic knowledge of Geotechnics including: analysis of soil laboratory testings, use of elementary constitutive models, solutions of simple problmes of geotechncial engineering.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims at giving to the students a consistent framework for geotechnical engineering design. Taken for granted in the first cycle degree the knowledge of the basics of Soil Mechanics, lectures are dedicated to the behaviour of natural soils for the definition of the geotechnical model in practical design. Both in situ and laboratory testing are presented and discussed through examples form real cases. The design of the typical geotechnical construction components are presented with emphasis on construction aspects and performances. The basics of constitutive modelling are given to initiate the students to the use of numerical methods for geotechnical design.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
A primarily objective of the course is to give to the student an operative knowledge of the subject, that is to this aim developed with great attention to Codes, both national and European. The modern trends of geotechnical design are highlighted in the three possible professional context of design companies, construction firms, contractors. The
TRANSVERSAL SKILLS:
An essential part of the course are the sessions of practical work where the students learn to define dimensions and resistances of all the typical construction components of geotechnical engineering. This practical work is included in a final geotechnical report to be presented for admission to the final exam. The report can be presented as a group work and the links with similar design activities carried out in parallel courses of structural design are strongly pursued.

Program
Theoretical aspects: Mechanical behaviour and properties of natural soils from laboratory and in situ testings; compressibility and strength of soils; soil dilatancy and friction. Undrained shear strength. Soil constitutive laws: linear and non linear elasticity; perfect and hardening plasticity. Hints on the Cam Clay model. Limit analysis: the classicla solutions from the Theory of Plasticity: use of the stress and strain characteristics. Engineering design: Earth retaining structures: rigid and flexible walls; anchors. Design of spread foundations: stability and serviceability. Settlement analysis. The design of pile foundations through analytical methods; pile settlements. Codes for geotechnical design: Eurocodes 7 and 8. Practical work: numerical examples will be assigned on the most common problems of geotechnical engineering

Development of the course and examination
LEARNING EVALUATION METHODS
The students are required to submit realistic geotechnical reports on few assigned problems of geotechnical design. These reports will be discussed at the oral examination together with

questions on theoretical, experimental and practical aspects of the discipline. If the candidate decides not to present the design Reports there will be a written test one week ahead of the oral colloquim, according to the examination calendar published on the website.

LEARNING EVALUATION CRITERIA
Aims at assessing the abilities of the candidate in solving real complex problems of geotechnical engineering.

LEARNING MEASUREMENT CRITERIA
These criteria tend to verify at what level the candidate is able to solve geotechnical engineering problems taking account of the siting and the construction difficulties of the reality. The ability shown by the candidates to select the appropriate construction method is specifically valued.

FINAL MARK ALLOCATION CRITERIA
Candidates are graded from 18 to 30 over 30 depending on their ability in representing and properly describe the complexities of modern geotechnical design.

Recommended reading
C. VIGGIANI: Fondazioni. Hevelius Edizioni ISBN 88 86977 12 3; Italian Code for Constructions (mainly as a reference text). Slide packages on specific topics available on the web site of the lecturer.

Progettazione Meccanica

Gianluca Chiappini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Basic knowledge of solid mechanics

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide knowledge to the design and testing of machines and complex mechanical systems. In particular, it intends to transfer the most advanced concepts of mechanics of materials, from the fracture mechanics to plasticity and creep, even in triaxial stress state. Analytical calculation methods are proposed for components subject to complex loadings, such as plates, disks and tubes, in order to achieve the theoretical basis of advanced structural mechanics
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will gain the ability to use the techniques and tools appropriate to address complex engineering problems, in order to be able to correctly interpret the causes of structural and technological behaviours. The acquired skills will allow the student to face the articulated mechanical systems projects, identifying and applying the most suitable calculation method for the analysis and design of machine components; the ability to solve typical problems of mechanical design, including structural optimization, will be transferred to the student
TRANSVERSAL SKILLS:
The resolution of exercises that will be conducted during lessons will help improve the ability to solve engineering problems. The execution of a short thesis and its discussion will allow the students to develop the ability to articulate and implement their ideas in a technical context and to present the results of their work in a clear form. The students will also acquire the ability to deal with a complete design problem, from the choice of the material and of the global structure, to the design and analysis of the main mechanical components, integrating the various multidisciplinary knowledge acquired during the studies

Program
First part: Mechanical behaviour of material: plasticity, linear elastic and elasto-plastic fracture mechanics, creep, low cycle fatigue. Second part: structural analysis of discs, pipes, plates and shells.

Development of the course and examination
LEARNING EVALUATION METHODS
Written and oral examinations, and a brief thesis work

LEARNING EVALUATION CRITERIA
In the written test, the student must demonstrate the ability to solve three design and/or verification questions, with the help of the formulas and mathematical tools presented during the lectures. In the oral examination, the student must answer one or two questions, showing that he had learned the main concepts and the theoretical basis of advanced structural mechanics.

LEARNING MEASUREMENT CRITERIA
A mark out of ten will be given to each of the three tests.

FINAL MARK ALLOCATION CRITERIA
The final mark will be sum of the votes of the written, oral and brief thesis tests.

Recommended reading
L. Vergani Meccanica dei materiali Ed. McGrawHill - S. Timoshenko Theory of plates and shell McGrawHill - A. Gugliotta Introduzione alla meccanica della frattura lineare elastica Ed.Levrotto & Bella

Progettazione per il Recupero di Edifici

Enrico Quagliarini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide students with the tools needed to design interventions for the recovery and preservation of historical buildings in the light of the current instances of seismic upgrading and architectural restoration. The purpose is to train a high-level professional engineer able to identify the problems and to provide consequent design solutions about the issues related to the recovery, the enhancing and the preservation of existing buildings, especially by taking into account the innovations in this topic.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Students will have to be able to critically read existing buildings both from a qualitative and a quantitative standpoint, so as to face with high-level (complex) design solutions and to carry out the research and development of new methodologies. They will also have to be able to responsibly design solutions based on their professional and engineering methodologies, beyond the usual rules and the current standards. This will be performed through the following skills: 1. The capability of reading existing buildings along their historical evolution; 2. The capability of identifying their damages and degradation processes; 3. The capability of designing the right solution following the previous issues.
TRANSVERSAL SKILLS:
Students, working alone or in team, will have to resolve one or more problems by providing some designing solutions. This will contribute to enhance their autonomy and their team-working, and to favour their communication skills so as to clearly and properly justify their designing choices. In this framework, students will be driven to autonomously look for their educational material, to get a synthesis, to test their skills on problems solving and to explain what they learnt.

Program
How to intevene on historical constructions: evolution of the scientific positions and today's debate. How a historical masonry building works: critical survey as a knowledge and diagnostic tool, failure processes. Local mechanisms and particular structures (arches, vaults,). Assessing the vulnerability of historical buildings. How to design actions to recover and preserve historical constructions into the framework of the actual Architectural Restoration and seismic upgrading issues. Traditional and innovative interventions. Guidelines for monumental buildings. Historical surfaces conservation. Behavioural design and historical buildings (mention). Case studies.

Development of the course and examination
LEARNING EVALUATION METHODS
students are evaluated through 2 levels: - first level: evaluation of the annual training exercises; - second level: oral exam on some of the topics of the course.

LEARNING EVALUATION CRITERIA
Students will have to be able to critically read existing buildings both from a qualitative and a quantitative standpoint, at both the two previous levels. Particular attention will be paid at their capability of reading existing buildings along their historical evolution; identifying their damages and degradation processes; responsibly designing the right solution following the previous issues.

LEARNING MEASUREMENT CRITERIA
Students' skill on problem-solving by providing technical detailed designing solutions and properly justifying their design choices will be evaluated at both the two previous levels.

FINAL MARK ALLOCATION CRITERIA
The maximum evaluation, that is 30 cum laude, is assigned to students who demonstrate, at both the previous two levels, an excellent skill on problem-solving by providing technical detailed designing solutions and properly justifying their design choices. The smallest evaluation, that is 18, is assigned to students who demonstrate, at both the previous two levels, a sufficient skill on problem-solving by providing technical detailed designing solutions and properly justifying their design choices.

Recommended reading
- Vallucci S., Quagliarini E., Lenci S. (2014) Costruzioni storiche in muratura. Vulnerabilità sismica e progettazione degli interventi, Utet Wolters Kluwer Italia - Doglioni F., Codice di pratica (linee guida) per la progettazione degli interventi di ri

Progetto di Strade

Amedeo Virgili

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Fundamentals of vehicle dynamics. Elements of traffic engineering.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course intends to provide all technical-scientific tools for planning a road infrastructure taking into account environmental issues as well. Through a classroom tutorial based on the use of specific software, students will acquire design skills of a road section.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The course will allow students to acquire methods and procedures for analyzing road infrastructure systems with the aim of planning and project execution. Theoretical and technical background will be acquired through classroom lectures and a tutorial which provides the use of a specific road design software.
TRANSVERSAL SKILLS:
The tutorial activities aimed at developing the road design project will help the student to improve own decision-making, judgment and interpersonal skills for managing projects related to Civil Engineering aspects on the basis of a multidisciplinary approach.

Program
Analysis of environmental and territorial planning charts; traditional and modern geometric design. Type road design, track analysis, minimum radius of curve, horizontal curves, design superelevation and widening on curves, vertical alignment of edges, design speed control chart; vertical alignment, vertical curves, climbing lane for heavy vehicles; typical cross sections, cross section elements: platform, roadway, traffic lane, traffic shoulder, roadsides. Preliminary, definite and executive plan. Metric calculation, costs analysis, works survey, specification of a contract. Preliminary environmental impact study: planning, design and environment; environmental impacts assessment and analysis, environment monitoring and mitigation. Road pavement design. Natural engineering techniques. Road traffic emissions. Road lighting. Road sign. Road safety: road restrains systems. Types, performance classes and design selection of safety barriers. Road design by means of a software: creation of numerical model for the ground, placing of the basic elements for the horizontal track, drawing out of the vertical profile of ground and placing of the gradients and vertical curves by design, drawing out of cross sections, placing of the road platform and calculation of volumes. Practice: road section design by means of a software.

Development of the course and examination
LEARNING EVALUATION METHODS
Oral exam after the approval of the design exercise.

LEARNING EVALUATION CRITERIA
The learning evaluation criteria consists of two examinations: - evaluation of the knowledge

necessary for the preparation of the design exercise; - oral examination focus on some of the course topics. The design exercise can be carried out as a group work; each group consists of, at most, six students. A positive score in the first test (design exercise) is mandatory in order to access to the oral examination. In the case of a negative score in the oral examination, the student have to take again both tests. In order to pass positively the examination, the student needs to prove to have fully understood the course topics and to have learned the criteria and the procedures necessary for the geometric design of highways.

LEARNING MEASUREMENT CRITERIA
Assignment of a final score (maximum score is 30)

FINAL MARK ALLOCATION CRITERIA
In order to pass the examination with a minimum score, the student needs to know sufficiently each course topic. Higher score will be assigned based on the general and specific competences. The maximum score will be achieved by proving an extensive knowledge of the course topics during the examinations. The score cum laude will be assigned to the student that will obtain the maximum score and will be able to prove a strong competence on the subject as well as to excel in the oral examination.

Recommended reading
P. Ferrari, F. Giannini, Ingegneria Stradale, Vol. 1 :Geometria e Progetto di Strade , Ed. ISEDI P. Ferrari, F. Giannini, Ingegneria Stradale, Vol. 2 :Corpo stradale e pavimentazioni , Ed. ISEDI G. Tesoriere, Strade, Ferrovie ed Aeroporti Vol. 1, Ed. UTET Santagata, Bocci, Canestrari, Cardone, Ferrotti, Graziani, Virgili e altri, Strade - Teoria e tecnica delle costruzioni stradali , Ed. PEARSON Slide presentation shown in classroom that are available on the official teacher page on UNIVPM website in the Section Allegati-Download paper . This material is password-protected; the teacher will give the password to the students.

Progetto di Strutture

Massimo Formica

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Knowledge of Structural Analysis are considered as acquired

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide the student with the necessary knowledge required for the structural modelling and design of a complex reinforced concrete building systems in seismic area.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student gains critical judgment skills, as well as synthesis and choice capabilities, which are necessary to design structural systems. These skills are developed through lectures and a designing exercise developed in groups.
TRANSVERSAL SKILLS:
The designing exercise contributes improving the student s self-learning and critical judgment skills, as well as communicative skills and the ability to generalise the acquired knowledge. Furthermore, an active involvement in the teamwork is developed.

Program
1) Steel-concrete composite beams: - types and construction methods; - structural analysis, sectional analysisl, verification at the SLE and ULS; - design and verification of connection and verification of the reinforcement in the concrete slab. 2) Reinforced concrete buildings in seismic zone: - structural typologies for reinforced concrete buildings; - design loads for civil structures (dead and live loads); - seismic actions in accordance with NTC 14/01/2008; - design criteria for sizing of the main structural elements; - design methods for secondary structural elements (concrete slabs and concrete stairs); - definition of structural models using 3D finite element solver; - global structural analysis of buildings (linear static and dynamic analysis); - verification of structural elements (capacity design); - foundation: typologies, geotechnical and structural design; - executive design drawings e calculation report.

Development of the course and examination
LEARNING EVALUATION METHODS
The evalulation of student learning is based on two assessments: - the development of a seismic resistant design, and the relevant executive drawings, of a reinforced concrete building; - an oral exam consisting in a discussion of the design project and in some theoretical questions on the topics covered during the course (students may be requested to answer some questions in writing and the answers will be successively discussed). To access the oral exam the student is required to have completed the project.

LEARNING EVALUATION CRITERIA
Through the design project and the oral exam the student must demonstrate to have learned the topics covered during the course, such as analysis and design methods of seismic resistant

structures.

LEARNING MEASUREMENT CRITERIA
The evaluation of both the assessment is expressed in thirtieths.

FINAL MARK ALLOCATION CRITERIA
The student is expected to pass both assessments. The final mark of the course will be calculated after the oral exam as the average of the marks received for these two assessments. The 'lode' will be awarded to students who, having correctly completed the two assessments, show an outstanding understanding in the subject.

Recommended reading
- AICAP progettazione di strutture in cls armato. Guida all uso dell Eurocodice 2 con riferimento alle Norme tecniche D.M. 14.01.2008 Volume 1 - AICAP progettazione di strutture in cls armato. Guida all uso dell Eurocodice 2 con riferimento alle Norme

Progetto di Strutture (EA)

Massimo Formica

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 90
Period 2s

Prerequisites
Knowledge of Structural Analysis are considered as acquired

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide the student with the necessary knowledge required for the structural modelling and design of a complex reinforced concrete building systems in seismic area. In detail, fundamentals of structural conception and construction techniques relevant to the design of buildings are provided.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student learns to develop adequate design and technical solutions, with reference to compatibility, environmental sustainability, requirements and possible constraints. These skills are developed through lectures and a designing exercise developed in groups.
TRANSVERSAL SKILLS:
The designing exercise contributes improving the student s self-learning and critical judgment skills, as well as communicative skills necessary for the teamwork.

Program
1) Steel-concrete composite beams: - types and construction methods; - structural analysis, sectional analysisl, verification at the SLE and ULS; - design and verification of connection and verification of the reinforcement in the concrete slab. 2) Reinforced concrete buildings in seismic zone: - structural typologies for reinforced concrete buildings; - design loads for civil structures (dead and live loads); - seismic actions in accordance with NTC 14/01/2008; - design criteria for sizing of the main structural elements; - design methods for secondary structural elements (concrete slabs and concrete stairs); - definition of structural models using 3D finite element solver; - global structural analysis of buildings (linear static and dynamic analysis); - verification of structural elements (capacity design); - foundation: typologies, geotechnical and structural design; - executive design drawings e calculation report.

Development of the course and examination
LEARNING EVALUATION METHODS
The evalulation of student learning is based on two assessments: - the development of a seismic resistant design, and the relevant executive drawings, of a reinforced concrete building; - an oral exam consisting in a discussion of the design project and in some theoretical questions on the topics covered during the course (students may be requested to answer some questions in writing and the answers will be successively discussed). To access the oral exam the student is required to have completed the project.

LEARNING EVALUATION CRITERIA
Through the design project and the oral exam the student must demonstrate to have learned the

topics covered during the course, such as analysis and design methods of seismic resistant structures.

LEARNING MEASUREMENT CRITERIA
The evaluation of both the assessment is expressed in thirtieths.

FINAL MARK ALLOCATION CRITERIA
The student is expected to pass both assessments. The final mark of the course will be calculated after the oral exam as the average of the marks received for these two assessments. The 'lode' will be awarded to students who, having correctly completed the two assessments, show an outstanding understanding in the subject.

Recommended reading
- AICAP progettazione di strutture in cls armato. Guida all uso dell Eurocodice 2 con riferimento alle Norme tecniche D.M. 14.01.2008 Volume 1 - AICAP progettazione di strutture in cls armato. Guida all uso dell Eurocodice 2 con riferimento alle Norme

Programmazione ad Oggetti

Francesco Pagliarecci

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
NO

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire the fundamental notions and advanced knowledge of Object-Oriented Programming, also through the study of a reference programming languages. This knowledge, by integrating the knowledge gained during the previous programming courses will form the insights that will enrich the understangin of the theory of languages and of the advantages of different programming paradigms.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
At the end of the course students will be able to use properly the principles of object-oriented programming and the syntax of the language used in the course to develop software of medium complexity, characterized by flexibility, compliance with the requirements and efficiency, choosing the most appropriate data structures and algorithms for the particular problem at hand and compying with application constraints related security.
TRANSVERSAL SKILLS:
The execution of a project, which will be played in groups or independently and that will lead to the drafting of a report, will help improve both the communication skills that also stems from teamwork, and autnonomous learning and problem solving skills.

Program
Review of procedural programming. Introduction to object-oriented programming. Introduction to Java. Object lifecicle and access control. Inheritance and polymorphism. Exception handling. Strings. Generics. I/O.

Development of the course and examination
LEARNING EVALUATION METHODS
Project + Oral

LEARNING EVALUATION CRITERIA
To successfully pass the assessment of learning, the student must demonstrate, through above descibed two tests, having understand criteria and procedures for software development through object-oriented programming. He must prove, in addition, to be able to apply, on their own, these criteria and these procedures to the project components or simple applications, to know how to properly use appropriate tools and technologies of developing and finally to draw up a technical report.

LEARNING MEASUREMENT CRITERIA
For each one of the described tests an evaluation has been assigned between zero and thirty. The

overall evaluation, is the average of the obteined marks in the two tests, with rounding up to the next integer.

FINAL MARK ALLOCATION CRITERIA

As the overall outcome of the evaluation is positive, the student must achieve at least the sufficiency, equal to eighteen points, in each of the above described tests. The highest rating is achieved by demonstrating a thorough understanding of the course content in the tests. Honours is reserved to students who, having done all the tests so correctly, have shown a particular brilliance in the oral presentation and preparation of the project.

Recommended reading

Herbert Schildt, Java la guida completa , McGraw-Hill

Programmazione e Controllo della Produzione

Archimede Forcellese

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Knowledge of manufacturing processes and most used production systems in the modern manufacturing industry is required.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire advanced knowledge on all the necessary activities to realize the planning and control of manufacturing production. This knowledge, by integrating the knowledge gained in the teachings of technologies and manufacturing systems, industrial equipment and industrial logistics, will form the insights that will enrich the knowledge of the main management policies of the production and for production planning tools in the medium/long term , so that the student acquires a clear awareness of the wider multidisciplinary context of engineering.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to address advanced design themes, even of considerable complexity, and treat the innovation and development of new products, new technological processes and production systems through the application of knowledge, the student will be able to develop production plans for the medium and long term. This ability is expressed through a number of vocational skills, such as: 1) the ability to schedule production using aggregate and detailed planning methods of the products, materials and production capacity, and 2) the ability to use innovative techniques for the production control in order to ensure the smooth flow of production.
TRANSVERSAL SKILLS:
The resolution of individual and group exercises in classroom will help to improve both the learning skills autonomously and the degree of independent judgment, both the communication skills that also stems from teamwork.

Program
GENERAL ASPECTS OF MANUFACTURING. Role and evolution of manufacturing, technical and management functions, planning and production control, decision making process. DEMAND MANAGEMENT. General aspects, techniques of demand forecasting, qualitative method, quantitative methods (casual and time series models), application cases. INDEPENDENT DEMAND MATERIAL MANAGEMENT. The role of the stocks, stock accounting systems, classification methods, inventory costs, models for management of continuous and independent demand materials (fixed order quantity and fixed order interval models). AGGREGATE PRODUCTION PLANNING. Fundamental aspects, aims, aggregate production planning process, quantitative models, disaggregation, application cases. MASTER PRODUCTION SCHEDULING. Definitions, ATP stocks calculation, reviewing of MPS, application cases. MATERIAL REQUIREMENT PLANNING. MRP systems, input/output of MRP, processing of MRP plans, MRP update, uncertainty management in MRP, lot sizing, nervousness of MRP systems, application cases. CAPACITY PLANNING. General aspects, techniques of capacity planning, input/output control, application cases. PRODUCTION ACTIVITY CONTROL. Production activity control systems, shop

floor order, resources to be allocated, main activities of the shop floor control, dispatching approaches, sequencing rules, application cases.

Development of the course and examination

LEARNING EVALUATION METHODS

The exam consists in written and oral tests. In the written one, the student must answer four questions chosen among the topics of the course. It will also be required to solve practical cases related to simple problems. The oral exam will prove the level of knowledge showed in the written test.

LEARNING EVALUATION CRITERIA

The student has to be able to autonomously deal with the application of the main models, metedologies and tools used in the production planning and control activities in the manufacturing industries. Aspects, such as the mastery of technical language and clarity of exposition, will also be assessed. Finally, the ability to properly use the acquired knowledge in solving simple problems must be proven.

LEARNING MEASUREMENT CRITERIA

The ability to independently deal with the topics of the course by applying the models, methods and tools of the production planning and control activities, the clarity of exposition, the mastery of technical language are evaulated.

FINAL MARK ALLOCATION CRITERIA

The final grade will be assigned considering the evaluation obtained in both tests.The minimum score, equal to eighteen points, will be achieved by the students who demonstrate sufficient capacity to answer to all the questions raised. The maximum grade, equal to thirty points with honors, will be given to students who have proven full mastery of the topics, exposed in full autonomy and with appropriate technical language.

Recommended reading

F. Gabrielli, Appunti di Programmazione e Controllo della Produzione , Pitagora Editrice, Bologna, 2006. Slides of the lectures uploaded to the Moodle platform of the Polytechnic University of Marche.

Project Engineering per l'Edilizia

Berardo Naticchia

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course of Building Project Engineering will provide technical, economic and managerial knowledge aimed to lead projects in Architecture-Engineering-Construction (AEC). The course emphasizes technical, operational and economic interrelationships during all life-cycle from planning to design, manufacturing, construction, maintenance of buildings and offers knowledge to successfully and effectively optimize the quality managing key factors of scope, schedule, budget, resources and technical communication. The program particularly focuses on Building Information Modeling (BIM) as a methodology for managing the design and construction processes and for controlling key factors to guarantee the technical quality and to minimize operational time and cost. That part of the design process included between the availability of the detailed design to the beginning of its execution will be focused, and the role of the Project Engineer will be defined, as that person that makes decisions from the constructor side.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Students will be able to adopt BIM tools and applications as the method for the management of design and construction processes, and for control of the quality of the final products, for management of Life-Cycle of buildings, including cost and operational issues.
TRANSVERSAL SKILLS:
Given the practice students will gain in the planning and arrangement of complex and coordinated technical documents, student will be able to project and set up technical information into the corresponding documents.

Program
ectures (48 hours): Introduction to Project Engineering: Main concepts, life cycle and organizational structure of the project, interactions and mapping of processes. Development of Project Engineering plan: analysis of the project information structure, definition of the project areas, development of the WBS, analysis of technical, operational and economic interrelationships during all phases of the life-cycle. Techniques of Project Quality Management: Definition of performance specifications, defining the structure of the quality checks. Planning Project Time: Definition of the scheduling of activities, defining the structure of the feed controls. Techniques of Project Cost Management: Structure of project costs, cost analysis and cost allocation. Techniques of Project Risk Management: Identification, qualitative and quantitative analysis of the risks. Communication Management with Building Information Modeling: Introduction to BIM, key concepts for the management of the project information system, the multi-dimensional structure of BIM data, key applications for modeling, organizing workset, on-field use of BIM information system. Classroom practice (24 hours): Application of methodologies and techniques of BIM modeling to a case of project engineering for building construction.

Development of the course and examination

LEARNING EVALUATION METHODS

Oral examination. The students are required to carry out analysis and technical insights arising from the annual theme of exercise.

LEARNING EVALUATION CRITERIA

Evaluation of the student's autonomous ability to apply methodologies and analysis models and technical management of the projects presented during the lessons of the course.

LEARNING MEASUREMENT CRITERIA

Learning is measured by assessing the methodological correctness and adequacy of the analysis and modeling techniques developed during the examination session.

FINAL MARK ALLOCATION CRITERIA

The highest rating is awarded to students who demonstrate mastery of methodologies and modeling techniques presented in the lectures of the course getting complete and technically correct results while the minimum rating is assigned to students who apply with sufficient control the methodologies explained obtaining acceptable methodological consistency but incomplete results.

Recommended reading

Teaching materials are provided by the professor during the course

Project Management per le Costruzioni

Alessandro Carbonari

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Knowledge of the most common procedures for the construction of buildings, of the issues relative to shop and fabrication drawings, and to the supervision of the execution of buildings.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course explores the methods for the management of complex building interventions, with explicit references to the stages and procedures typically required to manage the entire course of the intervention, but with special focus on the management of planning and execution. The approach is based on the framework provided by the Project Management Institute, more specifically the Construction Extension to the Project Management Body of Knowledge.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Students will learn the methodologies and techniques for the preparation of a Project Management Plan regarding a building contract, as well as the techniques for the control of the execution phase and the deviations from the baseline.
TRANSVERSAL SKILLS:
As the practical exercise of the course will be performed grouping the students into groups, they will be required to plan and agree their activities simulating the case of real commitments managed by a team of experts.

Program
Management methodologies concerning the whole construction process (from planning to building), whose issues are discussed according to the PMI international classification: Scope Management, Time Management, Cost Management, Resource Management, Risk Management, Integration Management, Quality Management, Procurement Management and Communications Management. In addition, fundamentals for risk assessment issues will be discussed. Methodologies and techniques for construction work planning: work phase scheduling; resource scheduling; CPM/PERT and PDM scheduling for work duraton planning; advanced methods for time scheduling; cost assessments; financial and economic risk analyses; probabilistic techniques for risk assessment and mitigation; decision theory and automation for Project Management. Techniques for the construction phase management, i.e. cost monitoring and sheduling; activity and project indexes; cost/schedule control systems criteria; non linear resource scheduling. Part of the lectures will be devoted to workshops, so as to provide students with the basic skills needed for software aided management of complex construction projects, whose application will be shown through the development of a demonstrator during the course's classes.

Development of the course and examination
LEARNING EVALUATION METHODS
One practical test and one verbal examination. The practical test is aimed at checking students' ability to deal with practical aspects of the construction process programming and management.

The verbal examination will be focused on the several topics of the course, that will be discussed even within real world scenarios.

LEARNING EVALUATION CRITERIA
In the practical test students will be assessed with respect to their capabilities in operational planning and scheduling of a construction site. The verbal examination will be used to assess student's skills about contextualization of the issues relative to scheduling of large and complex construciton sites and about problem solving in specific management scenarios.

LEARNING MEASUREMENT CRITERIA
The degree of success of the practical test will be assesssed in terms of correctness of the methodology and of the final schedule proposed. The verbal text will be ranked according to the clarity and completeness of the answers, to the degree of knowledge of the topics of the course and to the capability of combining the different topics into solving practical issues.

FINAL MARK ALLOCATION CRITERIA
The top score will be awarded to those students who deliver an escellent practical test and who are able to report excellently all the topics of the course and to apply their different knwoledge to real worlds scenarios to be discussed during the verbal examination. The border line score will be awearded to those students who deliver a quite good practical test and who have a basic knowledge of all the main topics of the course.

Recommended reading
- Project Management Institute - PMI Standards Committe, Guida al Project Management Body of Knowledge , Terza edizione, 2004. - Naticchia B., Tecniche per il management del costruire , Il lavoro editoriale/Architettura editions, 1996. - University lecture notes that can be downloded from Moodle webpage.

Protezione Idraulica del Territorio

Alessandro Mancinelli

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
notions of the bachelor degree.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course allows the students to acquire the basic engineering knowledge of the fluvial construction and environment protection actions. The course face to the specific knowledge of the fluvial environment. Design variables (rain and discharge) are defined in a probabilistic way. Along with the previous teaching the course provides to integrate the advanced knowledge useful for the design.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
To the aim of facing advanced applicative themes and technological processes, the student will have to acquire capabilities of understanding the problems and to reconstruct the flow rate. The student will be also able to make the more suitable choice in terms of design of a civil work in the environment and to prevent natural risk.
TRANSVERSAL SKILLS:
The implementation of exercise works of solving practical problems on the fluvial and hydraulic protection engineering, that will be carried out in group, allows the student to acquire the capabilities to work in a team, alone and to face the typical problems of advanced design activities.

Program
Aims of hydraulic structures and design regulations. Elements of hydrology: hydrological cicle; collection and analysis of data; geometrical representation of hydrological basins and of rivers; rainfall data analysis; flood models. Risk analysis. Hydraulic of rivers and mountain streams. Bed-load transport; check dams; riverbank stabilization and protection; stream junctions; levee design and other river improvements; diversion work; culverts and bridges. Hydroelectric plants: dam regulation, weir and barrages; energy dissipation; diversion works; canals and hydraulic tunnels. Elements of inland waterways.

Development of the course and examination
LEARNING EVALUATION METHODS
The exam consists in an oral test and in the discussion of the exercise work that the candidate presents for the exam. The oral test consists in some questions requested to the candidate about the topics of the course. The exercise work consists in resolving some applying practices about the topics of the course, proposed during the lessons and individually carried out by the candidate.

LEARNING EVALUATION CRITERIA
The positive result of the exam is proved if the candidate shows, by means of the previously described tests, to have well understood the topics proposed during the lessons and to be able to apply, autonomously and correctly, the tipycal methods, the models and the procedures of the

Hydraulic engineering.

LEARNING MEASUREMENT CRITERIA
Assignment of the final grade in thirtiethes.

FINAL MARK ALLOCATION CRITERIA
If the candidate obtains at least the pass grade for both the oral test and the exercise work and in describing the applyied methods, he reaches a positive final evaluation. Maximum evaluation is reached when the candidate shows a deep and complete knowledge of the topics of the course. The praise is reserved to those candidates that carry out oral test and exercise work exactly and completely and that distinguish themselves for them special excellence both for the oral presentation and for the editing of their exercise work.

Recommended reading
Chow V.T., Open channel Hydraulics, McGraw-Hill, New York, 1959. Da Deppo L., C. Datei e P. Salandin, Sistemazione dei corsi d'acqua - 5a Edizione, Libreria Cortina, Padova, 2004. Novak P., A.I.B. Moffat, C. Nalluri and R. Narayanan, Hydraulic structures - 3a Edizione, Spon Press, New York, 2001.

Prototipazione Virtuale

Maura Mengoni

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Main principles and basis of Mechanical Drawing, both handmade and computer-aided, design of machines and manufacturing cycles.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course allows the students to acquire the necessary technical knowledge required for an integrated use of geometric modelling, simulation and analysis tools, to support production/manufacturing processes. These knowledge will allow the student to acquire the skill required for the use of CAD and virtual prototyping systems aimed to reduce product/process development time
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
For the purpose of addressing the design and productive issues through the implementation of the acquired skills, the student will have to be able to profitably use the geometric modelling and simulation tools to support the design/production processes. This ability will be acquired through a series of professional skills such as: the skill to define tridimensional virtual prototypes; the skill to use virtual prototypes for analysis, validation and design assessment
TRANSVERSAL SKILLS:
The execution of a design exercise, which will be performed by groups of students and that will lead to the development of one or more virtual prototypes, will contribute to improve the student skill of express and support his/her ideas in a technical context, to present results of his/her work in a simple and understandable form

Program
The course is arranged in 42 hours of frontal lectures and 30 hours of exercises at the Virtual Prototyping Lab. It aims at providing methods and tools for the creation of virtual prototypes and their use in design and product validation as well as multimodal and multi-sensorial interaction technologies with particular attention to usability and ergonomics. The course program is based on the following topics: user-centered design methods and systematic approach to product design, advanced systems supporting design and representation, virtual prototyping environments and architectures, solid and surface modeling, principles of geometric modeling, virtual humans and tracking techniques, principles of human-computer interaction, new interaction paradigms based on multimodal, multi-sensorial, desktop or immersive technologies, applications and technologies of Virtual Reality and Augmented Reality, Reverse Engineering techniques. Numerous case studies from industry will be used. The exercises at lab will be organized into 24 hours of CAD for virtual prototyping and 6 hours for the products with high technological, functional, aesthetic and ergonomics values.

Development of the course and examination
LEARNING EVALUATION METHODS

The evaluation is based on three intermediate esaminations and a final assessment of the drawings and models the students realize during the course to represent their project and an oral exam at the end where questions are submitted to verify the learned lessons.

LEARNING EVALUATION CRITERIA

The criteria for the evaluation of intermediate and final results about the developed projects are: skill on using CAD tools for the representation of solids and surfaces, ability to apply both systematic design approaches and user-centred design methods in product development, competences in adopting virtual prototyping techniques to analyze physical ergonomics. Criteria for the evaluation of the final project are: knowledge of information gathering techniques to create a complete list of user needs and product requirements, ability to think about social and ethical effects of product design to include people with disabilities and/or frailties, competence of problem-solving and identify feasible and innovative design solutions, ability to use proper tools to represent design ideas and analyze the achieved outcomes and finally, ability for team working. The criteria to assess the oral exam are: knowedge of the course topics, skill of analysis and synthesis, ability to apply the achieved competences in specific domains, ability to clearly communicate ideas, concepts and to correlate them.

LEARNING MEASUREMENT CRITERIA

The measurement of the student learning is carried out by the assignment of a score to a set of evaluation metrics that differ according to the type of evaluation (i.e. intermediate tests, final project, oral exam) in order to reach the maximum score of 30/30 and laude. Metrics for the evaluation of the project are: degree of the proposed design innovation, level of project detail and achieved quality, correctness of drawings, models, analysis reports, number of functions that are implemented in the product, degree of product ergonomics and usability. Metrics for the evaluation of the oral exam regard the quality of the presentation and the competences matured on the course topics.

FINAL MARK ALLOCATION CRITERIA

The maximum score is 30/30 and laude. It is achieved by students that demonstrate autonomy in problem-solving and transdisciplinary knowledge of main tools and methods for virtual prototyping in the different examinations (graphic and oral). The minimum scorre is 18/30 and is assigned to students that have an enough knowledge of Virtual Prototyping tools and methods and design a simple product.

Recommended reading

Burdea G.G. and Coiffet P., 2003, "Virtual Reality Technology", Wiley-Interscience Pahl G., Beiz W., Wallace K., Blessing L.T.M. and Bauert F., 1995, "Engineering Design: A systematic Approach", Springer Wilson C., 2011, "Handbook of User-Centered Design Methods", Morgan Kaufmann Goldman R., 2009, "An integrated Introduction to Computer Graphics and Geometric Modeling", CRC Press. Ulrich K.T., Eppinger S.D., Filippini R., 2007, Progettazione e Sviluppo Prodotto , Mc Graw-Hill. Grau O., 2004, "Virtual Art: from Illusion to Immersion", Leonardo Book Series, The MIT Press Ohta Y., Tamura H., 2014, "Mixed Reality: merginig real and virtual words", Springer De Fusco R., 2014, "Made in Italy: storia del design italiano", Altralinea Edizioni Dardi G., Bigatti D., 2014, "Storia dell'impresa e storia del design. Prove di dialogo.", Archetipo libri

Recupero degli Edifici

Elisa Di Giuseppe

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Knowledge of construction elements and building technology, structural engineering and building physics.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to deepen their knowledge of construction techniques in historical building and intervention methods on the historic built heritage. To this end, particular attention is paid to the knowledge of historic building materials and traditional building techniques and to develop tools and methodologies necessary to carry out all the preliminary investigations intervention of preservation and renovation of the historical heritage. The course provides the student also the necessary tools for the design of structural measures for the recovery and conservation of historical buildings in the light of the current instances of seismic improvement and architectural restoration.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to develop methodologies and operational instruments in the restoration of existing buildings, the design exercises of the course deal with the question of recovery of an existing building in masonry. These exercises will enable students to develop their knowledge and technical skills to design the restoration of historical buildings that meet the functional reasons, formal, technical and structural policies that govern the formation of the constituent characteristics of the restoration project.
TRANSVERSAL SKILLS:
The execution of design exercises in groups on the question of recovery of an existing masonry building will be for the student an opportunity to apply the knowledge and methods described in the lessons. The group exercises will lead to the drafting of a detailed design of a building block with load-bearing masonry structure. The project is represented graphically in a "book". The design process as part of the recovery of the housing is developed taking into account the conservation needs of the building or parts thereof, functional adaptation and improvement from a structural point of view. The acquisition of judgment skills is through discussion of advanced aspects of discipline during the written and oral exams.

Program
Contents (lessons, 48 hours): Traditional construction technologies (bearing masonry, arches and vaulted ceilings, wooden floors, trusses, foundations). Historical building materials (stone, brick, mortar, wood, finishing materials). Tools and methodologies for the preliminary survey (critical survey, historic-architectural research, instrumental analysis). The process of damage (structural instability, seismic vulnerability, material pathologies). Methodologies and criteria for intervention on the existing building stock, for the renovation and preservation according to the criteria of the architectural restoration and seismic improvement. Hygrothermal retrofitting. Classroom exercises (24 hours): Renovation project of an existing masonry building, from the formal, functional,

performance, structural points of view.

Development of the course and examination
LEARNING EVALUATION METHODS
The evaluation will focus on: a written examination on the contents of the course lectures; a set of project drawings made during the classroom exercises, opportunity for the student to apply the knowledge and methodologies described in the lessons and to develop their technical skills.

LEARNING EVALUATION CRITERIA
During the examinations, the student must demonstrate the ability to use, independently and fairly, knowledge, technical skills, working methods and instruments concerning the renovation of existing buildings. Furthermore the student must demonstrate sufficient autonomy and ability to judge, select, synthesize and clearly present ideas, concepts and solutions relating to the topic.

LEARNING MEASUREMENT CRITERIA
During the examinations, the level of knowledge of the topic is evaluated. The student's technical capacity to use in a relevant, correct and independent way, the typical methodologies and tools of building renovation projects is also assessed.

FINAL MARK ALLOCATION CRITERIA
Top mark (thirty points with honors) is awarded to students who demonstrate, in both examinations, full mastery of the course contents and complete autonomy to use, in a relevant, correct and independent way, the typical methodologies and tools of building renovation projects. The lowest mark (eighteen points) is awarded to students who demonstrate sufficient knowledge of the course contents and sufficient ability to use typical methodologies and tools of building renovation projects.

Recommended reading
Caleca L., Architettura tecnica, Dario Flaccovio ed. 2000; Doglioni F., Codice di pratica, BUR Marche 29/09/2000; Vallucci S. et al., Costruzioni storiche in muratura, Wolters Kluwer 2014; further material on doodle.

Recupero e Conservazione degli Edifici (EA)

Enrico Quagliarini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 90
Period 1s

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide students with the tools needed to design interventions for the recovery and preservation of Architectural Heritage in the light of the current instances of seismic upgrading and architectural restoration. The practical sessions involve exercises on the restoration of an existing complex having environmental and / or historical significance. The purpose is to train a high-level professional engineer able to complete methodologies and operative tools towards designing interventions on Architectural Heritage for its conservation, up to their accurately fulfilment from an aesthetic, functional and technical-economic standpoint.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Students will have to be able to express current design trends for recovery and restoration; identify the degradation processes; comparing traditional and innovative construction techniques; design the main techniques for recovery and consolidation, so as to so as to face with high-level (complex) design solutions and to carry out the research and development of new methodologies. They will also have to be able to responsibly design solutions based on their professional and engineering methodologies, beyond the usual rules and the current standards.
TRANSVERSAL SKILLS:
Students, working alone and in team, will have to resolve one or more problems by providing some designing solutions. This will contribute to enhance their autonomy and their team-working, and to favour their communication skills so as to clearly and properly justify their designing choices. In this framework, students will be driven to autonomously look for their educational material, to get a synthesis, to test their skills on problems solving and to explain what they learnt.

Program
Frontal lessons (78 hours): How to intevene on Architectural Heritage: evolution of the scientific positions and today's debate. How a historical masonry building works, traditional constructive techniques, degradation processes. Local mechanisms and particular structures (arches, vaults,). Assessing the vulnerability of historical buildings. How to design actions to recover and preserve Architectural Heritage and its constructive elements. Traditional and innovative interventions. Guidelines for monumental buildings. Historical surfaces conservation. Behavioural design and historical buildings (mention). Case studies. Training exercises (12 ore): Design actions on a case study with historical and/or environmental value: schemes of interventions on the whole case study; interventions on constructive elements and their connections; constructive details.

Development of the course and examination
LEARNING EVALUATION METHODS
students are evaluated through 2 levels: - first level: evaluation of the annual training exercises; -

second level: oral exam on some of the topics of the course.

LEARNING EVALUATION CRITERIA
Students will have to be able to express, at both the two previous levels, current design trends for recovery and restoration; identify the degradation processes; comparing traditional and innovative construction techniques; design the main techniques for recovery and consolidation. This has to be done by doing justified choices.

LEARNING MEASUREMENT CRITERIA
Students' skill on problem-solving by providing technical detailed designing solutions and properly justifying their design choices will be evaluated at both the two previous levels.

FINAL MARK ALLOCATION CRITERIA
The maximum evaluation, that is 30 cum laude, is assigned to students who demonstrate, at both the previous two levels, an excellent skill on problem-solving by providing technical detailed designing solutions and properly justifying their design choices. The smallest evaluation, that is 18, is assigned to students who demonstrate, at both the previous two levels, a sufficient skill on problem-solving by providing technical detailed designing solutions and properly justifying their design choices.

Recommended reading
- Vallucci S., Quagliarini E., Lenci S. (2014) Costruzioni storiche in muratura. Vulnerabilità sismica e progettazione degli interventi, Utet Wolters Kluwer Italia - Doglioni F., Codice di pratica (linee guida) per la progettazione degli interventi di

Restauro Architettonico (EA)

Fabio Mariano

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 90
Period E/1s-2s

Prerequisites
Knowledge of ancient and modern History of Architecture; good handling of drawing instruments for Architectural Survey, manual techniques and electronic softwares for graphical rendering

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to train Designer Restorer able to know and understand an architectural and environmental cultural object in its historical evolutive aspects, in its structural components and materials, in its intrinsic environmental and cultural values in order to be able to operate with awareness and competence in restoration project / conservation of historical artefact artistic updated according to the principles of the theory and technology, in order for a proper recovery, protection and future maintenance. The course and its labs are designed in coordination with Area of the History of Architecture; Area Imaging and Surveying; Area Technology of Building Elements; Area Technical Architecture; Area of Structural Engineering, Area of Architecture and Architectural Composition.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to address advanced design themes, even of considerable complexity, through the application of knowledge gained, students will thrash out all the aspects of the architectural and environmental cultural object which constitute the essential basis of any proper restoration and conservation project: the documentary history, the geometric survey, documentation of possible previous restoration, diagnostic analysis, etc. They will have to be critically analyzed and evaluated in their specific and applicative values for the project, in the field of the development of operational techniques and of applicable administrative regulations.
TRANSVERSAL SKILLS:
The course deals with tutorials, analysis and design studies to be carried out in working groups, on the theme of restoration / preservation of buildings of historical and environmental complexes undergo bond of Bodies of protection, in order to create and stimulate the design ability of the students regarding the topics covered.

Program
Restoration means to be engaged in the guardianship of an historical monument and to hand it on to the future as it is, with his total heritage of historical marks, by making it easy to be understood to our posterity in every part, giving readability to his transformations during the times. Likewise we are obliged to set up all technical actions to preserve his structural and surfaces integrity during the times to come. As well restoration is a critical action , which is the more effective the more we deeply know his history (age, building documents, surveys, materials analysis, etc.). Since this informations are basic to restore the past, they will be analyzed and carefully handled in our restoration project, with realistic consciousness of up-to-date technical rules and laws. On-the-spot investigations, technical specimens and papers, as well as specific lectures by professional advisers will help us to carry out our academic projects.

Development of the course and examination

LEARNING EVALUATION METHODS

Learning level will be with checked through an assiduous control of the cultural and technical growiChecking on the technical and cultural knowledge acquired by the student on treated themes during lessons and laboratorieng up by the student

LEARNING EVALUATION CRITERIA

Checking on the technical and cultural knowledge acquired by the student on treated themes during lessons and laboratorie

LEARNING MEASUREMENT CRITERIA

The student must testify in detail his conscious handling and grasp in restoration project drawings and architectural surveys on a selected architectural monument .

FINAL MARK ALLOCATION CRITERIA

Maximum evaluation wil be attributed to a good handling of project techniques, drawings and mature consciousness of highlights and criteria concerning a restoration design.

Recommended reading

S.FRANCESCHI, L.GERMANI, Manuale operativo per il Restauro Architettonico, Ed.DEI Roma, 2010

Reti di Sensori Wireless per Internet of Things

Paola Pierleoni

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
This course requires the knowledge of the basic concepts of signal and telecommunications theory.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
To know and understand the issues related to the design of wireless sensor networks related to their pervasive influence, the characteristics of the transmission medium, the variety of network architectures and possible applications. Increase knowledge of standard protocols and emerging ones in the scientific literature regarding the Internet of Things, by analyzing the performance achievable under changing choices in each level of the protocol architecture. Study the so-called smart objects and how networks of smart objects can be interconnected using the IP protocol to be able to understand and define innovative technics in the design of IoT s systems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
To be able to make informed choices on the basis of quality of service and traffic characteristics for the specific application, and to use this knowledge for the development and implementation of original solutions in various application fields and, if possible, in research ones. In general, to evaluate, analyze and solve problems in new and emerging areas such as the Internet of Things using the newest technologies.
TRANSVERSAL SKILLS:
A smart object is essentially a device equipped with sensing / actuator units, a microprocessor, a communication device and a power source. The scope of the study is therefore highly interdisciplinary, involving sectors such as micro- and nano-electronics, embedded systems, wireless sensor networks, ubiquitous computing, mobile computing, computer networking, mobile telephony, telemetry, etc. The description of projects already carried out and the implementation of new ones through laboratory experiences will provide cross skills in different ICT disciplines giving the students the ability to use, develop and manage disparate technologies and skills within broader contexts related to their field of study. It will start from the analysis of the problem to get through the design, implementation, optimization and verification of the final system performance.

Program
(Lectures, 48 hours) General: Internet of Things (IoTs). Wireless Sensor Network (WSNs) and Wireless Body Sensor Networks (WBSNs). Sensor Network protocol stack: Physical Layer, Data Link Layer, Network Layer, Transport and Application Layers. Cross Layer optimization. Energy Management. Relevant Standards for each level of the protocol stack. Design constrains and WBSNs applications. Internet of Things over IP protocol Architecture. Fundamental TCP/IP architectural design principles. Recalls of IPv4. QoS: delay, jitter, packet loss. Transport protocols: TCP, UDP. IPv6 and TCP/IP protocol stack. Fragmentation. High level protocols. Smart Objects hardware and software. Operanting Systems for Smart Objects. IPv6 for Smart Objects and the Internet of Things. uIPv6. The 6LowPAN Adaptation Layer. RPL: routing in Smart Objects networks. CoAP. Standardization. Interoperability. Non-IP Smart Objects tecnologies. Web services for Smart

Objects. Connectivity models for Smart Objects networks. Security for Smart Objects. Theory about inertial sensors. Accelerometer, gyroscope, magnetometer and barometer. Orientation filters: acquisition, calibration, data fusion. Acquisition, processing and transmission of biometric signals: ECG, EMG, breathing etc. Indoor localization techniques. The application of Smart Objects networks for indoor localization. Monitoring of environmental parameters for Smart Cities, Smart Lighting, Smart Home, precision agriculture, logistics applications, etc. Laboratory activities (24 hours). BLE. Android operating system and applications. Arduino: tutorial on Arduino board and its programming in a series of practical realizations (applications of smart lighting and power metering systems, proximity detection, IMU , wearable biomedical devices , etc.). Wi-IMU: GUI, cuboid. orientation filters and complementary filter. Classification techniques. Fall Detection algorithms. MatLab simulations on filters and algorithms. Application of inertial systems for the monitoring of neurological diseases and clinical tests. Postural detection. Activity level and tracking. Design of Web server services for sensor data. Contiki. Development and application of a WSN system for indoor localization. Examples of web-based management systems for sensor networks. WebRTC and its capabilities for real-time transmission of data acquired from the biometric sensors. Proposition of facultative experimental projects to the students.

Development of the course and examination
LEARNING EVALUATION METHODS
The students learning assessment is done through a verbal examination that covers specific topics of the course. This assessment can optionally also include the presentation and discussion of a project chosen among those proposed by the teacher. The project is typically a practical implementation of one of the topics covered in the course. It will be presented in the form of technical report and / or hw / sw prototype version, typically a Wireless Sensor Network subsystem. The project can be done in groups. The size of each group shall be agreed with the teacher on the basis of the complexity of the chosen project. The discussion of the project and the verbal examination must take place with the participation of all students belonging to the same group.

LEARNING EVALUATION CRITERIA
The student must demonstrate the understanding of the fundamental concepts of network architectures and protocol stacks discussed during the course to successfully pass the assessment of learning. In addition, the student must identify the problems and the design criteria with reference to the different application fields, the specific quality of service and traffic parameters. The student must know how to apply, in independent way, those criteria and procedures to the design of simple network architectures, offering the most suitable protocols for each layer of the stack, taking into account the issues involved. The student, during the verbal examination, may present and discuss an optional project, showing knowledge, methodological skills and technological constraints of the proposed solution.

LEARNING MEASUREMENT CRITERIA
The verbal examination is evaluated by a score of thirty.

FINAL MARK ALLOCATION CRITERIA
During the verbal examination the student must obtain a score of at least eighteen points in order to have a positive evaluation. The student must demonstrate an overall knowledge of the topics and present them in a correct manner and with the use of proper technical terminology to successfully pass the verbal examination. In case of submission of a project, it must fullfil the minimal functional requirements agreed with the teacher.The student must demonstrate a thorough understanding of topics presented with a mastery of technical language to get the maximum score. Praise is given to students who perform correctly the verbal examination and show a particular brilliance and mastery of the topics.

Recommended reading

Jean-Philippe Vasseur, Adam Dunkels, Interconnecting Smart Objects with IP: The Next Internet , Elsevier. Ilya Grigorik, High Performance Browser Networking , O'Reilly. Rob Manson, Getting Started with WebRTC - Explore WebRTC for real-time peer-to-peer communication , PACKT Publishing.

Reti di Telecomunicazione

Paola Pierleoni

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
This course requires the knowledge of the basic concepts of signal and telecommunications theory.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
To know and understand the current status and future trends of telecommunication standards, with the aim that the student has an adequate preparation to his immediate placement into employment. In particular, the problems linked to the design of telecommunication networks, both in geographic, metropolitan and local areas, to the different transmission solutions, the variety of network architectures, protocols and application fields are studied in deep. It will start from the investigation of standards and emerging protocols, analyzing the performance achievable under changing design choices at each level of the protocol architecture. Much of the course is devoted to the TCP/IP architecture, starting from the native protocols up to the latest RFC (Request For Comments) and the use of these protocols in a variety of network architectures.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
To be able to make informed choices on the basis of quality of service and traffic characteristics required by specific applications and to use this knowledge for the development and implementation of efficient solutions in different application contexts. In general, to evaluate, analyze and solve problems in new and emerging areas using the most modern technologies. All this is finalized to a placement into employment in a short time also furnishing a strong basis for a graduated student.
TRANSVERSAL SKILLS:
To be able to understand the issues involved, to apply the acquired knowledge, to propose solutions to problems, to learn new methodologies in relation to the planning, management and monitoring of telecommunication networks.In particular, students will deepen the practical aspects of the course, carrying out the design of basic network components, configuration of equipment and telecomunication systems, monitoring of elementary networks, design and test of telecom services, analysis activities, design and management of systems for the treatment, transmission and processing of information. The use in the laboratory of network simulators and communication devices, along with the creation and tests of simple communication systems, will develop and put to use a number of cross skills in different ICT disciplines such as electronics, computer science, electrical engineering, signal theory, electromagnetic fields, antennas, etc. The students will then have the ability to use, develop and manage disparate technologies and skills within broader contexts related to their field of study.

Program
(Lectures, 38 hours) Protocols and architectures. OSI. TCP/IP. Data communications interfaces. Asynchronous and synchronous transmission. Line configurations. Interfacing. Mechanical, electrical, functional and procedural characteristics of some typical interfaces. Transport of the information. PDH. SDH. Data Link protocols. Line control. Flow control. Error detection and control. ARQ techniques. HDLC protocol (LAP-B, LAP-D, LAP-F). WAN. Circuit switching concepts. Routing

in circuit-switching networks. Control signalling. Packet switching principles. Routing in packet-switching networks. Datagram and virtual circuit. Notes on X.25, ISDN and B-ISDN, Frame Relay and ATM. Congestion control in data networks. Traffic Management. LAN architecture. Internetworking devices. Wireless LAN. IEEE 802.x. Internetworking protocols. Internet Protocol: IPv4 vs. Ipv6. Transport protocols: TCP, UDP. Distributed applications. Network security. QoS. Network innovation. Full IP network. Core & Access Evolution. DWDM. Metro Ethernet. Wireless Access. Laboratory activities (10 hours). Wireshark. WireShark captures. ICMP (Ping, Trace route, etc.), TCP, UDP, DNS, ARP, RARP. Networking devices configuration through simulators.

Development of the course and examination
LEARNING EVALUATION METHODS
The students learning assessment is done through a verbal examination that covers specific topics of the course. This assessment can optionally also include the presentation and discussion of a project chosen among those proposed by the teacher. The project is typically a practical implementation of one of the topics covered in the course. It will be presented in the form of technical report and / or hw / sw prototype version, typically network protocols implementation. The project can be done in groups. The size of each group shall be agreed with the teacher on the basis of the complexity of the chosen project. The discussion of the project and the verbal examination must take place with the participation of all students belonging to the same group.

LEARNING EVALUATION CRITERIA
The student must demonstrate the understanding of the fundamental concepts of network architectures and protocol stacks discussed during the course to successfully pass the assessment of learning. The student must be able to analyze and evaluate, through the use of sw tools provided during the lessons, the performance of a specific solution. In addition, the student must have clear issues of employment of the individual network architectures with reference to the different fields of application. The student, during the verbal examination, may present and discuss an optional project, showing knowledge, methodological skills and technological constraints of the proposed solution.

LEARNING MEASUREMENT CRITERIA
The verbal examination is evaluated by a score of thirty.

FINAL MARK ALLOCATION CRITERIA
During the verbal examination the student must obtain a score of at least eighteen points in order to have a positive evaluation. The student must demonstrate an overall knowledge of the topics and present them in a correct manner and with the use of proper technical terminology to successfully pass the verbal examination. In case of submission of a project, it must fullfil the minimal functional requirements agreed with the teacher. The student must demonstrate a thorough understanding of topics presented with a mastery of technical language to get the maximum score. Praise is given to students who perform correctly the verbal examination and show a particular brilliance and mastery of the topics.

Recommended reading
William Stallings, Data& Computer Communications , Prentice Hall. William Stallings, Network Security Essential , Prentice Hall. William Stallings, High-speed networks and Internets: Performance and Quality of Services , Prentice Hall. Hu Hanrahan, Network Convergence: Services, Applications, Transport and Operation Support , John Wiley & Sons.

Riabilitazione Strutturale (CIV)

Fabrizio Gara

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Material covered in Structural Analysis and Seismic Engineering is considered as assumed knowledge

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course provides basic theoretical knowledge and practical skills required for the seismic retrofit and upgrading of existing reinforced concrete and masonry buildings. By improving skills deriving from the first cycle degree, the student improves his knowledge in the field of civil engineering with fundamentals of structural rehabilitation.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student gains skills necessary to understand the behaviour of structural systems and to design appropriate retrofitting solutions. These skills are developed through lectures, including specific practical examples.
TRANSVERSAL SKILLS:
Practical examples, presenting in some cases different solutions for a specific problem, allow the student to improve his critical judgment skill as well as the ability in modelling, representing and analysing structural complex systems.

Program
The problems of restoration and seismic retrofit of existing constructions. The knowledge and surveying of constructions; historic analysis and critical surveying; geometrical and dimensional surveying; the crack pattern and settlements surveying; material and structure surveying; soil and foundation inspections; levels of knowledge. Concrete buildings in seismic areas: in situ and laboratory tests on materials and structural elements; safety requirements; method of analysis assessment criteria; traditional techniques for structural element retrofitting; innovative techniques for building seismic retrofitting; interventions on foundation. Masonry buildings: materials and historical development of masonry; typologies; in situ and laboratory tests on materials and wall elements; the ideal masonry model; strength criteria; masonry building analysis; the ideal model of seismic-resistant buildings; global analysis methods and assessment criteria; local mechanism analysis; interventions for the improvement of static and seismic structural problems; interventions on foundation. Wood floor: material charachteristics; design and verifications of wood structural elements; pathologies, damages and surveying techniques; restoration and substitution techniques of wood floors. Industrial buildings: damages and surveying and analysis of typical seismic vulnerability; intervention for structural strenghtening and seismic retrofitting.

Development of the course and examination
LEARNING EVALUATION METHODS
The evalulation of student learning is based on two assessments: - a written test concerning theoretical topics ; - an oral exam consisting in a discussion of the written test and in some other

theoretical questions on the topics covered during the course; students may be present and discuss an optionl design project, taht can be developed also in group, concerning the seismic assessment of an existing building and in the retrofitting designt.

LEARNING EVALUATION CRITERIA
Through the written test and the oral exam, and eventually the optional project, the student must demonstrate to have a clear knowledge of the topics covered during the course, such as in particular the methods for the assessment of an existing building, the analysis methods and the main interventions for structural restoration and seismic retrofitting.

LEARNING MEASUREMENT CRITERIA
The evaluation of both the assessment is expressed in thirtieths.

FINAL MARK ALLOCATION CRITERIA
The student is expected to pass both (written and oral) assessments. The final mark of the course will be calculated after the oral exam as the average of the marks received for these two assessments, or three in case of presentation of the optional project.. The 'lode' will be awarded to students who, having correctly completed the assessments, show an outstanding understanding in the subject.

Recommended reading
R. Antonucci, Restauro e recupero degli edifici a struttura muraria , Maggioli Editore. F. Jacobelli, Progetto e verifica delle costruzioni in muratura in zona sismica , EPC libri. G. Manfredi, A. Masi, R. Pinho, G. Verderame, M. Vona, Valutazione degli edifici esistenti in cemento armato . Slides of lectures are provided by the lecturer and are available at the Centro Copie Ingegneria

Riabilitazione Strutturale (EA)

Alessandro Balducci

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 90
Period 1s

Prerequisites
Structural analysis and design (Tecnica delle Costruzioni).

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to improve the knowledge of techniques for the structural rehabilitation of reinforced concrete, masonry and mixed masonry-reinforced concrete existing buildings, with particular focus on seismic issues.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Disciplinary knowledge gained in the framework of the structural retrofit of existing buildings makes the student able to develop adequate design and technical solutions, with reference to compatibility, environmental sustainability, requirements and possible constraints. The required skills are developed through lectures, including specific practical examples, in conjunction with an optional designing exercise carried out individually or in groups.
TRANSVERSAL SKILLS:
The designing exercise helps to improve the self-learning skill, the ability to communicate results and to generalise the acquired knowledge. Furthermore, an active involvement in the teamwork is developed.

Program
The problems of salvage and restoration. The surveying of buildings for safety inspection and structural overhaul; geometrical and dimensional surveying; critical surveying; the investigation of decay and their explanation; material and structure inspections; foundation and terrain inspections. Masonry buildings: the historical development of materials and masonry; typologies; the ideal masonry model; resistance criteria; masonry building design in accordance with the standards in force. Floors: wood as a construction material; the design of wood structures; historical floors; typologies; pathologies; salvage, strengthen and retrofitting techniques. Masonry arches and vaults: history and development; the arch and vault check; decay and salvage/strengthening techniques. Masonry buildings in seismic areas: the ideal model of buildings capable of withstanding an earthquake; safety requirements; action and seismic combinations; global analysis methods and check criteria; local mechanism analysis methodology; techniques for improving building's seismic response and how to choose between them; the capacity model for a vulnerability evaluation and seismic retrofitting in accordance with Italian Standards (NTC 2008). Concrete buildings in seismic areas: safety requirements; action and seismic combinations; the analysis method and check criteria; capacity models for seismic vulnerability checking and for retrofitting; traditional techniques for primary and secondary structural element retrofitting; innovative techniques for a building's seismic rehabilitation; base isolation; dissipative brace windward. Mixed structures. Building decay due to foundation collapse: monitoring techniques and subsidence measurement; evolution; decay analysis and their causes; retrofitting and rehabilitation techniques; typical causes.

Development of the course and examination

LEARNING EVALUATION METHODS

Not available

LEARNING EVALUATION CRITERIA

Not available

LEARNING MEASUREMENT CRITERIA

Not available

FINAL MARK ALLOCATION CRITERIA

Not available

Recommended reading

R. Antonucci, Restauro e recupero degli edifici a struttura muraria , Maggioli Editore. F. Jacobelli, Progetto e verifica delle costruzioni in muratura in zona sismica , EPC libri. G. Manfredi, A. Masi, R. Pinho, G. Verderame, M. Vona, Valutazione degli edifici esistenti in cemento armato .
Educational material will be provided by the teacher.

Riabilitazione Strutturale (EDI)

Alessandro Balducci

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Nothing

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to improve the knowledge of techniques for the structural rehabilitation of reinforced concrete, masonry and mixed masonry-reinforced concrete existing buildings, with particular focus on seismic issues. The course objective is that of training engineers able to work in the framework of the structural retrofit, maintenance and management of existing buildings.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student gains skills necessary to identify structural problematic aspects of complex building systems, and to suggest appropriate design solutions for the rehabilitation. The necessary skills, critical judgment and capacity for choice, are developed through lectures, including specific practical examples, in conjunction with an optional designing exercise carried out individually or in groups.
TRANSVERSAL SKILLS:
The designing exercise helps to improve the self-learning skill, the ability to communicate results and to generalise the acquired knowledge. Furthermore, an active involvement in the teamwork is developed.

Program
Architecture and engineering in ancient and modern times; The Greece (architectural models, materials and construction techniques); The Ancient Rome (materials, building technology and construction, urban models, architectural types); The Early Christian and the Byzanine architecture; The Romanescque and the Gothic architecture; The Renaissance, the Mannerism and the Baroque. Architecture and engineering in contemprary times; the industrial revolution and the birth of the Technical Schools of Engineering in Europe (engineering of concrete and engineering of metals); evolution of modern city (London, Paris, Wien, Barcelona, Philadelphia, New York, Washington, Chicago, Rome). The contribution of great master of the twentieth century: United States and Frank Lloyd Wright; Germany, Deutscher Werkbund, Walter Gropius, Ludwig Mies van der Rohe and the contribution of Peter Behrens; France by August Perret and Le Corbusier; Scandinavia, Finland and Alvar Aalto. Engineering and architecture in Italy in the twentieth century. Engineering and architecture of the late twentieth century in an international context. Monographic lectures on British School (Norman Foster, Richard Rogers, Peter Rice and Nicholas Grimshaw), the United States School (SOM, Pietro Belluschi, Peter Eisenman, Frank Gehry, Steven Holl, Philip Johnson, Richard Meier). Historical evolution of the city of Ancona in ancient and contemporary times.

Development of the course and examination
LEARNING EVALUATION METHODS
Not available

LEARNING EVALUATION CRITERIA
Not available

LEARNING MEASUREMENT CRITERIA
Not available

FINAL MARK ALLOCATION CRITERIA
Not available

Recommended reading
K. Frampton, "Tettonica e architettura", Skira, Milano 2005 W.J.R. Curtis, "L'architttura dal 1900", Phaidon, Londra 2006 B. Zevi, "Saper vedere l'architettura", Einaudi, Torino 1953 A. Rossi, "L'architettura della città", Quodlibet, Macerata 2011 E. Torroja, "La concezione strutturale", Città Studi Edizioni, Milano 1966 M. Salvadori, R. Heller, "Le strutture in architettura", Etas Kompass, 1964

Ricerca Operativa

Ferdinando Pezzella

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
Systems of linear equations, Convex analysis

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims allowing students to acquire the basic knowledge on the mathematical programming models for decision optimization problems in the company management. It gives the necessary mathematical and application basis for solving linear programming problems with particular reference to both the algorithmic and the computational aspects. The knowledge transmitted will provide students with the methodological instruments for developing both optimization models and methods based on linear programming and on the related solution algorithms.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will be able to mathematically formulate the company management problems. Moreover, he/she will acquire the capability of using the optimization software and of interpreting the obtained results through simulations run on computers.
TRANSVERSAL SKILLS:
The presentation and the discussion of the application problems of Operations Research, during the written and the oral test, will allow students to improve their autonomous judgment degree and their communication skills. The learning capability will be developed by applying the acquired knowledge to contests that differ from the ones presented during the course and by examining in depth through an autonomous search. The presentation and the discussion of the application problems of Operations Research will allow students to improve their autonomous judgment degree, their communication skills and their capability of applying the acquired knowledge to contests that differ from the ones presented during the course.

Program
- Introduction to optimization problems - Mathematical programming models - Formulation of linear programming models - Graphical solution of linear programming in two variables - Review of linear algebra and convex analysis - Simplex method in tableau form - Pivot matrix method - Simplex in matrix form - Revised simplex methods - Two-phase simplex method - Duality theory and primal-dual relationships: dual variables and duality theorems - Dual simplex method - Stability analysis of the optimal solution - Linear Programming applications to production planning problems - Transportation problems: mathematical model - Assignment problems : mathematical model - Software LINDO (Linear INteractiver Discrete Optimization)

Development of the course and examination
LEARNING EVALUATION METHODS
The evaluation of the students learning level consists of: -- A written examination that requires solving a linear programming problem via several solution methods, studied during the course. Its

duration is two hours. -- An oral examination that requires discussing two or more themes, analyzed during the course. Only the students who have reached a sufficient level in the written examination are allowed accessing the oral one. The students have to do the oral test in the same exam of the writing one. In the case of the oral examination is negatively evaluated, the result of the writing test will be maintained only for the next exam.

LEARNING EVALUATION CRITERIA

In order to pass the learning evaluation, the student, through both the examination tests, has to prove that he/she has understood the arguments, addressed during the course, among which:
--Linear Programming model and its applications to some decisional problems; --Linear Programming theory and the solution proprieties; - Simplex method and its different versions; --Theorems of the Dual Theory and the Stabiltity Analysis; --Linear Programming applications to some production planning problems

LEARNING MEASUREMENT CRITERIA

Both the writing and the oral examination are scored out of a maximum of thirty points (i.e., the score is between zero and thirty). The total score, for a maximum of thirty points, is the rounded up average value of the previous two scores .

FINAL MARK ALLOCATION CRITERIA

The result of the learning evaluation will be positive if the student reaches a sufficient level (equal to eighteen points) in both the two examinations (such as in both the writing and the oral test). The evaluation of thirty points is reached by proving, in both the examinations, a deep knowledge of the arguments, addressed during the course, together with the ability to efficiently solve the Linear Programming problems. The evaluation of thirty points cum laude is for students who have carried out both the examinations in a correct and complete way, showing a particular clarity during the oral discussion and in the writing test.

Recommended reading

- Educational material provided by the teacher on Learning Management System - MOODLE - F. Pezzella, Elementi di Programmazione Lineare, Liguori Editore, Napoli

Ricerca Operativa (GEST)

Fabrizio Marinelli

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Elements of linear algebra and convex analysis.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course introduces the mathematical modeling and shows the basic topics, the methodological approaches and the solution techniques for linear and integer linear programming problems. The teaching describes the nature of the decision problems that particularly arise in production and service systems and illustrates the main techniques for their modeling and solution.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will be able to formulate and quantitatively solve decision problems that arise within production and service systems. Such skills mainly consist in the ability of a) correctly identify the decisional aspects of a decision-making problem, b) define suitable measures of performance indicators, c) identify the physical and operational constraints and finally d) encoding and solving problems by suitable software tools. Given the interdisciplinary nature of these activities, the student will be able to work within cross-functional teams, acting as interface between the various professional skills.
TRANSVERSAL SKILLS:
The student skills will be checked through modeling exercises and the application of algorithms and solution techniques illustrated in the course, as well as by a final test, in which students must demonstrate sufficient knowledge of the theoretical principles and the optimization methods for linear and integer linear programming. In general, these activities will contribute to the improvement of both the degree of independence of judgment, and the ability of analysis, abstraction, modeling, interpretation and communication of the quantitative results related to decision-making problems.

Program
- Organized systems and decision-making problems. - Linear and integer linear programming models. - AMPL: an algebraic modeling language. - Basic topics in convex analysis and linear algebra. - Theory of Linear Programming. - Simplex algorithm and revised simplex algorithm. - Duality theory: motivations and main results. - Dual simplex algorithm. - Sensitivity analysis and economic interpretation. - Integer Linear Programming. - ILP models for noteworthy combinatorial optimization problems on graphs. - The method of cutting planes. Gomory cuts and cover inequalities for Knapsack 0-1. - Applications.

Development of the course and examination
LEARNING EVALUATION METHODS
The assessment of the level of learning includes both a written and an oral exam. The written lasts 2 hours and is composed by a first part with multiple-choice tests and a second part with one or more exercises on mathematical modeling and/or solution of (integer) linear programming models by means of the techniques presented in the course. During the exam students cannot use notes

and books. The access to the oral exam is reserved to students that achieve a written rating of at least 18 points. The oral exam consists of the discussion of the written exam and the solution of one or more questions in order to verify the logical deductive skills and the understanding of the course topics.

LEARNING EVALUATION CRITERIA

It is evaluated the ability to clearly and logically explain ideas, concepts and theoretical results of linear programming. It is also assessed the ability to independently set and solve decision problems by correctly using appropriate methods, models and tools of mathematical programming and in particular od linear programming.

LEARNING MEASUREMENT CRITERIA

Knowledge of ideas, concepts and theoretical results is analytically measured by a score assigned to the first part of the written exam that ranges between -7 and 14 points. The ability to formulate and solve decision-making problems by means of the tools of linear programming is analytically measured by a score assigned to the second part of the written that ranges between 0 and 14 points. the capability of synthesis, logical and clear exposition is measured analytically by a score assigned to the oral exam that ranges between 0 and 30 points.

FINAL MARK ALLOCATION CRITERIA

The final grade is equal to half the sum of the scores awarded to the two parts of the written exam and to the oral exam. The maximum grade, equal to thirty points with honors, is awarded to students who demonstrate total mastery of the theoretical and methodological tools of linear programming, and full autonomy and logical accuracy in setting and solving the proposed problems. The minimum grade, equal to eighteen, is assigned to students who demonstrate to be able to solve the proposed problems and to sufficiently know of the theoretical and methodological tools of linear programming.

Recommended reading

a) C. Vercellis, Ottimizzazione. Teoria, metodi , applicazioni, Mc Graw-Hill, 2008. b) S. Martello, D. Vigo, Esercizi di Ricerca Operativa , Progetto Leonardo, Bologna, 2001. c) presentations, exercises and lecture notes.

Ricerca Operativa 2

Ferdinando Pezzella

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
Linear programming

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims at the acquisition of advanced tools of optimization techniques: non-linear programming, graph theory and optimization methods on networks, integer linear programming and combinatorial optimization, as well as the knowledge of the modeling language LINGO and of the main optimization software.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will be able to identify the most appropriate methods and algorithms and develop exact and heuristic algorithms for solving problems in the large, typical of real production and distribution logistics problems that arise in business management. The student will also acquire the ability to design and implement optimization algorithms and interpret the results using computer simulations.
TRANSVERSAL SKILLS:
The preparation and oral discussion of a report on the application of optimization methods to problems of business decisions, which is done by deepening topics using materials other than those proposed, will help to improve the communication skills and the ability to learn independently of student. Judgement will be enhanced by the need to identify the most appropriate techniques for each application context.

Program
- Transportation problems : mathematical model, constraint matrix, simplex method - Assignment problems : mathematical model, hungarian method - Network optimization methods: shortest path, minimum spanning tree - Project scheduling: PERT - Maximum flow problem : mathematical model, Ford and Fulkerson s algorithm - Minimum cost flow problem on networks : mathematical model and simplex on networks - Linear integer programming models and combinatorial optimization - Gomory's cutting plane method - Branch and bound algorithms. - Applications of integer linear programming problems in production management - Applications of integer linear programming problems in logistics management - Combinatorial optimization problems and applications - Traveling salesman problem: mathematical models and related solution methods - Vehicle routing problems: mathematical models - Knapsack problems - Software LINGO (Linear INteractive Global Optimization) and Microsoft Excel Solver

Development of the course and examination
LEARNING EVALUATION METHODS
The evaluation of the students learning level consists of an oral examination that is characterized by: --the presentation and the dissertation of an individual essay concerning the arguments addressed during the course. In this essay, the student has to prove his/her ability to use optimization software for solving the problems of production management and logistics. --the

discussion of one or two themes, addressed during the course.

LEARNING EVALUATION CRITERIA
In order to pass the learning evaluation, the student has to prove that he/she has understood the arguments, addressed during the course, among which: --Mathematical models together with the related solution methods of the most significant network optimization problems; --Network techniques for the projects management; --Mathematical models together with the related methods for solving Integer Linear Programming and combinatorial optimization problems; -- Some applications of the Integer Linear Programming in production management; --Solving some production management mathematical models through both the optimization software LINGO and the Excel Solver.

LEARNING MEASUREMENT CRITERIA
During the course the student has to show ability to both model and solve some real-world management decision-making problems through optimization software and the implementation of heuristic approaches.

FINAL MARK ALLOCATION CRITERIA
The result of the learning evaluation will be positive if the student reaches a sufficient level (equal to eighteen points) during both the essay dissertation and the oral examination. The evaluation of thirty points is reached by proving a deep knowledge of the arguments, addressed during the course, together with a good ability to solve the optimization problems. The evaluation of thirty points cum laude is for students who have both showed a particular clarity during the oral examination and developed in the essay efficient computer programs for solving optimization problems

Recommended reading
- Educational material provided by the teacher on Learning Management System - MOODLE - F. Pezzella, E. Faggioli, Ricerca Operativa: problemi di gestione della produzione, Pitagora, Bologna - M. Fischetti, Lezioni di Ricerca Operativa, Edizioni Libreria Progetto, Padova

Rilievo dell'Architettura (EA)

Paolo Clini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 90
Period E/1s-2s

Prerequisites
no

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire theoretical and practical knowledge of surveying in the context of modern and historic architecture and urban planning. It will combine what has been learnt from courses in Design and in History with further insights, so broadening their understanding of the areas of surveying and information recording. Students will gain a clear awareness of the issues surrounding morphometry and artefacts states of decay and composition, with specific reference to the most advanced technological applications available for digital data recording, in order that they gain the knowledge necessary for taking care of properties and for any possible restoration projects.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Students must learn to identify the best survey methods and the most appropriate technologies to employ on any proposed project and they must know how to use them, at least in simple cases. This is to enable them to apply this knowledge when tackling advanced design themes, including those of a very complex nature; they should also be able apply the knowledge for the purposes of innovation and for developing new products and technological processes. This will be expressed through the development of a mixture of both organisational and professional skills, including: 1. the ability to choose the correct survey methods and the correct technologies suitable for their project; 2. the ability to carry out direct, laser and photogrammetric survey operations, working individually or as part of a group; 3. the ability to interpret the results produced when carrying out a survey and digital recording process for an architectural / artistic / urban artefact and to communicate them, by working as a team with the others involved.
TRANSVERSAL SKILLS:
There will be some practical exercises which will apply the knowledge gained to specific case studies; these will be undertaken in groups and will involve the drawing up of survey documentation. This will help to improve students general levels of independent judgement, their ability to communicate (particularly when working in groups), their capacity for independent learning and their ability to draw conclusions.

Program
ABasic notions of architectural and urban Survey; general characters of the history of architectural survey Theoretical and analytical foundations of Survey, measurement theory; Methods and tools for the direct, instrumental and photogrammetric survey; Survey methods by direct scanning; The spherical photogrammetry for the survey and documentation of the architecture; Catalogue of architectural heritage; Applications and experiences of survey From survey to communication and musealization of the architecture, virtual reality applications.A group for the survey of an architectural artefact will be carried out during the course. This work will be collected in the form of graphic works. The exam will consist of the evaluation of this work and of the theoretical teaching.;

Development of the course and examination

LEARNING EVALUATION METHODS

The exam consists of an oral part and of the presentation and discussion, still oral, of the monographic Architectural Survey conducted in teams during the year.

LEARNING EVALUATION CRITERIA

The exam consists of an oral test on the course topics and of a discussion on laboratory activity. Each student will also be asked to carry out an in-depth activity by producing an incisive personal interpretation, still oral, on one of the topics covered in class.

LEARNING MEASUREMENT CRITERIA

The final mark is expressed in thirties

FINAL MARK ALLOCATION CRITERIA

he final mark results from an average of the mark allocated to the theme of the year (teamwork) and of the mark awarded for the oral test. Top marks are awarded when thorough knowledge of the contents and good self-critical interpretation of the same are proven. Students that, in addition to achieving top marks, demonstrate to fully master the subject, together with the adequate language register, are eligible for laude.

Recommended reading

Mario Docci, Diego Maestri, Manuale di rilevamento architettonico e urbano, Laterza, Bari, 1 ed. 2009. Paolo Clini, Il Rilievo dell Architettura, metodi, tecniche ed esperienze, Firenze, Alinea editrice, 2008; Paolo Clini (a cura di), Documentare l'Architettura storica, Arcane editrice, Roma, 2011

Rischio Idrogeologico

Torquato Nanni

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Geo-lithology and Applied Geology

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables the student to acquire basic concepts on the environmental system (Geology, Physical geography, Geomorphology, Hydrogeology), natural hazards and hydrogeological risk analysis.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The knowledge acquired during the course gives to the future environmental engineer the ability to recognize natural hazards that affect engineering projects.
TRANSVERSAL SKILLS:
The basic knowledge of natural hazards enables the future environmental engineer to communicate with different specialists in the analysis and reduction of the geological risk.

Program
(Frontal lessons 60 hours). Basic concepts of Physical geography, Geomorphology and Applied Geomorphology. Processes, morphological forms and deposits. Catchment area and morphometry. Fluvial forms and processes. Geology, hydrogeology, landslides and slope stability. Coastal morphology and processes. The hydrogeological risk, prevention and mitigation

Development of the course and examination
LEARNING EVALUATION METHODS
the evaluation is through written test with oral discussion. In the test, students have to deal with the issues related to the theoretical part of Aplied Geomorphology, basic hydrogeology, natural hazard and risk, reading and analysis geomorpholocical maps with recognition of the natural hazard zones..

LEARNING EVALUATION CRITERIA
In examinations, students must demonstrate the ability to use independently and correctly geomorphological and hydrogeological methodology to analysis of natural hazards in the environmental system. Must demonstrate synthesis capacity and, at the same time, completeness in the responses to questions. I

LEARNING MEASUREMENT CRITERIA
during the examination the student's ability to answer the questions correctly on the course theoretical arguments and the correct interpretation of the geomorphological and hydrogeological maps with the recognition of natural hazards in the environmental system are evaluated.

FINAL MARK ALLOCATION CRITERIA
The maximum mark, derived from the scores obtained by the test, is equal to thirty points with

honors and is assigned to students that demonstrate full autonomy in the response. The minimum rating is eighteen and is assigned to students that have sufficient knowledge to set a correct answer.

Recommended reading

Vito Ferro - La sistemazione dei bacini idrografici. Ed. McGraw-Hill; 2006; Mauro Menichetti - Geomorfologia fluviale. Ed.Pitagora editrice Bologna, 2000; Enzo Pranzini - La forma delle coste. Geomorfologia costiera, impatto antropico e difesa dei litorali. Ed. Zanichelli 2004; APAT. Fenomeni di dissesto geologico idraulico sui versanti. Classificazione e Simbologia - Manuali ISPRA APAT-39/2006. - http://www.isprambiente.gov.it/it/pubblicazioni/manuali-e-linee-guida; Marina De Maio,Massimo Civita, Marco Farina, Adriano Zavatti - Linee guida per la redazione e l uso delle carte della vulnerabilità degli acquiferi all inquinamento, Manuali ISPRA - ANPA 4/2001 http://www.isprambiente.gov.it/it/pubblicazioni/manuali-e-linee-guida; Massimo Rinaldi Nicola Surian Francesco Comiti Martina Bussettini. IDRAIM Sistema di valutazione IDRomorfologica, AnalisI e Monitoraggio dei corsi d'acqua Manuale tecnico operativo per la valutazione ed il monitoraggio dello stato morfologico dei corsi d acqua. Versione 1- Manuali ISPRA, 2011. http://www.isprambiente.gov.it/it/pubblicazioni/manuali-e-linee-guida

Scienza delle Costruzioni (CA)

Fabrizio Davi'

Seat Ingegneria
A.A. 2016/2017
Credits 12
Hours 96
Period E

Prerequisites
Calculus, Linear Algebra, Physics

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
This course intends to provide the theoretical and practical bases for the comprehension of the main methods and applications of the basic sciences to the conception and analysis of civil and enviromental engineering structures. Specifically, the course deals with the methods of analysis of isostatic and hyperstatic structures, the fundamental principles of continuum mechanics, elasticity and elastic beams. Moreover, we provide the skills to solve strength and deformability evaluation problems for beams structures.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to tackle the topics related to structural design and analysis, the student will acquire the competences to autonomously identify and solve problems. These competences will provide the student with the knowledge that will be useful for professional activities (structural design, management and organization) in freelance, industry or public administrations career profiles, thanks also to the interaction with other civil and environmental engineering experts.
TRANSVERSAL SKILLS:
The presented theory and the discussed problems represent a basic theoretical tools in the design of any structural system. These concepts are essential in order to interpret, analyze, model and solve more complex problems related to structural analysis.

Program
Vector spaces. Scalar and vectorial products. Tensor spaces. Identity tensor. Transpose. Symmetric and skew-symmetric tensor: axial tensor. Orthogonal tensors. Kinematics. Deformation and deformation gradient. Deformations of line, surface and volume elements. Polar decomposition theorem. Kinematics of rigid bodies: degrees of freedom. Spin Tensor and angular velocity. Poisson formula. Plane rigid motion. Constraint: lagrangean coordinates. Multiple constraints. Statically determinated, undeterminated and impossible systems. Rigid body statics: internal actions in rigid systems. Work, power and energy. Force and couplke resultants. Virtual power principle. Static balance laws. Reactive forces in constrained rigid systems. Reactive forces in statically determinated rigid systems. Reactive forces and equilibrium configurations in statically impossible rigid systems. Statics of rods: internal actions, balance laws and boundary conditions. Internal action diagrams. Plane rods: archs and straight rods. Rods kinematics: kinematical descriptors, deformations measures, compatibility equations. Kirchhoff's rod. Constitutive relations: linearly elastic rods. Virtual works, energetics and variational formulations. Minimum principles. Hyperstatic plane frames; the Müller-Breslau equations as a consequence of Complementary nergy minimum principle. Tridimensional linear elasticity. Kinematics: displacement and strain. The infinitesimal strain tensor. Statics: the notion of stress. Cauchy's theorem. Virtula works for defromable systems. Linear isotropic materials. The Saint-Venant's problem for isotropic solids. The Clebsch's solution.

Yield criteria . Stability of Euler beams.

Development of the course and examination
LEARNING EVALUATION METHODS
The final test consists of a written test and an oral colloquia. The written test requires the study of a simple hyperstatic plane frame.

LEARNING EVALUATION CRITERIA
The written test must verify the ability to resolve a statically-indeterminate plane truss, determining also the displacements of a given section and performing the safety analysis of another section. The diagrams of the stress characteristics must be correctly drawn and from the data provided in the text the displacement or rotation of a section must be correctly evaluated. The ideal Huber-Von Mises tension compatible with the admissible one must be also evaluated for a section In the oral test must verify the ability to solve problems of a theoretical or applicative nature by starting from the equations of mechanics of deformable bodies. It could also require proofs of theorems or deductions of equations, focusing more on the deductive aspects rather than on mnemonic.

LEARNING MEASUREMENT CRITERIA
In the written test the relevance of the obtained results with the solution is checked; in the oral test both the knowledge of the topics and the capability to develop solutions to proposed problem are checked

FINAL MARK ALLOCATION CRITERIA
For the written exam is admitted only the positive result associated with the determination of the exact solution. For the oral exam grade is assigned by taking into account the topics knowledge, the capability to apply these knowledges to solve examples and the smartness and neatness of language

Recommended reading
F. Davì, Note di Scienza delle Costruzioni, 2013 (free downloadable from University official Webpage) P. Podio-Guidugli, Lezioni di Scienza delle Costruzioni, Aracne Editrice, Seconda Edizione 2009 L. Gambarotta, L. Nunziante ed A. Tralli, Scienza delle Costruzioni, McGraw-Hill, Terza Edizione 2011. C. Comi e L. Corradi Dell'Acqua, Introduzione alla meccanica strutturale, McGraw-Hill, 2003. F.P. Beer, E.R. Johnston Jr. e J.T. DeWolf, Meccanica dei solidi, McGraw-Hill, Terza Edizione 2006

Scienza delle Costruzioni (EA)

Stefano Lenci

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 90
Period 1s

Prerequisites
Knowledge of the basic topics of analysis (limit, derivative, integral, resolution of ordinary differetial equations, etc.), of linear algebra (matrixes, Rouche-Capelli theorem, eigenvalues problem, etc.) and physics (force, work, etc.)

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
This course intends to provide the main concepts on the kinematics and statics of deformable structures and on the strength of materials, which are essential for the design of real structures. The course allows to better understand the applications of the mathematical tools and physical principles, learnt during the preliminary courses of general physics, mathematical analysis, geometry and statics, to the design process of a structure. In particular the course deals with the mechanics of deformable bodies, the theory of elastic beams, the study of hyperstatic structures, the stability of the equilibrium and the linear dynamics of structures.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to tackle the problems related to analysis of structures and their design, the student must learn how to interpret and set up the data, associated with all the structural aspects of the design of a structure, with scientific precision, understand the strain and stress state within the various structural members and know how to verify their safety.
TRANSVERSAL SKILLS:
By means of the resolution of hyperstatic structures, the study of the stress state in the critical sections of a beam and their safety verification, the student will acquire the theoretical and practical skills which are necessary in the exercise of the profession, learning how to exploit the physical mathematical tools within the analysis of architectural structures.

Program
1. Kinematics of deformable bodies and analysis of strain 2. Statics of deformable bodies and analysis of stress 3. Constitutive relations and energy relationships 4. The elastic problem 5. The De Saint-Venant (D.S.V.) problem 6. Traction 7. Bending moment (flexure), bendings and traction 8. Approximate theory of shear 9. Torsion 10. The Principle of Virtual Works 11. Displacements method for statically indeterminate structures 12. Yield and strength criteria 13. Stability of elastic equilibrium 14. Variational principles 15. Basics of dynamics of structures

Development of the course and examination
LEARNING EVALUATION METHODS
The learing evaluation will be done in two steps: - a written examination, where the students are asked to solve exercises related to the topic of the lectures; - an interview (oral examination) which will involve all the topics discussed during the lectures, including exercised aimed at checking the application of the general theory.

LEARNING EVALUATION CRITERIA
To get a positive evalution, the candidate must: - show that he/she understood the topics developed in the lectures; - be able to elaborate the previous concepts in order to solve simple problems of structural engineering, including the understanding of various mechanical behaviours; - be able to understand stresses and deformations which develops within a structure; - be able to determine stresses in beams, to perform safety checks, to solve simple structures from statics and kinematics points of view.

LEARNING MEASUREMENT CRITERIA
The final evaluation, expressed by a number from 0 to 30 (positive evaluation from 18 to 30), will reflect: - the level of general knowledge of the student; - the capacity of the student to elaborate the general concepts, and his/her skills in applyin them to basic structural problems typical of the mechanical engineering.

FINAL MARK ALLOCATION CRITERIA
In the written examination the minimum sufficient score (18/30) is obtained when, although not having solved exhaustively all exercises, the student shows to be able to solve statically undetermined structures and to draw the graphs of the internal actions. The maximum score (30/30) is obtain when all exercises are fully and correctly solved. Getting the 18/30 in the written examination is necessary to be admitted to the oral examination. In the oral examination the minimum sufficient score (18/30) is for students that show the understanding of the basic concepts illustrated during the lecturers. The mark will increase as much as the student will show a deep knowledge and his/her ability to elaborate these concepts. The maximum score (30/30) is obtained with a deep knowledge of all the topics and with the ability to apply them to real cases or to exercises proposed by the examinator. To get a positive evaluation, the student must get a minimum sufficient score also in the oral examination. The final mark will summarize the marks obtained in the written and oral examinations. The summa cum laude is for students that, having obtained maximum marks in both written and oral examination, show special cleverness during the interview.

Recommended reading
Corradi dell Acqua, Meccanica delle Strutture , McGraw-Hill Gambarotta, Nunziante, Tralli, Scienza delle Costruzioni , McGraw-Hill Lenci, Lezioni di Meccanica Strutturale , Pitagora Menditto, Lezioni di Scienza delle Costruzioni , Pitagora Muscolino, Dinamica delle Strutture , McGraw-Hill

Scienza delle Costruzioni (MECC) (A/L)

Stefano Lenci

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Knowledge of the basic topics of analysis (limit, derivative, integral, resolution of ordinary differetial equations, etc.), of linear algebra (matrixes, Rouche-Capelli theorem, eigenvalues problem, etc.) and physics (force, work, etc.)

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course allows students to get sufficient depth knowledge of structural mechanics, covering structures made from any material and any size. The basic knowledge of mechanics of solids will be given, which are necessary for mechanical design and for the study of the behavior of machines and mechanisms, as well as the foundation for the determination of the stress and strain fields in 3D bodies, of internal forces in structures made by beams, and for the safety checks. Such knowledge, which provide some of the basic concepts for a basic engineering education in the industrial field, are of direct practical utility and needed mechanical design, applied mechanics and mechanical technology courses, will provide the student with the typical mechanical engineer background.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The expertise obtained by the students will provide students the ability to address standard design problems, applying mathematical methods to model, analyze and solve engineering problems, to carry out analysis and design of machine parts or simple mechanical systems and to settle the elastic problem for the determination of stress and strain field in any 3D body. The student will know how to correctly interpret the causes of structural behaviors that are commonly addressed in engineering practice. This ability will be obtained through a series of specific skills, such as: 1. the ability to determine the stress field which is generated inside the structures, 3D bodies and well as statically determined and statically undetermined structures, as a result of static loads and distortions; 2. the ability to determine the strain field; 3. the ability to assess whether the material is capable of withstanding the stress field that is generated by external loads
TRANSVERSAL SKILLS:
The skills acquired during the course will then be applied and further developed in the courses of mechanical design, applied mechanics and mechanical technology, thus promoting cross-disciplinary learning. The knowledge will also be useful for solving problems not typical of mechanical engineering, for example transverse to other branches of engineering.

Program
1. Kinematics of rigid bodies 2. Statics of rigid bodies 3. Geometry and statics of beams 4. Principle of Virtual Works for rigid bodies 5. Centroid, area, moments of inertia 6. Kinematics of deformable bodies 7. Statics of deformable bodies 8. Constitutive relations 9. The De Saint-Venant problem and the technical theory of beams 10. Principle of Virtual Works for deformable bodies 11. Yield criteria

Development of the course and examination
LEARNING EVALUATION METHODS

The learing evaluation will be done in two steps: - a written examination, where the students are asked to solve exercises related to the topic of the lectures; - an interview (oral examination) which will involve all the topics discussed during the lectures, including exercised aimed at checking the application of the general theory.

LEARNING EVALUATION CRITERIA

To get a positive evalution, the candidate must: - show that he/she understood the topics developed in the lectures; - be able to elaborate the previous concepts in order to solve simple problems of structural engineering, including the understanding of various mechanical behaviours; - be able to understand stresses and deformations which develops within a structure; - be able to determine stresses in beams, to perform safety checks, to solve simple structures from statics and kinematics points of view.

LEARNING MEASUREMENT CRITERIA

The final evaluation, expressed by a number from 0 to 30 (positive evaluation from 18 to 30), will reflect: - the level of general knowledge of the student; - the capacity of the student to elaborate the general concepts, and his/her skills in applyin them to basic structural problems typical of the mechanical engineering.

FINAL MARK ALLOCATION CRITERIA

In the written examination the minimum sufficient score (18/30) is obtained when, although not having solved exhaustively all exercises, the student shows to be able to solve statically undetermined structures and to draw the graphs of the internal actions. The maximum score (30/30) is obtain when all exercises are fully and correctly solved. Getting the 18/30 in the written examination is necessary to be admitted to the oral examination. In the oral examination the minimum sufficient score (18/30) is for students that show the understanding of the basic concepts illustrated during the lecturers. The mark will increase as much as the student will show a deep knowledge and his/her ability to elaborate these concepts. The maximum score (30/30) is obtained with a deep knowledge of all the topics and with the ability to apply them to real cases or to exercises proposed by the examinator. To get a positive evaluation, the student must get a minimum sufficient score also in the oral examination. The final mark will be a weighted average of the marks obtained in the written (weight 0.25) and oral (weight 0.75) examinations. The "summa cum laude" is for students that, having obtained maximum marks in both written and oral examination, show special cleverness during the interview.

Recommended reading

Comi, Corradi dell'Acqua, Introduzione alla Meccanica Strutturale , McGraw-Hill Lenci, Lezioni di Meccanica Strutturale , Pitagora Menditto, Lezioni di Scienza delle Costruzioni , Pitagora

Scienza delle Costruzioni (MECC) (M/Z)

Francesco Clementi

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Knowledge of the basic topics of analysis (limit, derivative, integral, resolution of ordinary differetial equations, etc.), of linear algebra (matrixes, Rouche-Capelli theorem, eigenvalues problem, etc.) and physics (force, work, etc.)

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course allows students to get sufficient depth knowledge of structural mechanics, covering structures made from any material and any size. The basic knowledge of mechanics of solids will be given, which are necessary for mechanical design and for the study of the behavior of machines and mechanisms, as well as the foundation for the determination of the stress and strain fields in 3D bodies, of internal forces in structures made by beams, and for the safety checks. Such knowledge, which provide some of the basic concepts for a basic engineering education in the industrial field, are of direct practical utility and needed mechanical design, applied mechanics and mechanical technology courses, will provide the student with the typical mechanical engineer background.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The expertise obtained by the students will provide students the ability to address standard design problems, applying mathematical methods to model, analyze and solve engineering problems, to carry out analysis and design of machine parts or simple mechanical systems and to settle the elastic problem for the determination of stress and strain field in any 3D body. The student will know how to correctly interpret the causes of structural behaviors that are commonly addressed in engineering practice. This ability will be obtained through a series of specific skills, such as: 1. the ability to determine the stress field which is generated inside the structures, 3D bodies and well as statically determined and statically undetermined structures, as a result of static loads and distortions; 2. the ability to determine the strain field; 3. the ability to assess whether the material is capable of withstanding the stress field that is generated by external loads
TRANSVERSAL SKILLS:
The skills acquired during the course will then be applied and further developed in the courses of mechanical design, applied mechanics and mechanical technology, thus promoting cross-disciplinary learning. The knowledge will also be useful for solving problems not typical of mechanical engineering, for example transverse to other branches of engineering.

Program
1. Kinematics of rigid bodies 2. Statics of rigid bodies 3. Geometry and statics of beams 4. Principle of Virtual Works for rigid bodies 5. Centroid, area, moments of inertia 6. Kinematics of deformable bodies 7. Statics of deformable bodies 8. Constitutive relations 9. The De Saint-Venant problem and the technical theory of beams 10. Principle of Virtual Works for deformable bodies 11. Yield criteria

Development of the course and examination
LEARNING EVALUATION METHODS

The learing evaluation will be done in two steps: - a written examination, where the students are asked to solve exercises related to the topic of the lectures; - an interview (oral examination) which will involve all the topics discussed during the lectures, including exercised aimed at checking the application of the general theory.

LEARNING EVALUATION CRITERIA

To get a positive evalution, the candidate must: - show that he/she understood the topics developed in the lectures; - be able to elaborate the previous concepts in order to solve simple problems of structural engineering, including the understanding of various mechanical behaviours; - be able to understand stresses and deformations which develops within a structure; - be able to determine stresses in beams, to perform safety checks, to solve simple structures from statics and kinematics points of view.

LEARNING MEASUREMENT CRITERIA

The final evaluation, expressed by a number from 0 to 30 (positive evaluation from 18 to 30), will reflect: - the level of general knowledge of the student; - the capacity of the student to elaborate the general concepts, and his/her skills in applyin them to basic structural problems typical of the mechanical engineering.

FINAL MARK ALLOCATION CRITERIA

In the written examination the minimum sufficient score (18/30) is obtained when, although not having solved exhaustively all exercises, the student shows to be able to solve statically undetermined structures and to draw the graphs of the internal actions. The maximum score (30/30) is obtain when all exercises are fully and correctly solved. Getting the 18/30 in the written examination is necessary to be admitted to the oral examination. In the oral examination the minimum sufficient score (18/30) is for students that show the understanding of the basic concepts illustrated during the lecturers. The mark will increase as much as the student will show a deep knowledge and his/her ability to elaborate these concepts. The maximum score (30/30) is obtained with a deep knowledge of all the topics and with the ability to apply them to real cases or to exercises proposed by the examinator. To get a positive evaluation, the student must get a minimum sufficient score also in the oral examination. The final mark will summarize the marks obtained in the written and oral examinations. The summa cum laude is for students that, having obtained maximum marks in both written and oral examination, show special cleverness during the interview.

Recommended reading

Comi, Corradi dell'Acqua, Introduzione alla Meccanica Strutturale , McGraw-Hill Lenci, Lezioni di Meccanica Strutturale , Pitagora Menditto, Lezioni di Scienza delle Costruzioni , Pitagora

Scienza delle Costruzioni 2

Fabrizio Davi'

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course intends to provide the bases to the design and analysis of complex structural systems, made of traditional or innovative construction materials. The modeling, representation and analysis skills for civil engineering complex structures are developed aiming at the real design and effective realization of the structure. For this purpose the student must examine in depth all the subject matters coming from the first three years of Civil and Enviromental Engineering with particular attention to the course of Scienza delle Costruzioni. The main topics of the course are: mathematical aspects of the deformation method; discrete and continuous systems (beams and plates) dynamics; the stability of structures; limit analysis of two-dimensional framed structures, referring to NTC2008.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The required knowledge and the technical and analytical skills will be acquired through frontal lectures and class exercises. These abilities, integrated and supported by other structural design courses, will allow the autonomous conception and realization of civil engineering structural designs, taking into account the current code of practice and the most suitable synthetic and numerical methods of analysis.
TRANSVERSAL SKILLS:
The presented theory and the discussed problems represent advanced theoretical tools in the design of any structural system. These concepts are essential in order to interpret, analyze, model and solve more complex problems related to structural analysis.

Program
Linear elasticity. Constitutive relations: material symmetries and the elasticity tensor; anisotropic materials. The elastic problems of position, traction and mixed. Energetical methods and variational formulation: minimum and mixed principles (Hu-Washizu and Hellinger-Reissner-Prager). The Saint-Venant for anisotropic solids with the Voigt's and Clebsch's hypotheses. Plates: the Kirchhoff and Reissner-Mindlin models for anisotropic materials. Dynamics; progressive plane waves and the acoustical tensor. Rods and plates dynamics: wave solutions and separable solutions: eigenvalue problems. Stability. Theory of plasticity and limit analysis for plane structures

Development of the course and examination
LEARNING EVALUATION METHODS
The final test consists of a written test and an oral colloquia.

LEARNING EVALUATION CRITERIA
he written test assesses the ability to find the collapse load for a statically-undetermined plane truss,

the ability to analyze in terms of capacity design the same structure and the ability to perform a exact or approximated dynamic analysis of a plane structure. The oral test must verify the ability to solve problems of a theoretical or applicative nature by starting from the equations of mechanics of deformable bodies. It could also require proofs of theorems or deductions of equations, focusing more on the deductive aspects rather than on mnemonic.

LEARNING MEASUREMENT CRITERIA

In the written test the relevance of the obtained results with the solution is checked; in the oral test both the knowledge of the topics and the capability to develop solutions to proposed problem are checked.

FINAL MARK ALLOCATION CRITERIA

For the written exam the valuation is performed by assigning to each partial exercise a rating: the sum of these ratings is the final grade of the test. The maximum rating assigned to each exercise is known in advance and shown on the text. In the oral examination, the student can take for granted the result of written test or require an oral examination, in which case the vote is given taking into account the results of the written test (50% of overall assessment) and taking into account the topics knowledge, the capability to apply these knowledges to solve examples and the smartness and neatness of language.

Recommended reading

F. Davì- Note di Scienza delle Costruzioni 2 (Free download from Professor personal page on the University website) M.E. Gurtin - An introduction to Continuum Mechanics, Academic Press, 1981 M.E. Gurtin - The Linear Theory of Elasticity, in Mechanics of Solids, vol. II, Springer Verlag, 1984. S.P. Timoshenko, S.Woinowsky-Krieger-Theory of Plates and Shells , McGraw-Hill, 1982. S.P. Timoshenko, D.H. Young, W. Weaver Jr.- Vibrations problems in engineering, John Wiley & Sons, 1974. A.E.H. Love - A treatise on the mathematical theory of elasticity, Dover, 1944. E. Benvenuto - La Scienza delle Costruzioni nel suo sviluppo storico, Sansoni, 1981. C. Massonet, M. Save - Calcolo Plastico a Rottura delle Costruzioni, Maggioli Editore, 2008. R. Baldacci, G. Ceradini ed E. Giangreco - Dinamica e Stabilità, CISIA 1974.

Scienza delle Strutture

Michele Serpilli

Seat Ingegneria
A.A. 2016/2017
Credits 12
Hours 96
Period I

Prerequisites
Linear algebra, vectors, mathematical analysis, ordinary and linear differential equations, geometry, main concepts on material point and rigid bodies mechanics.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course intends to provide the fundamental basis of structural analysis by developing the theoretical principles which allows to understand the mechanical behavior of elastic solids and, in particular, of elastic beam structures. The course tackles the main problems related to the analysis of isostatic and hyperstatic structures, the essential knowledge of solid mechanics, the study of the strain and stress state and the capacity of evaluating beam structures strength and deformability.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will be able to apply his knowledge in order to develop critical and practical skills, which are necessary for the structural analysis. Concerning with the area of the comprehension of a structural system, the student will obtain the capability to analyze isostatic and hyperstatic structures, compute the stresses in a beam and perform safety verifications. These abilities will be gained through the development of exercises, which require the use of those models presented during the lectures.
TRANSVERSAL SKILLS:
The presented theory and the discussed problems represent a basic theoretical tools in the design of any structural system. These concepts are essential in order to interpret, analyze, model and solve more complex problems related to structural analysis.

Program
1. RIGID BODY KINEMATICS Rigid body motion External and internal constraints Rigid bodies systems Kinematical analysis Kinematical classification of structures 2. RIGID BODY STATICS Static characterization of constraints Equilibrium equations Static classification of structures Constraint reactions Static matrix Superposition principle 3. INTERNAL ACTIONS Definition of a beam Internal actions in 3D: N, Tx, Ty, Mx, My, Mt, and in 2D: N, M, T Internal actions diagrams Equilibrium differential equations Jump conditions (concentrated loads) and boundary conditions. 4. AREAS GEOMETRY Total area First order moments and center of mass Second order moments Huyghens theorem principal axes of inertia Inertia tensor 5. KINEMATICS OF DEFORMABLE BODIES Elementary deformations: stretch ration, shear strain, area and volume variations Strain tensor Principal axes - strain invariants 6. STATICS OF DEFORMABLE BODIES Definition of stress Theorem of Cauchy Stress tensor Mohr's circle Triaxial, uniaxial, plane stress state Spherical and deviatoric stresses Principal axes Equilibrium equations 7. CONSTITUTIVE LAWS Uniaxial test Generalized linear elastic costitutive law Homogeneity and isotropy Strain energy 8. THEORY OF ELASTIC BEAMS Saint Venant's problem Normal force Flexure Eccentric normal force - Jourawski's approximated shear theory Torsion (circular, rectangular and thin-walled cross-sections) Elastic line differential

equations 9. FAILURE CRITERIA AND STRENGTH VERIFICATIONS Local failure Tresca, Beltrami, Von Mises criteria Strength verification and project 10. PRINCIPLE OF VIRTUAL WORKS Principle of virtual works (P.L.V.) 11. STABILITY OF EQUILIBRIUM Critical load for concentrated elasticity systems - Euler s problem Eulerian load

Development of the course and examination

LEARNING EVALUATION METHODS

The learming evaluation is divided into two parts: - a written test, consisting in the solution of two exercises to be completed in three hours; - an oral exam, consisting in the discussion of the main theoretical concepts and some application exercises.

LEARNING EVALUATION CRITERIA

In order to have a positive result, the student must prove to: - have reached a good understanding of the main theoretical and application concepts of the mechanics of rigid bodies and deformable bodies; - be able to use autonomously and in a correct way the models and the main methods of analysis of isostatic and hyperstatic structures and solve problems related to the evaluation of beam structures strength and deformability; - be capable to clearly expose the principal ideas and concepts of structural analysis.

LEARNING MEASUREMENT CRITERIA

During the written and oral tests, the professor will evaluate the autonomous ability of the student to set up and solve problems related to the topics of the course. Moreover, the professor will evaluate the abilities to use the main methods, theoretical models and tools of structural analysis.

FINAL MARK ALLOCATION CRITERIA

The written test is preparatory to the oral exam. In order to access to the oral exam, the student must obtain at least the passing mark, equivalent to 18/30, at the written test. In order to have an overall positive result, the student must obtain at least the passing mark, equivalent to 18/30, at both written and oral tests. The maximum evaluation mark, equivalent to 30/30 with lode , is obtained by proving an exhaustive knowledge of the contents of the course and a full autonomy in aswering the questions and solving problems. The minimum evaluation mark, equivalent to 18/30, is reserved to those student who prove to be able to solve problems with a sufficient knowledge of the methods and models of structural mechanics.

Recommended reading

Lenci, Lezioni di Meccanica Strutturale , Pitagora. Menditto, Lezioni di Scienza delle Costruzioni , Pitagora. Gambarotta, Nunziante, Tralli, Scienza delle Costruzioni , McGraw-Hill. Corradi dell'Acqua, Meccanica delle Strutture , McGraw-Hill. Comi, Corradi dell'Acqua, Introduzione alla Meccanica Strutturale , McGraw-Hill. Exercise book of Scienza delle Costruzioni for Ingegneria Meccanica and Ingegneria Edile-Architettura, Prof. Lenci, available at C.L.U.A.

Scienza e Tecnologia dei Materiali

Francesca Tittarelli

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
-

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire the skills to interpret the correlations between atomic/molecular structure, microstructure, macro-structure and behavior of materials. Integrating the knowledge gained in the basic sciences courses, it allows to aquire the theoretical and practical basis for understanding the major physical-chemical, morphological and mechanical characterization techniques for building materials, and for diagnosis of their degradation. The course enables students to learn he methods of production, the properties and durability of different classes of materials used in civil and environmental engineering.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to address advanced design themes and treat the innovation and development of new products and new technological processes through the application of knowledge, the student should be able to correctly interpret the correlations between structure and properties of building materials. This will be reflected in a range of professional skills, such as: 1. the ability to choose the most suitable material for the realization of a particular structure in a given exposure environment; 2. the ability to analytically describe and appropriately interpret the results of laboratory tests on construction materials; 3. the ability to identify the causes of failure of a construction material working in a team with other elements involved in the study of the problem.
TRANSVERSAL SKILLS:
The course improve the ability to learn and draw conclusions independently, the ability to be concise, the independent judgment skills and communication skills promoting the use of an adequate technical and scientific language.

Program
Correlation between structure of materials and their properties. Covalent, ionic, molecular and metallic solids. Comparison between classes of materials. Transport mechanisms in materials. The role of water as deterioration agent of porous materials. Durability and sustainability of materials. Chemical, physical, morphological and mechanical characterization of materials. Destructive and non-destructive testing. General properties of building materials and related applications: wood, raw earth, ceramic, glass. Historical evolution of binders: gypsum, lime, lime and pozzolana, hydraulic lime, Portland cement and blended cements. Hydration of cement. Aggregates: eligibility criteria, grain size; chemical additives: accelerators, retarders, superplasticizers, air-entraining agents, curing agents, water repellents. Fresh concrete: workability, compaction degree, bleeding and segregation, plastic shrinkage. Hardened concrete: curing, thermal gradients, differential expansion, drying shrinkage deformation and creep. Mix-Design. Durability of concrete and related normative. Steels: general purpose, quality, welding (steel for reinforced concrete and carpentry). Structure (Fe-C diagram), production and properties. Metal-environment interaction: introduction to

thermodynamics and kinetics of corrosion, corrosion of reinforcement bars and metal structures. Polymeric materials: thermoplastics, thermosets and elastomers in construction. Composite Materials.

Development of the course and examination

LEARNING EVALUATION METHODS

Oral examination. To answer some questions, if necessary, short calculations will be carried out by the student during the oral test.

LEARNING EVALUATION CRITERIA

To successfully pass the examination, the student should demonstrate: how to interpret the correlations between atomic and molecular structure, microstructure, macrostructure and the behavior of materials, he has acquired the theoretical and practical bases for the physical, chemical and mechanical characterization of materials and to know the methods of production, properties and the main applications for the different classes of materials used in construction field.

LEARNING MEASUREMENT CRITERIA

Attribution of the final mark in thirtieths

FINAL MARK ALLOCATION CRITERIA

In order to pass the exam with a minimum score the student should possess the full knowledge. Further score will be awarded based on the mastery of specific and general skills. The honors will be given to students who, having achieved the highest rating, have demonstrated a particular command of the subject with otstanding ability to connect the different contents of the course.

Recommended reading

Class notes, slides presented at lessons given by the teacher, Bertolini, Materiali da costruzione , Città Studi Edizioni, M.Collepardi, Il nuovo calcestruzzo (Tintoretto ed.)¸ L. Coppola, A. Buoso, Il Restauro dell'Architettura moderna in cemento armato, HOEPLI Ed.

Scienza e Tecnologia dei Materiali (EA)

Saveria Monosi

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 60
Period 1s

Prerequisites
L esame consiste in una prova orale. Sono previste prove facoltative di auto-valutazione in itinere, il cui scopo principale sarà fornire allo studente una indicazione sul suo grado di preparazione.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The architecture with its different aspects and contents, from technical-building to the historical and urban planning finds the meaning in innovation expressive, technical and constructive. The professional role is an engineer, designer and manufacturer capable of synthesis between design and technical skills, able to propose innovations, but also preservation of existing works. Every new construction must be in harmony with the environment where it operates and each intervention should be designed and carried out respecting the quality of the architectural heritage. The course enables students to acquire the skills to interpret the correlations between structure, microstructure, and behavior of materials. The aim is to supply knowledges on traditional and innovative material usually used in building construction.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The professional figure must show ability to control the plurality of fields involved in the architectural project for a comprehensive assessment of the process, from the project, to the economic evaluation, to the construction site and to safety fields. In order to tackle and implement projects, the engineer-architect will also be able to choose between traditional and innovative materials by optimizing the choices, showing particular attention to environmental sustainability as well as the quality of the building construction.
TRANSVERSAL SKILLS:
The future engineer-architect will have to know how to connect the acquired knowledge of the available materials to the required mechanical properties and durability. He must have independent judgment and critical ability to make choices, but also communication skills to enable effective teamwork.

Program
Nella prova orale lo studente deve dimostrare di conoscere le caratteristiche generali che stanno alla base delle prestazioni dei materiali e che forniscono gli strumenti per una scelta ottimale. Le prove di auto-valutazione, sotto forma di test a risposta multipla e/o domande aperte, prenderanno in considerazioni gli stessi aspetti. L'esito positivo viene conseguito dallo studente che dimostra di possedere una complessiva conoscenza dei contenuti, esposti in maniera sufficientemente corretta con utilizzo di terminologia appropriata. La valutazione massima verrà conseguita dimostrando una conoscenza approfondita dei contenuti, esposta con completa padronanza del linguaggio tecnico-scientifico.

Development of the course and examination
LEARNING EVALUATION METHODS

La prova orale comprenderà da un minimo di tre ad un massimo di cinque quesiti ai quali sarà assegnato il punteggio corrispondente alla difficoltà. La lode verrà attribuita agli studenti che, avendo conseguito la valutazione massima, abbiano dimostrato una particolare padronanza della materia

LEARNING EVALUATION CRITERIA
Attribuzione del voto finale in trentesimi

LEARNING MEASUREMENT CRITERIA
Basics of chemistry and solid state physics

FINAL MARK ALLOCATION CRITERIA
General hints relating to technology production of solid state matter. Materials for Engineering: selection and application criteria. History and evolution of building materials. The development of new materials. Stone materials. Ceramic materials. Bricks for construction. Wood as a building material. Non-hydraulic and hydraulic binders. The cement: historical development, production, composition and properties of Portland cement and blended cements. The hydration, curing and development of strength. The fresh concrete. Proportioning of concrete as a function of mechanical performance and durability. The properties of hardened concrete. Outlines to special concretes. Durability and degradation of building materials, the possibility of their recovery. Steel as a building material. Metal alloys with regard to their use in construction. Plastic materials in construction. Composite materials. Textbooks: N. Davey, A History of Buildings materials, Phoenix House, London, 1965; L. Bertolini, Materiali da costruzione, CittàStudi edizioni AIMAT; Manuale dei materiali per l'ingegneria, McGraw-Hill Italia, Milano, 1996. Learning Evaluation Methods: The exam consists of an oral examination. Optional itinere self-assessment tests, whose main purpose will be to provide the student an indication of the degree of preparation. Learning Evaluation Criteria: In the oral exam, the student must demonstrate knowledge of the general characteristics that underlie the performance of materials and providing the tools for an optimal choice. The tests of self-evaluation, in the form of a multiple choice test and/or open questions, take into consideration the same issues. The positive outcome is achieved by the student who demonstrates that he has a overall knowledge of the contents exposed in a sufficiently corrected way with the use of appropriate terminology. The highest rating is achieved by demonstrating a thorough knowledge of the contents, exposed with complete mastery of the scientific-technical language. Learning Measurement Criteria: Awarding of the final mark into thirtieths Final Mark Allocation Criteria: The oral test will include a minimum of three to a maximum of five questions to which give a score corresponding to the difficulty. cum laude will be given to students who, having achieved the highest rating, have demonstrated a particular mastery of the matter.

Recommended reading
La prova orale comprenderà da un minimo di tre ad un massimo di cinque quesiti ai quali sarà assegnato il punteggio corrispondente alla difficoltà. La lode verrà attribuita agli studenti che, avendo conseguito la valutazione massima, abbiano dimostrato una particolare padronanza della materia Criteri di Attribuzione del Voto Finale: Attribuzione del voto finale in trentesimi --------Programma in Lingua Inglese------- Previous Requirements: Basics of chemistry and solid state physics Topics: General hints relating to technology production of solid state matter. Materials for Engineering: selection and application criteria. History and evolution of building materials. The development of new materials. Stone materials. Ceramic materials. Bricks for construction. Wood as a building material. Non-hydraulic and hydraulic binders. The cement: historical development, production, composition and properties of Portland cement and blended cements. The hydration, curing and development of strength. The fresh concrete. Proportioning of concrete as a function of mechanical performance and durability. The properties of hardened concrete. Outlines to special concretes. Durability and degradation of building materials, the possibility of their recovery. Steel as

a building material. Metal alloys with regard to their use in construction. Plastic materials in construction. Composite materials. Textbooks: N. Davey, A History of Buildings materials, Phoenix House, London, 1965; L. Bertolini, Materiali da costruzione, CittàStudi edizioni AIMAT; Manuale dei materiali per l'ingegneria, McGraw-Hill Italia, Milano, 1996. Learning Evaluation Methods: The exam consists of an oral examination. Optional itinere self-assessment tests, whose main purpose will be to provide the student an indication of the degree of preparation. Learning Evaluation Criteria: In the oral exam, the student must demonstrate knowledge of the general characteristics that underlie the performance of materials and providing the tools for an optimal choice. The tests of self-evaluation, in the form of a multiple choice test and/or open questions, take into consideration the same issues. The positive outcome is achieved by the student who demonstrates that he has a overall knowledge of the contents exposed in a sufficiently corrected way with the use of appropriate terminology. The highest rating is achieved by demonstrating a thorough knowledge of the contents, exposed with complete mastery of the scientific-technical language. Learning Measurement Criteria: Awarding of the final mark into thirtieths Final Mark Allocation Criteria: The oral test will include a minimum of three to a maximum of five questions to which give a score corresponding to the difficulty. cum laude will be given to students who, having achieved the highest rating, have demonstrated a particular mastery of the matter.

Segnali Numerici

Franco Chiaraluce

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
The Course requires the knowledge of the basic concepts of telecommunications.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
To deepen the topics relative to the characterization of digital signals and their usage in a telecommunication system.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student shall be able to process digital signals in view of optimizing the performance of digital communication systems. This way, he will acquire a series of vocational skills, like: 1. the ability to develop simulators of TLC systems able to replicate the behavior of real transmission systems; 2. the ability to define suitable modulation and coding schemes able to comply with prefixed quality targets, for example in terms of error rate and occupied bandwidth. The student shall demonstrate to be able to apply the knowledge acquired also in the framework of a project, based on Matlab, to develop during the course. Check of learning will consist in an oral test.
TRANSVERSAL SKILLS:
The software project to develop during the course will be executed in groups and will contribute to improve the ability of the students to cooperate, communicate and elaborate, as well as the ability to draw shared conclusions.

Program
Contents (Frontal lectures, 54 hours) - Binary sequences: generation through LFSR and chaotic algorithms. - Optimal receiver in the presence of thermal noise and bandwidth limitations (hard detection). - Continuous phase modulations. - Equalization techniques for the multipath channel. - Viterbi's Algorithm with hard decision. - Pragmatic approach to block and convolutional codes for error correction. - Examples of turbo codes and their use in the TLC standards. - Spread spectrum techniques. - Outline of ultra-wide bandwidth systems. - Channel capacity. - Introduction to cryptography. Classroom exercises (18 hours) - Simulation of a 2-PSK system.

Development of the course and examination
LEARNING EVALUATION METHODS
The exam consists of an oral test. If necessary, the questions requiring the execution of short calculations are answered in written form during the oral test. The student is asked to illustrate the theoretical foundations and examples of application of digital signals in the framework of a telecommunication system. He must also demonstrate to be able to apply the knowledge acquired in the framework of a software project, whose target is the simulation of the performance of a digital modulation scheme in the presence of thermal noise.

LEARNING EVALUATION CRITERIA
The student must demonstrate to possess an adequate knowledge of the course's contents,

exposing them in a sufficiently correct way, by using the right technical notation and by showing an adequate capacity to formalize the problems, also as regards the mathematical issues. The maximum mark is reached by demonstrating to have a deep and thorough knowledge of the topics, and a complete control of the technical and formal language.

LEARNING MEASUREMENT CRITERIA

The learning level is measured by the student's capacity to demonstrate to be able to process digital signals, though the methods and tools provided in the course, with the goal to optimize the performance of digital communication systems.

FINAL MARK ALLOCATION CRITERIA

The oral exam consists of two or three questions, depending on the topics discussed during the interview. Each answer receives a mark ranging between 0 and 15 (for the case of two questions) or between 0 and 10 (for the case of three questions). Laude is assigned to those students who, having reached the maximum mark, demonstrate a thorough knowledge of the subjects.

Recommended reading

1. Set of lectures provided by the teacher, that can be found in the university Moodle platform. 2. John G. Proakis, Masoud Salehi, Communication Systems Engineering , 2nd Edition, Prentice Hall, 2002.

Sicurezza e Impatto Ambientale dei Campi Elettromagnetici

Graziano Cerri

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Knowledge of ordinary differential equations of the first and second order. Knowledge of integral computation. Knowledge of divergence, gradient and curl operators. Complex numbers. Vectors. Measurement Units. Elements of electromagnetic fields.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course provides elements to understand national and international standards concerning safety for exposition to electromagnetic fields, and physical-mathematical tools to classify and describe the interaction mechanisms between electromagnetic fields and human body, in the frequency range from industrial frequency up to microwaves. This knowledge, as well as elements concerning the disciplines of electromagnetics, electronics and telecommunications, constitutes the basis for the estimation of exposition hazards related to the use of electronic devices for power industrial applications and electric energy management and distribution
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to face problems related to safety aspects for exposition to electromagnetic fields, also in complex environments, the student has to understand correctly the risk assessment for common people and workers. This means: capability for application of standards in realistic environments; capability to carry out measurements critically explained; capability of choice of suitable techniques to minimize the electromagnetic environmental impact of telecommunication systems; capability of handling techniques to mitigate the electromagnetic impact in areas exposed to not complying field levels
TRANSVERSAL SKILLS:
Some measurements carried out in laboratory and concerning significant canonical situations, previously described theoretically in the classroom, will lead to the development of technical reports. The aim is to improve the general autonomous judgement, to better the capability to relate with other students, and to develop the critical learning process

Program
Safety Ground connection; Low frequency electromagnetic fields exposition; National and international regulations for exposition of workers and population to low frequency electromagnetic fields; Measurements of low frequency fields; Mitigation of exposition to low frequency fileds; High frequency electromagnetic fields exposition; Dosimetry; National and international regulations for exposition of workers and population to high frequency electromagnetic fields; Measurements of high frequency fields; Mitigation of exposition to high frequency fileds; Electromagnetic Susceptibility. Notes: 1) depending on the number of attending students, and considering the availability of only one measurement set-up, laboratory sessions will be carried out, but it is impossible to quantify this activity in terms of hours.

Development of the course and examination

LEARNING EVALUATION METHODS
The exam is oral. It generally consists of three questions. The first has a practical feature and consists of the soluton of a test case. The second concerns theoretical aspects related to the modeling of the interaction between electromagnetic fields and biological bodies. The third pertains national and international regulations.

LEARNING EVALUATION CRITERIA
The student has to show his understanding and his capability to discriminate the fundamental aspects characterizing the environmental impact of the electromagnetic fields, adopting proper methods to state, approach, and solve autonomously safety problems related to the exposition of workers or population to electromagnetic fields.

LEARNING MEASUREMENT CRITERIA
It is related to the autonomy of the student to approach the proposed problems, to the correct methodologic approach, and to the discriminating capability to choose the most suitable solution properly related to the regulations.

FINAL MARK ALLOCATION CRITERIA
The three exam questions have equivalent weights. The highest mark cum laude is given if the student shows total autonomy, a rigorous methodologic approach, a great critical sense. The minimum score of eighteen over thirty is given when the student shows sufficient autonomy and sufficient knowledge of the most important aspects related to the environmental impact of the electromagnetic fields.

Recommended reading
1) D. Andreuccetti, M. Bini, et al. Protezione dai Campi elettromagnetici non Ionizzanti , 3^Ed., CNR (available on line, free download); 2) C. Polk, E. Postow, Biological effects of electromagnetic fields , CRC Press.

Sicurezza nelle Reti di Telecomunicazione

Marco Baldi

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Basic concepts of telecommunications.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course will allow students to achieve an advanced knowledge of the principles and practices of digital data security. Such a knowledge, built upon the theoretical and practical principles provided by the courses in the area of telecommunications, will bring the student a wide awareness about classical as well as modern approaches and methods to obtain transmissions of digital data able to guarantee confidentiality, authentication, integrity and non-repudiation.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will become able to apply his knowledge to face advanced design challenges concerning the analysis and the use of algorithms for encryption, authentication and digital signing of messages, as well as protocols and systems for secure transmissions and storage of digital data. Such an ability will be translated into some professional skills, like the ability of assessing the security level which is necessary for data relevant to some specific applications and of identifying the critical elements in the design of secure telecommunication networks.
TRANSVERSAL SKILLS:
Students will perform group exercises based on the use and development of software for implementing and validating techniques for digital data security. This will contribute to improving their autonomous judgment skills in defining the path to the solution of problems. Communication skills will also be refined by group work. Also their learning abilities will be improved by group work and by the use of software tools which will integrate didactic materials.

Program
Introduction to information security and cryptography. Principles of number theory. Principles of information theory. Principles of coding theory. Symmetric and asymmetric cryptography. DES, AES, RSA, ElGamal cryptographic systems. Cryptographic systems based on error correcting codes. Hash functions. Protocols for digital signatures. Protocols for networks security. Physical layer security. Software exercises on security techniques.

Development of the course and examination
LEARNING EVALUATION METHODS
The exam consists of an oral test, in which the student will be asked to explain the basic concepts and describe the main techniques concerning security in telecommunications networks. It will also be proposed to each student to perform an in-depth analysis by carrying out a project or, at the option of the student, preparing a paper on one of the topics of the course.

LEARNING EVALUATION CRITERIA
The student, during the oral test, will have to present and discuss the project or paper and

demonstrate the theoretical and practical knowledge of techniques for ensuring security in telecommunications networks. To successfully pass the oral exam, the student will have to demonstrate an overall knowledge of the contents of the course, presented in a sufficiently correct way and with the use of proper technical terminology. The highest rating is achieved by demonstrating a thorough understanding of the course contents, exposed with mastery of the technical language.

LEARNING MEASUREMENT CRITERIA

The ability and autonomy of the student in facing and solving theoretical and practical problems related to the security of telecommunication networks will be assessed during examinations.

FINAL MARK ALLOCATION CRITERIA

The final mark will be computed by summing the evaluation of the oral examination to that of the project or paper prepared by the student. The student will be able to achieve up to a maximum of 10 points through the presentation and discussion of the project or the paper. The oral exam will be divided into two or three questions, depending on whether or not the student will present the project or paper. Each question will be evaluated with a score ranging from 0 to 10 points. Honors students will be those who achieve the highest rating and also demonstrate full mastery of the subject.

Recommended reading

Lecture notes provided by the teacher. W. Trappe, L. C. Washington, Introduction to Cryptography with Coding Theory , Pearson - Prentice Hall. W. Stallings, Cryptography and Network Security: Principles and Practice , Pearson - Prentice Hall. M. Baldi, QC-LDPC Code-Based Cryptography , SpringerBriefs in Electrical and Computer Engineering.

Sistemi di Automazione

Silvia Maria Zanoli

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Basic definitions and concepts of Discrete Event Systems - Basic concepts of Petri Nets

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to illustrate to students the advanced methods of modeling and control of an Automated Production System (a discrete event system, complex, distributed, random) in order to predict / evaluate its performance under real, and therefore uncertain, operating conditions. Models introduced to this end are Markov chains, Stochastic Petri Nets (SPN) and Generalized SPN (GSPN). In addition, students will learn the most important techniques and advanced control architectures in the industry, highlighting the implementation issues.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Students will be able to model a discrete event timed system from examples of real systems, motivating any modeling choices made, and to propose appropriate criteria for evaluating the performance of the tested system. In the application of advanced control techniques it is required to solve the main implementation problems. These capabilities will originate through a series of vocational skills, such as: 1. the ability to critically analyze the results of modeling and / or design; 2. the ability to organize work into subtasks and the coordination of individual activities, working in a team with other elements involved in the problem resolution.
TRANSVERSAL SKILLS:
Participation in working groups for the development of an adequate modeling of an advanced production system and the drafting of a final report for the analysis of performance, will help improve the degree of independence of judgment in general, together with the ability of communication which derives from group activities; in addition the student s learning autonomy and his/her capability of drawing conclusions will be stimulated; finally, the student will improve his/he skill on writing of technical reports.

Program
Concepts of production systems and production processes. Automation production systems and their classification. Production equipment. Process and manufacturing productions automation. Principal performance indexes. DCS systems. Discrete Event System Modelling and Analisys: - Time in Petri Nets, Petri Nets with priority, PN states, Enabling of transitions; - Brief notes on Markov Process and on generalyzed Markov processes (GSMP). Continuous time and discrete time Markov Chains - Stocastic Petri Nets and Generalized Petri Net and their relationship with Markov Chain. Modeling and analisys of industrial cases. Use of modeling SW for GSPN. Students, organized into working groups, will be required to propose examples of real systems to refine their modeling capabilities of timed discrete event systems. Such examples will be discussed in class with the teacher. As regards the "time-driven" control will be described: - Advanced control architectures based on industrial PID, highlighting the implementation issues

Development of the course and examination

LEARNING EVALUATION METHODS

The assessment of students' level of learning is performed by means of two tests to evaluate the theoretical skills (written and oral test) and a practical test of modeling and analysis of the performance of a system by means of timed discrete event stochastic models. A written report of the practice test is required. Students that in the practical test have demonstrated sufficient expertise and clarity and precision in the report are exempted from the written test. The written and practical test are preparatory to the oral test. In the event of a negative outcome for the oral exam, the student must repeat the written test.

LEARNING EVALUATION CRITERIA

The evaluation the learning takes into account the results of verification tests / learning measurements and skills acquired and the ability to overcome any deficiency encountered by the results of the tests.

LEARNING MEASUREMENT CRITERIA

The measure of learning through written test is intended to assess the modeling skills on stochastic dynamic systems and the knowledge on control techniques with advanced industrial controllers.To perform the written test, if required, a time limit is given. The measure of learning through oral test is designed to test the comprehension of the topics covered in the course deepening practical applications. The measure of learning through the design activity is designed to test the ability of modeling of stochastic timed discrete event systems and the use of the tools of analysis and synthesis of such systems. The written test, if required, and the practical are in preparation for the oral exam. The tests are carried out of thirty.

FINAL MARK ALLOCATION CRITERIA

In order to pass the exam with the minimum score,equal to eighteen, the student must have sufficient knowledge of all the topics of the course. Additional points will be awarded by demonstrating in-depth knowledge of the content of the course in the written and oral tests together with good autonomy in setting and solving proposed problems. The "lode" is given to students who, having done all the tests correctly and completetly, have demonstrated a particular brilliance in the oral and in the preparation of written assignments and in the design activity

Recommended reading

-Lecture notes (scaricabili dal sito moodle del corso) - Ajmone Marsan M. et alii: Modelling with Generalised Stochastic Petri Nets John Wiley, 1994 For further readings the following texts are recommended: - Carlucci D., Menga G. Teoria dei Sistemi ad eventi discreti .UTET, Torino (1998),Collana UTET università - Cassandras,C.G., Lafortune S. Introduction to Discrete Event Systema (Cap 8), Kluwer Academic Pub., 2008. - GianAntonio Magnani, Tecnologie dei sistemi di controllo, McGraw-Hill

Sistemi di Automazione Industriale

Giuseppe Conte

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Basic notions of automatic control, computer sciences

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course provides students with knowledge on methodologies and tools for design, analysis and management of industrial automation systems. It develops the ability to understand issues in installing and managing industrial automation systems by analyzing and discussing the evolution of automation in production and production management.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Applying knowledge and understanding. Students acquire the ability to understand general issues of production and production management by the analysis of representative situations and the study of industrial automation solutions.
TRANSVERSAL SKILLS:
Tests and guided problem sessions give to students the possibility to develop the ability - to learn by assessing the completeness and adequacy of their preparation; - to make judgment by developing and proposing solutions to problems of representation and management of automation systems; - to communicate effectively by formulating and properly describe solutions to specific problems.

Program
- Elements of automatic control - Elements of Industrial Automation. - SFC. - Industrial automation systems: - historical development and present situation - role in production plants - CIM and their management.

Development of the course and examination
LEARNING EVALUATION METHODS
Written tests (at least three) on topics of the course during the lessons. Written final test (free response to two questions over three related to course topics). Oral test (questions related to answers given during the written tests, questions about topics of the course. Sufficiency in the final written test is required to get access to the oral test.

LEARNING EVALUATION CRITERIA
Correctness, completeness and adequacy of the answers given in the written tests. Correctness, completeness and adequacy of the answers in the oral test.

LEARNING MEASUREMENT CRITERIA
Final written test: 0-5 points for each of the three criteria listed above for each of two answers. Sufficiency corresponds to 18 points with a minimum of 2 points for each criterium for each answer. Other written tests and oral test: -5/+5 points, distributed as follows: - written test: -2/+2 correctness of answers in the oral test: -1/+1 - adequacy of answers in the oral test: -1/+1 -

completeness of answers in the oral test: -1 to +1.

FINAL MARK ALLOCATION CRITERIA
30/30 cum Laude is for candidates who master completely the topics and are able to illustrate them clearly.

Recommended reading
- G. Bertoni, M. E. Penati, L' automazione industriale. Dal mulino da seta alla fabbrica automatica, Esculapio - C. Bonivento, L. Gentili, A. Paoli, Sistemi di automazione industriale, McGraw Hill - Lecture notes

Sistemi di Elaborazione dell'Informazione

Primo Zingaretti

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Fondamenti di Informatica

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course allows students to acquire the basic concepts to configure and use properly the most current architectures of computer systems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
This ability is expressed through a series of laboratory exercises with the most popular operating systems, from Windows to Unix/Linux, with the aim to resolve typical problems in computer systems.
TRANSVERSAL SKILLS:
The resolution of typical problems in the field of computer systems, which will be carried out during both theoretical and laboratory lessons, will help improving both their skills of analysis and the communication skills stemming from dealing with the solutions proposed by fellow students.

Program
Computer systems: historical overview, classification, requirements Recall on computer system architecture Operating systems structure and functionalities Process management Process communication Memory management File system I/O systems Distributed systems Case studies: Linux, Windows

Development of the course and examination
LEARNING EVALUATION METHODS
Evaluation of students' learning level is performed by means of an oral examination consisting of three/four questions on the course topics.

LEARNING EVALUATION CRITERIA
To pass the oral examination the student must show a comprehensive knowledge of the course contents, expounded in a sufficiently correct way by using an adequate tecnical terminology.

LEARNING MEASUREMENT CRITERIA
Marks in thirtieths.

FINAL MARK ALLOCATION CRITERIA
The final evaluation will be in relation to the grade of knowledge of the course contents, as comes out from oral examination. Honours are reserved to students who proved a complete mastery of the matter.

Recommended reading

Sistemi di Telecomunicazione

Susanna Spinsante

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
To better address the study of the course contents, the student should have acquired at least the basics knowledge of electromagnetic fields, telecommunications and signal processing.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
Through the study of the most important telecommunication systems, the course enables students to acquire knowledge needed to understand the issues relating to transmission of information, and to know how to apply appropriate design procedures of communication systems. The course, by integrating the knowledge gained in previous courses like electromagnetic fields, telecommunications, and signal theory, provides the student with a solid technical background on communication systems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
This ability will be developed in practice through a number of vocational skills, such as: 1. the ability to correctly choose the appropriate transmission medium, and the associated system architecture, to meet the system requirements; 2. the ability to identify and properly quantify the parameters necessary for the dimensioning of the system; 3. the ability to identify the causes of performance degradation, and the suitable countermeasures.
TRANSVERSAL SKILLS:
(ENG) Training activities and laboratory sessions will help improve the student s ability to learn independently and to draw conclusions. Both the student s ability to communicate and his/her independence of judgment in general, will be stimulated and refined, through oral discussions.

Program
Introduction to communication systems. Description of systems (fixed and mobile, free and guided propagation). Reception quality (bit error rate, delay, jitter). Noise effects on the received signal (thermal noise and artificial noise). Bit, frame and carrier synchronization. Block scheme of transceivers. Adaptative equalization at intermediate frequency and at base band. Spread spectrum techniques. Multiple access techniques. Systems on twisted pairs. ADSL. Fiber optics communications. Optical devices. Optical link budget. Line-of-sight radio systems. Link budget in fade environment. Mobile radio propagation. Planning of mobile radio systems. Description of GSM, GPRS and UMTS.

Development of the course and examination
LEARNING EVALUATION METHODS
The assessment of student learning consists of two parts: - A written test, which requires the solution of two or three exercises on topics covered in the course, to be completed in two hours; - An oral test, consisting in the discussion on one or more topics covered in the course (including lab sessions), and in the deepening of any gaps identified in the written test. Some questions posed during the oral may require the execution of short calculations. The written test is mandatory for the

oral exam, it is advisable to take the oral exam after having obtained at least the minimum mark in the written test. The oral examination must be taken in the same appeal of the written test. In case of failure of the oral exam, the student must also repeat the written test.

LEARNING EVALUATION CRITERIA

In order to successfully pass the assessment of learning, the student must demonstrate, through the trials described above, that he/she possesses the knowledge and methodological skills for the characterization of the main telecommunication systems, the definition of their requirements and performance, the selection of the most suitable solution in relation to specific application needs. To successfully pass the oral exam, the student will demonstrate an overall knowledge of the course content (including lab sessions), presented in a sufficiently corrected way with the use of proper technical terminology. The highest rating is achieved by demonstrating a thorough understanding of the course content, exposed with complete appropriateness of technical language.

LEARNING MEASUREMENT CRITERIA

For both written and oral tests, a score between zero and thirty is assigned. The overall grade is given by the weighted average of the marks obtained in the two tests (accounting for 1/3 the result of the written test, and for 2/3 the result of the oral examination), with rounding to the greatest integer value.

FINAL MARK ALLOCATION CRITERIA

For the overall outcome of the exam to be positive, the student is advised to obtain at least sufficiency, equal to eighteen points, in the written test. And the student is required to achieve at least sufficiency (equal to eighteen points) in the oral test. The highest rating is achieved by demonstrating a thorough understanding of the course content under both tests. Praise is given to students who, having performed the tests correctly and completely, have demonstrated a particular brilliance in oral, and in the solution of the written exercises.

Recommended reading

Lecturer's handnotes and additional material provided by the lecturer through the course website.

Sistemi Elettronici

Laura Falaschetti

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
basic electronics

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide the necessary knowledge for designing digital microcontrolled-based electronic systems. To this end the fundamental architectures of microcontrollers, the elements of assembly language programming.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The course is intended to train the students so that they acquire the capability of applying the knowledge to the design specifications, to the selection and programming of digital electronic systems to obtain the desired performance, to the using of tools for programming microcontrollers.
TRANSVERSAL SKILLS:
The course provides a multidisciplinary background on hardware and software for the design of digital microcontrolled-based electronic systems, which can be spent in the fields of biomedical engineering, telecommunications, automatic control and information technology in general.

Program
Microcontrollers: generality, PIC16F84A, architecture, file register set, instruction set, timing, interrupt. PIC 16F873A and PIC 16F887. Serial Communication: SPI, Microwire, I2C, asyncronous communication, USART. ADC and DAC conversion. PIC 18FXX2. Basics of assembly programming. Designing electronic system with microcontrollers. DC voltage supplies: generality, voltage references, series voltage regulators, switching voltage regulators.

Development of the course and examination
LEARNING EVALUATION METHODS
oral examination

LEARNING EVALUATION CRITERIA
To pass the exam the student will show to know all the metodologies and techniques for designing an electronic systems

LEARNING MEASUREMENT CRITERIA
A score in the range 18-30 will be given as a final grade

FINAL MARK ALLOCATION CRITERIA
The oral examination will be focused on questions concerning the course topics and the discussion of a specific design with refernece to the approach used and the results obtained.

Recommended reading

Martin Bates, PIC Microcontrollers , Elsevier, 2005. Tim Wilmshurst, Designing Embedded Systems with PIC Microcontrollers , Elsevier, 2007. Lecture notes.

Sistemi Elettronici

Laura Falaschetti

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
basic electronics

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide the necessary knowledge for designing digital microcontrolled-based electronic systems. To this end the fundamental architectures of microcontrollers, the elements of assembly language programming, the DC voltage supplies will be studied.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The course is intended to train the students so that they acquire the capability of applying the knowledge to the design specifications, to the selection and programming of digital electronic systems to obtain the desired performance, to the using of tools for programming microcontrollers.
TRANSVERSAL SKILLS:
The course provides a multidisciplinary background on hardware and software for the design of digital microcontrolled-based electronic systems, which can be spent in the fields of biomedical engineering, telecommunications, automatic control and information technology in general.

Program
Microcontrollers: generality, PIC16F84A, architecture, file register set, instruction set, timing, interrupt. PIC 16F873A and PIC 16F887. Serial Communication: SPI, Microwire, I2C, asyncronous communication, USART. ADC and DAC conversion. PIC 18FXX2. Basics of assembly programming. Designing electronic system with microcontrollers. DC voltage supplies: generality, voltage references, series voltage regulators, switching voltage regulators.

Development of the course and examination
LEARNING EVALUATION METHODS
oral examination

LEARNING EVALUATION CRITERIA
To pass the exam the student will show to know all the metodologies and techniques for designing an electronic systems

LEARNING MEASUREMENT CRITERIA
A score in the range 18-30 will be given as a final grade

FINAL MARK ALLOCATION CRITERIA
The oral examination will be focused on questions concerning the course topics and the discussion of a specific design with refernece to the approach used and the results obtained.

Recommended reading

Martin Bates, PIC Microcontrollers , Elsevier, 2005. Tim Wilmshurst, Designing Embedded Systems with PIC Microcontrollers , Elsevier, 2007. Lecture notes.

Sistemi Informativi e Basi di Dati

Claudia Diamantini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
storage devices, files and file system, basic concepts of algebra e logics

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims at introducing the concepts, methods and languages for the management of structured information within organizations. The student will learn the advantages of using DBMS to manage data in an integrated fashion and the differences with a file-based management. It provides also the basic notions of database design.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
At the end of the course the student will be able to perform simple gathering and analysis of information requirements, to design medium-sized databases taking into account issues related to social, health, security and economic constraints, to create, populate, and query databases using state-of-the-art languages and database management systems.
TRANSVERSAL SKILLS:
The development of the project of a database, which will be done in groups and will be documented by a report, will help to enhance communication, independent judgment and problem solving skills. Group work and interaction with domain experts, during the requirement gathering phase, will contribute to improve the ability to communicate with non-engineering parties.

Program
- Introduction to enterprise information systems: definitions of organization, information and computer systems. Enterprise processes. Characteristics of processes, information and data. - Introduction to databases and database management systems: basic definitions, database schemes and instances, abstraction levels, abstraction and independence. Languages for database management, Database users. - Relational model: definition of relation, relations and tables, null values, integrity constraints. - Relational algebra and calculus. - SQL. - Database design. Conceptual design and the Entity/Relationship model. Logical design. - Theory of normalization. - Advanced laboratory of database design

Development of the course and examination
LEARNING EVALUATION METHODS
Evaluation is based on three tests: - a project in which the student faces the problem of collection and analysis of requirements and the design of a database using models, methodologies and languages introduced in the course. The project leads to the writing of a report documenting the activities undertaken and the results obtained; - a written examination composed by open-ended and closed-ended questions on theoretical and practical course topics; - an oral examination, consisting of the discussion of concepts and theoretical aspects on one or more topics covered in the course, possibly starting from learning gaps that emerged in the previous tests Projects can be developed in groups of three students at most. A positive outcome of the project gives access to the

written test, either in the same exam session or in subsequent exam sessions. In order to access the oral examination the student has to obtain a positive outcome in the written examination. Oral examination must be taken in the same exam session as the written examination. In case of failure of the oral examination, the student must also repeat the written test.

LEARNING EVALUATION CRITERIA
To successfully pass the assessment of learning, the student must demonstrate, through the tests described above, a good understanding of the concepts presented in the course and mastery of the use of languages to define and manipulate databases. The student also must demonstrate a clear understanding of, and be able to correctly apply, the methodologies for database design.

LEARNING MEASUREMENT CRITERIA
During the tests it is assessed the degree of completeness and depth achieved in knowledge and understanding of the issues, models, languages and methodologies for managing databases. It is also assessed the ability to use in a correct and autonomous way models, languages and methodologies for solving typical problems in database management.

FINAL MARK ALLOCATION CRITERIA
A score between zero and 30 is assigned to each of the three tests indicated above. The overall grade is between zero and 30, calculated as the average of the marks obtained in the three tests. In order for the overall outcome grade to be positive, the student must achieve at least a pass, amounting to eighteen points in each of the three tests, showing a basic knowledge and understanding on all the questions proposed, and the ability to autonomously solve simple problems, or problems of medium complexity with the help of the teacher. The highest rating is achieved by demonstrating a thorough understanding of the course content, full autonomy and mastery of techniques. The praise is reserved for students who have demonstrated a particular brilliance in the colloqium and in the preparation of written assignments.

Recommended reading
- P. Atzeni, S. Ceri, S. Paraboschi, R. Torlone, Basi di dati: modelli e linguaggi di interrogazione , 3° ed. , McGraw-Hill, Italia - Further material provided by the teacher on the course site hosted on the University learning management system, https://lms.univpm.it

Sistemi Informativi e Basi di Dati (GEST)

Domenico Potena

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims at introducing the concepts, methods and languages for the management of structured information within organizations. The student will learn the advantages of using DBMS to manage data in an integrated fashion and the differences with a file-based management.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
At the end of the course the student will be able to perform simple gathering and analysis of information requirements, to design medium-sized databases, to create, to populate, and to query databases using state-of-the-art languages and database management systems.
TRANSVERSAL SKILLS:
The development of the project of a database, which will be done in groups and will be documented by a report, will help to enhance communication, independent judgment and problem solving skills. Group work and interaction with domain experts, during the requirement gathering phase, will contribute to improve the ability to communicate with non-engineering parties.

Program
- introduction to enterprise information systems: definitions of organization, information and computer systems. Enterprise processes. Characteristics of processes, information and data. Introduction to databases and database management systems: basic definitions, database schemes and instances, abstraction levels, abstraction and independence. Languages for database management, Database users. - relational model: definition of relation, relations and tables, null values, integrity constraints. - relational algebra. - SQL. - database design: general methodologies, conceptual design and the Entity/Relationship model. logical design.

Development of the course and examination
LEARNING EVALUATION METHODS
The assessment of student learning is structured in three parts: - The development of a project of a database; - A written test, consisting of closed- and open-ended questions on the topics of the course; - An oral examination, consisting in the discussion on one or more topics covered in the course, also starting from the any gaps that emerged during the development of the other tests. The project can be done in groups, with a maximum of three students. A positive outcome of the project gives access to the written test, in the same or subsequent examination session. In order to access to the oral exam, the student must achieve at least a pass in the written test. The oral examination is to be held in the same session of the written test. In case of negtive result of the oral exam, the student must also repeat the written test.

LEARNING EVALUATION CRITERIA

In order to successfully pass the assessment of learning, the student must demonstrate, through the procedure described above, that: - she has understood the concepts presented in the course on the models and languages for data management and - she has a clear understanding of methods for database design, and has to be able to correctly apply these methods.

LEARNING MEASUREMENT CRITERIA
For each of the abovementioned tests a score between zero and thirty is assigned. The overall score is the average of scores obtained in the three tests.

FINAL MARK ALLOCATION CRITERIA
In order to pass the exam, the student has to achieve at least a pass (i.e. 18/30) in each of abovementioned tests. The maximum score is achieved by demonstrating, in each test, a thorough understanding of the course topics. The 30 cum laude is reserved for students who have demonstrated to be particularly brilliant both in written and oral presentations.

Recommended reading
P. Atzeni, S. Ceri, S. Paraboschi, R. Torlone, Basi di dati: modelli e linguaggi di interrogazione , 2° ed. , McGraw-Hill, Italia

Sistemi Integrati di Produzione (GEST)

Archimede Forcellese

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Knowledge on fundamental aspects concerning the most common manufacturing processes, the machine tools, production planning and control, industrial logistic and automation is required.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course intends to acquire advanced knowledge on the range of activities allowing the design and manage production systems used in the manufacturing industry. This knowledge, by integrating acquired notions in the courses of technologies and production systems, production planning and control, industrial plants and industrial logistics, will form the insights that will enrich knowledge on types and methods of designing and management of complex production systems, so that the student acquires a clear awareness of the wider multidisciplinary context of engineering, with a clear reference to the aspects strictly related with the technologies and production systems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to address advanced project issues, even of considerable complexity, and treat the innovation and development of new products, technological processes and production systems through the application of knowledge, the student must acquire the ability to apply advanced tools for design and management of production systems. This capacity is expressed through a variety of vocational skills, such as: 1. the ability to choose the components and layout of the production system for the solution of the specific problem; 2. the ability to design production systems using advanced simulation tools; 3. the ability to integrate the different components constituting the production system.
TRANSVERSAL SKILLS:
The resolution of individual and group exercises in classroom will help to improve both the learning skills autonomously and the degree of independent judgment, both the communication skills that also stems from teamwork.

Program
INTRODUCTION. Manufacturing of discrete parts and production system, production typologies (job shop, batch, cellular and mass production), automation in production system (fixed, programmable and flexible automation), integration in manufacturing, automation principles and strategies, CIM, integrated design of product-process-manufacturing system. DECISION MAKING. Decision making processes and environment, decision making attributes in production (time and productivity, cost, flexibility and quality). NUMERICAL CONTROL. Components of numerical control system, reference system, positioning, types of numerical control, positioning and speed control,accuracy and repeteability, interpolation, computer numerical control, distributed numerical control, adaptive control, CNC programming. APPLICATION OF COMPUTER NUMERICAL CONTROL. Machining center, turning center, mill-turining center, coordinate measurement machine, other applications. INDUSTRIAL ROBOTS. Components, joints, serial and parallel robots, arm and wrist configurations, work volume, actuators, load capacity, dynamic performance characteristics, control

systems, peripheral equipments, programming techniques, robotised cells, cell control, applications of industrial robots. MATERIAL HANDLING. Material transport equipment, storage systems, material handling system design, characteristics and analysis of automated guided vehicles, characteristics and analysis of conveyor systems. AUTOMATED PRODUCTION LINES. Fundamental aspects, analysis of single model and mixed model production lines, line balancing algorithms, production lines with buffer storages. Application cases. GROUP TECHNOLOGY AND CELLULAR MANUFACTURING. Part families, visual inspection, part classifications and coding, production flow analysis, composite part and standard plan, cellular manufacturing, cellular layout, Hollier methods, performance measures. Application cases FLEXIBLE MANUFACTURING SYSTEMS. Fundamental aspects, classification, components, flexibility criteria, applications and benefits, planning and implementation issues, design of FMS and performance measures (Bottleneck models). Application cases.

Development of the course and examination
LEARNING EVALUATION METHODS
The exam consists in written and oral tests. In the written one, the student must answer four questions chosen among the topics of the course. It will also be required to solve practical cases related to complex problems. The oral exam will prove the level of knowledge showed in the written test.

LEARNING EVALUATION CRITERIA
The student has to be able to autonomously deal with the application of the main models, metedologies and tools used in the analysis, design and management of integrated manufacturing systems. Aspects, such as the mastery of technical language and clarity of exposition, will also be assessed. Finally, the ability to properly use the acquired knowledge in solving complex problems must be proven.

LEARNING MEASUREMENT CRITERIA
The ability to independently deal with the topics of the course by applying the models, methods and tools in analysing, designing and managing the integrated manufacturing systems, the clarity of exposition, the mastery of technical language are evaulated.

FINAL MARK ALLOCATION CRITERIA
The final grade will be assigned considering the evaluation obtained in both tests. The minimum score, equal to eighteen points, will be achieved by the students who demonstrate sufficient capacity to answer to all the questions raised. The maximum grade, equal to thirty points with honors, will be given to students who have proven full mastery of the topics, exposed in full autonomy and with appropriate technical language.

Recommended reading
M. P. Groover, Automation, Production Systems and Computer-Integrated Manufacturing , Prentice Hall, 2001. Slides of the lectures uploaded to the Moodle platform of the Polytechnic University of Marche.

Sistemi Integrati di Produzione (MECC)

Michela Simoncini

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
Knowledge on fundamental aspects concerning the most common manufacturing processes, the machine tools, production planning and control, industrial logistic and automation is required.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course intends to acquire advanced knowledge on the range of activities allowing the design and manage of production systems used in the manufacturing industry. This knowledge, by integrating acquired notions in the courses of mechanical technology and production systems, production planning and control, industrial plants and manufacturing systems, will represent the insights that will enrich the knowledge of the manufacturing production industry, so that the student will acquire a clear understanding of the most wider multidisciplinary context of engineering, with a clear reference to the aspects strictly connected with the systems and production technologies
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to address advanced design themes, even of considerable complexity, and treat the innovation and development of new products, technological processes and production systems through the application of knowledge, the student must acquire the ability to design and manage the systems of production used by the manufacturing industry in the industrial field, with particular reference to those with a high level of automation. This capacity is expressed through a range of vocational skills, such as: 1. the ability to choose the components and layout of the production system for the solution of the specific problem; 2. the ability to design the production systems using advanced simulation tools; 3. the ability to integrate the various components which make up the production system.
TRANSVERSAL SKILLS:
The resolving of individual exercises and classroom group workshops will help to improve the learning skills autonomously, the degree of independent judgment and the communication skills resulting from teamworking

Program
INTRODUCTION. Manufacturing of discrete parts and production system, production typologies (job shop, batch, cellular and mass production), automation in production system (fixed, programmable and flexible automation), integration in manufacturing, automation principles and strategies, CIM, integrated design of product-process-manufacturing system. DECISION MAKING. Decision making processes and environment, decision making attributes in production (time and productivity, cost, flexibility and quality). NUMERICAL CONTROL. Components of numerical control system, reference system, positioning, types of numerical control, positioning and speed control,accuracy and repeteability, interpolation, computer numerical control, distributed numerical control, CNC programming. APPLICATION OF COMPUTER NUMERICAL CONTROL. Machining center, turning center, mill-turining center, coordinate measurement machine, other applications. INDUSTRIAL ROBOTS. Components, joints, serial and parallel robots, arm and wrist configurations, work

volume, actuators, load capacity, dynamic performance characteristics, control systems, applications of industrial robots. MATERIAL HANDLING. Material transport equipment, storage systems, material handling system design, characteristics and analysis of automated guided vehicles, characteristics and analysis of conveyor systems. AUTOMATED PRODUCTION LINES. Fundamental aspects, analysis of single model and mixed model production lines, line balancing algorithms, production lines with buffer storages. Application cases. FLEXIBLE MANUFACTURING SYSTEMS. Fundamental aspects, classification, components, flexibility criteria, applications and benefits. Application cases.

Development of the course and examination
LEARNING EVALUATION METHODS
The exam consists in written and oral tests. In the written one, the student must answer four questions chosen among the topics of the course. It will also be required to solve practical cases related to complex problems. The oral exam will prove the level of knowledge demonstrated in the written test.

LEARNING EVALUATION CRITERIA
The student has to be able to autonomously deal with the application of the main models, metedologies and tools used in the analysis, design and management of integrated manufacturing systems. Aspects, such as the mastery of technical language and clarity of exposition, will also be assessed. Finally, the ability to properly use the acquired knowledge in solving complex problems must be proven.

LEARNING MEASUREMENT CRITERIA
The ability to independently deal with the topics of the course by applying the models, methods and tools in analysing, designing and managing the integrated manufacturing systems, the clarity of exposition, the mastery of technical language are evaluated.

FINAL MARK ALLOCATION CRITERIA
The final grade will be assigned considering the evaluation obtained in both tests. The minimum score, equal to eighteen points, will be achieved by the students who demonstrate sufficient capacity to answer to all the questions raised. The maximum grade, equal to thirty points with honors, will be given to students who have proven full mastery of the topics, exposed in full autonomy and with appropriate technical language.

Recommended reading
M. P. Groover, Automation, Production Systems and Computer-Integrated Manufacturing , Prentice Hall, 2001. Slides of the lectures are available on the Moodle platform of the Polytechnic University of Marche.

Sistemi Oleodinamici e Pneumatici

Leonardo Pelagalli

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
Concepts of Machines and Energetic Systems, Applied Mechanics to Machines

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course provides students with an advanced knowledge of the main components of oleodynamic and pneumatic systems. Students deepen their knowledge in the field of transmission of mechanical energy by means of fluid-dynamic circuits
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Students must be able to understand both the operation and the potentiality of an oleodynamic/pneumatic circuit and to assess the benefit of applying a component/systems in relation to the final use context. The main skills acquired in the course are: 1. Ability to plan all the steps for the modeling and the design of an oleodynamic/pneumatic circuit; 2. Ability to assess the performance of an oleodynamic/pneumatic circuit; 3. Ability to properly choose the components of an oleodynamic/pneumatic circuit in relation to the application context
TRANSVERSAL SKILLS:
The knowledge in the field of oleodynamic/pneumatic circuits will improve the ability of students to develop autonomous judgement during the design phase so that they can be able to discuss with specialists with different expertise

Program
General principles. Hydraulic energy transmission. Head and fluid loss. Hydraulic fluid classification. Physical and chemical characteristics. Graphic symbols and standardisation. Hydraulic open and closed circuits. Pumps and engines with pistons, blades, gears. Hydraulic jacks. Geometrical displacement. Formulas for performances computation. Pressure regulation valves. Pressure reduction valves. Sequential valves. Flow regulation valves. Flow limitation valves. Flow dividers. Overcenter valves. Direction regulation valves. Non-reversal valves. Rotary and case distributors. Feeding groups. Utilizing groups. Parallel, in series and mixed circuits. Circuits for sequences. Hydrostatic transmissions. Load sensing systems. Fitting elements for circuits. Compressors. Compressor and tank choice. Pneumatic jacks and hammers. Pressure, flow, direction regulation valves.

Development of the course and examination
LEARNING EVALUATION METHODS
The assessment of the level of learning and understanding consists of two parts: 1 - written test containing four questions related to the topics covered in the lectures 2 - oral clarification and/or deepening of the themes of the written test, if necessary, by adding an additional problem of theoretical and/or application nature.

LEARNING EVALUATION CRITERIA

The student has to demonstrate to have understood and acquired the physical principles and theoretical considerations on the basis of configurations and running of components and plants in the oleodynamic and pneumatic technical sectors. The responses also include the quantitative knowledge of the topic.

LEARNING MEASUREMENT CRITERIA

The student knowledge is graded through the attribution of a final mark out of thirty. The passing score is 18/30, the highest score is 30/30, brilliant students may receive in addition a praise. The final evaluation results from the weighted average of the pre-trial written examination (25%) and oral (75%). To pass the exam both tests should be sufficient.

FINAL MARK ALLOCATION CRITERIA

In order that the final outcome of the evaluation is positive, the student will have to prove that he has no gaps on basic skills covered in the course. The highest rating is achieved by demonstrating in-depth knowledge of the course content. Praise is given to students who, having done the pre-exam and oral fairly and with good level of detail, have also shown a particular brilliance in exposure and/or have demonstrated particular mastery of the material knowing also the use of the acquired skills to analyze topics not explicitly covered or treating the topics in a way alternative to the proposed one.

Recommended reading

- Lecturer's notes - Speich H., Bucciarelli, A. Manuale di Oleodinamica-Principi, Componenti, Circuiti, Applicazioni,Tecniche Nuove - Nervegna N., Oleodinamica e Pneumatica - Sistemi Vol.1, Politeko - Nervegna N., Oleodinamica e Pneumatica Componenti Vol.2, Politeko - Belladonna U., Elementi di Oleodinamica - Principi, Componenti, Impianti, Hoepli

Sistemi Operativi

Luca Spalazzi

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Programming skills, Static (records and arrays) and dynamic (files, lists, stacks, and trees) data structures.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims at providing students with the fundamental conceptual tools in order to understand, configure, and use the most recent operating system architectures. Such topics, integrated with the notions acquired throughout the course of Fundamentals of Computer Science and the course of Algorithms and Data Structure", will enrich the knowledge and comprehension of the basic principles for the rational treatment of information, especially with digital automatic machines.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to deal with the issues related to configuration and management of computer systems of medium complexity, the student must be able to correctly understand the structure and functionalities of an operating system. This ability will be expressed through a number of professional skills, such as: 1. applying algorithms and data structures of an operating system; 2. installing and configuring an operating system; 3. starting the basic services of a server.
TRANSVERSAL SKILLS:
The participation to a set of e-learning activities and to a forum about the topics of the course as well as passing a written test and an oral exam will improve the independence of judgment in general, the communication ability (also deriving from the participation in the forum), and the ability to autonomously learn and draw conclusions of the student.

Program
Unit 1 Introduction to computer systems. Unit 2 Concurrent programming. Unit 3 CPU scheduling (mono- and multi-processor systems). Unit 4 Memory (mono- and multi-processor systems). Unit 5 Input-Output. Unit 6 Case study: Linux.

Development of the course and examination
LEARNING EVALUATION METHODS
The learning evaluation consists of three parts: 1. E-learning activities for each unit there is a set of activities and exercises to be accomplished. This part is passed when all the activities are accomplished and the exercises received an average score greater than 60%. 2. Written exam - - passed e-learning activity seven exercises (two exercises have a score of 2, five exercises have a score of 1) to be solved in 1 hour. - non-passed e-learning activity nine exercises (two exercises have a score of 2, seven exercises have a score of 1) to be solved in 1 hour. 3. Oral exam a discussion about two topics from the syllabus. Who has scored less than 5 marks in the written exam + e-learning activities is not admitted to the oral exam. Who has scored 5 marks in the written exam + e-learning activities is admitted to the oral exam in the same session. Who has scored more than 5 marks in the written exam + e-learning activities is admitted to the oral exam in any session

of the same academic year.

LEARNING EVALUATION CRITERIA
1. E-learning activities: students must accomplish each activity suggested by the teacher and be able to use OS algorithms and data structures. 2. Written exam: students must be able to use OS algorithms and data structures. 3. Oral exam: students must know what are OS algorithms and data structures.

LEARNING MEASUREMENT CRITERIA
1. E-learning activities: passing this past has a score of 2. 2. Written exam - - passed e-learning activity 5 exercises have a score of 1. 2 exercises have a score of two. - non-passed e-learning activity 7 exercises have a score of 1. 2 exercises have a score of two. A wrong or missing answer gives a score of 0. 3. Oral exam: each one of the two topics assignes a score up to 10.

FINAL MARK ALLOCATION CRITERIA
Final mark: the sum of the previous two marks. 31 marks is equivalent to 30 e lode (full mark with distinction).

Recommended reading
ilberschatz, Galvin, Sistemi Operativi 9^ Ed., Pearson, 2014

Sistemi Operativi 2

Aldo Franco Dragoni

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enriches knowledge of Operating Systems adding knowledge related to some advanced topics, with particular reference to issues relating to the scheduling of processes in "real-time" contexts and the concurrent processing in distributed environments (no shared memory). Finally, the course goes into detail of programming at the "kernel" level of the operating system Linux, the choice being justified by the fact that this is the most popular "open source" operating system among those available under the GPL license.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The knowledge given during the course is particularly geared to computer engineering aspects close to the hardware, that is precisely the Operating System. After completing the course the student will acquire the basic skills to develop real-time and distributed applications; he will also have learned to develop a simple Linux kernel driver.
TRANSVERSAL SKILLS:
The course structure and the type of training provided lend themselves to the development of projects that can be done in groups. Collaboration in the implementation of a project will help improve the communication skills that comes from teamwork and independent judgment.

Program
Operating Systems. Memory Management. File System. I/O. CPU scheduling. Interrupts. DMA. Processes and threads. Communication and Synchronization. Linux: an overview. Scheduling. Interrupt and Synchronization. Real time Operating Systems. Hard and Soft real time. Real time Scheduling. Preemptiveness. RT Algorithms for aperiodic scheduling (EDD, EDF), and periodic scheduling (Rate Monotonic Scheduling - RMS). Linux and real time. Pro & Cons. implementations. RTAI. RTAI. Programming. Distributed Systems. Multi-Agent Systems

Development of the course and examination
LEARNING EVALUATION METHODS
The exam consists of a written test with questions and exercises on the topics covered during the course

LEARNING EVALUATION CRITERIA
The student must demonstrate an adequate knowledge of the scheduling algorithm "real time", the principles of distributed programming and programming modules of the Linux kernel

LEARNING MEASUREMENT CRITERIA
The student must demonstrate a comprehensive knowledge of the contents with the use of

appropriate technical terminology

FINAL MARK ALLOCATION CRITERIA
The vote comes out of thirty

Recommended reading
Silberschatz, Galvin, Gagne, Sistemi Operativi VI° Ed., Addison-Wesley, 2002. Giorgio C. Buttazzo, Sistemi In Tempo Reale, Pitagora Editrice Bologna 2008. Developing Multi-Agent Systems with JADE, Wiley

Stabilità dei Pendii ed Opere di Sostegno

Viviene Marianne Esther Fruzzetti

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
Knowledge of basic principles of soil mechanics, geology, hydraulics, geotecnical and structural design

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course tackles the themes of slope stability analysis and retaining structures design, providing the students the opportunity to apply their knowledge of soil mechanics and geotechnical engineering to real case studies. The analysis of the structures will be carried out using also geotechnical numerical codes.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Students will be able to interpret the results of geotechnical investigations, select soil parameters (strength and stiffness), define a representative geotechnical model, carry out analysis according to the national code (NTC2008) even by the use of professional software, to prepare a geotechnical report. T
TRANSVERSAL SKILLS:
The course aims at providing students with the appropriate skills to solve typical and simple geotechnical problems in autonomy and to tackle more complex problems in a critical way taking into account both construction aspects and technological solutions.

Program
Soil investigation: in situ and laboratory testing. Soil geotechnical properties: shear strenght, total and effective, peak, critical and residual strenghts. Monitoring. Slope stability. Instability processes: classifications, definition of the geotechnical model, slope stability analyses. Slope stabilization: structural remedials, drainages. Pratical work: analysis of a slope stability problem also by using professional software Retaining structures. Earth pressure theories, both in static and seismic conditions. Soil structure interaction models. Geotechnical design and technologies: earth walls, diaphragm walls and sheet piles. Anchors. Practical work: design of flexible earth retaining structures and of their anchors, also by using professional software.

Development of the course and examination
LEARNING EVALUATION METHODS
Path1. Written and oral examinations. Three hours are at student's disposal to solve a geothecnical problem related to the topic of the lectures. Path 2. Report of pratical work and oral examination. The pratical work is a geotechnical report pertaining to a real problem; the report will contain an interpretation of data sets useful to make an appropiate choice of strenght parameters and soil stiffness, a realistic geotechnical model, the geotechnical analysis according national code. For both paths, the oral examination includes open questions on theorethical, experimental and practical aspects of the discipline.

LEARNING EVALUATION CRITERIA
Path 1. A first stage is constituted by a written examination, followed by an oral examination relating also to other course topics. The minimum entry requirement for oral examination is a sufficient mark on written examination. Path 2. The student will discuss his pratical work, then will give an oral examination relating to other course topics. For both paths, the students must justify exhaustively their geotechnical design choices, also for complex geotechnical problems.

LEARNING MEASUREMENT CRITERIA
Marks are expressed out of 30.The final evalutation, expressed by a number from 0 to 30 (positive evalutation from 18 to 30) will be a ponderate averange of the evalutions of written (or pratical work) and oral examination.

FINAL MARK ALLOCATION CRITERIA
Positive evaluation: suitable knowledge of topics and proper use of technical language. Full evaluation: in depth knowledge of course topics, mastery of technical language, ability to optimize a geotechnical design and to apply the knowledge gained in sister courses.

Recommended reading
Clayton et al.(2006) La spinta delle terre e le opere di sostegno Hevelius Ed.;Farulla A. (2001) Analisi di stabilità dei pendii, Hevelius Ed.; Desideri A. et al. (1997) Drenaggi a gravità per la stabilizzazione dei pendii, Hevelius Ed.; Papers and technical report provided by lecturer.

Statica (EA)

Giammichele Cocchi

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 72
Period 2s

Prerequisites
general Physic and Analysis I methods

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
This course intends to provide the basic concepts on the kinematics and statics of structures, constituted by rigid bodies. By integrating the preliminary notions on the mechanics of rigid bodies, learnt during the course of general physics, and by using the theoretical bases, obtained in the courses of mathematical analysis 1 and geometry, this course will be very helpful for the conception and design of architectural structures. The course deals with the statics of structures as a theoretical support to the study of constructions stability in architecture; we propose the analytical and graphical approaches, the study of the constraints, the problem of the equilibrium and the internal actions diagrams.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will be able to apply the fundamental concepts of the mechanics of structures to the design process, with a particular attention to the methodologies of resolution of isostatic structures. The student will develop the following abilities: the comprehension of the kinematical and static scheme of a real structure; the ability to the trace the internal action diagrams in order to analyze the stress state in rigid beams isostatic structures.
TRANSVERSAL SKILLS:
The student will test himself with some exercises on isostatic structures, facing the difficulties of putting together the intuition and the analytical accuracy, proper of the conception and design of architectural structures.

Program
Program:Contents of frontal lessons (48 hours) Mass Geometry,Structures with rigid beam analysis,Graphics static,Statical principal equations,Teorem of virtual works,Bond reactions and interactions,Internal forces diagrams,Kinetic arrangements ,Plane and spatial truss structures,Symmetrically and non symmetrically structures,Differential equilibrium equations,Curved beams,Static of cable structures. Exsercises in classroom(24 hours) To establish the reactions of simple plane an spatial structures .Construction of axial force ,shear force and bending moment diagrams in isostatic esamination tests structures.Calculation of inertial properties of composite elementary sections.

Development of the course and examination
LEARNING EVALUATION METHODS
The appraising consists in write an oral tests.In write test the student have to calculate the bound reactions and have to draw the internal action diagrams of complex isostatic structures.He have to evaluate the inertial properties of composite sections and to apply the virtual work theorem to calculate the bond reactions and internal forces of a simple structure. During the oral test the

student may confirm the vote of the write test or may change it by means of reply to teoretical questions about program.

LEARNING EVALUATION CRITERIA
In examination tests the student have to demonstrate to utilize ,with correct results,the methods ,the models and the tools of static which are developed during the lessons.

LEARNING MEASUREMENT CRITERIA
The autonomous ability of planning and solving the assigned problems Is evaluated during the examination tests .Moreover the ability of a correct and pertinet utilizing the methods,the models and the tools of static is evaluated .

FINAL MARK ALLOCATION CRITERIA
The greatest vote equal to 30 points with praise is assigned to the students which can demonstrate full mastery in planning and resolving the two tests problems of static.The minimum vote equal to 18 points is assigned to the students which can demonstrate sufficient mastery in planning and resolving the two tests problems of static.

Recommended reading
Stefano Lenci ,Lezioni di meccanica strutturale,Pitagora Bologna

Storia dell'Architettura 1 (EA)

Paolo Clini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 90
Period E/1s-2s

Prerequisites
no

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course provides students with tools for knowledge and historical and the critical understanding of architecture from the Greek and Roman Antiquities to the 18th Century. Such knowledge is acquired through the theories of architecture and the study of the characters of the space, forms, languages and styles, typologies and construction of the most significant works and the review of the current and the most representative authors. The course aims also to give students methods and tools for the analysis of the heritage and to stimulate sensitivity to the cultural and architectural context.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The course aims to give to the students the ability to express critical attitudes and analysis of the design process, aimed at assessing the relationship with the context for the maintenance, preservation and develoment of the cultural heritage.
TRANSVERSAL SKILLS:
The analysis of key works showing the evolution of languages and techniques of architecture and construction is developed in the laboratory annexed to the course. This activity aims to improve the ability of use critical and technical tools that will be developed in the design courses.

Program
ARCHITECTURE OF ORIGINS, the definition of the archetype forms of architecture. GREEK ARCHITECTURE, general features of Greek art and culture; the architecture of the temples in archaic, classical and Hellenistic periods. The Acropolis in Athens. ROMAN AND EARLY CHRISTIAN ARCHITECTURE : features of Roman art and culture; from the republican age to Constantine; the late ancient and the premises of medieval architecture. ROMANESQUE AND MEDIEVAL ARCHITECTURE: the Early romantics; Romanesque in Europe and in Italy (the early renaissance); Gothic Architecture in Europe and in Italy. RENAISSANCE ARCHITECTURE: Renaissance art and culture; from the Florentine 400 s (Alberti, Brunelleschi) to the Roman 500 s (Bramante, Michelangelo, Raffaello); Classicism and mannerism in northern Italy (Palladium, Giulio Romano). BAROQUE AND ROCOCO' ARCHITECTURE : art and culture in the 600 s; Baroque in Rome (Bernini, Borromini) and in Piedmont (Guarini, Juvarra). NEOCLASSICISMO: Art and neoclassic culture, neoclassicism in Europe and in Italy.

Development of the course and examination
LEARNING EVALUATION METHODS
To take the exam, students must have attended at least 80% of the laboratory classes. According to covered topics, the exam will include: Oral exam on the general part; Laboratory activity assessment

LEARNING EVALUATION CRITERIA
The exam consists of an oral test on the course topics and of a discussion on laboratory activity. Each student will also be asked to carry out an in-depth activity by producing an incisive personal interpretation, still oral, on one of the topics covered in class.

LEARNING MEASUREMENT CRITERIA
The final mark is expressed in thirties

FINAL MARK ALLOCATION CRITERIA
Serious lack of knowledge pertaining to history periodization and identification of the artefacts and buildings as described above will result in non-achievement of overall success. Top marks are awarded when thorough knowledge of the contents and good self-critical interpretation of the same are proven. Students that, in addition to achieving top marks, demonstrate to fully master the subject, together with the adequate language register, are eligible for laude.

Recommended reading
De Fusco, Renato, Mille anni di architettura in Europa, Bari, Laterza, 1999, pp. 714. AA. VV., Lineamenti di Storia dell Architettura, Sovera, Roma, 2000 (I° ed. 1994) Summerson John, Il linguaggio classico dell Architettura, Torino, Einaudi, 2000 (I° ed. 1963), pp. 100. Vitruvio, De Architectura, an italian editions with drawings and comments. Lecture notes organised by the teacher available at the photocopy center of the Faculty of Engeneering.

Storia dell'Architettura 2 (EA)

Antonello Alici

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 90
Period 1s

Prerequisites
History of Architecture 1

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course refines and completes the historical and critical knowledge and aims to move the student to a more mature understanding of the architectural work through the study of the 19th and 20th Century. The rapid evolution of technology and the building technologies experienced after the Industrial Revolution and the new capacity of circulation of experiences in different continents stimulates the student to develop new skills and a more refined vocabulary which facilitates the connection with the design disciplines, from the restoration and enhancement of the cultural heritage to the urban and architectural regeneration.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The sensitivity to the site and the understanding of the value of the architectural work anticipate the issues of the restoration and extend the ability to express critical attitudes and analysis of the design process. These skills will be widened through study travels, which are essential for the full understanding of the complexity of the matter, as well as in workshops. The course is in close connection with the courses of Architectural Design and Restoration.
TRANSVERSAL SKILLS:
The workshop and the direct visit to the architectural sites and works will favour the improvement of the skills and knowledge of the student. Group work will foster communication skills and knowledge exchange.

Program
The course aims to give to the future engineer-architect a basic knowledge of the artistic and architectural culture of the modern and contemporary age from late 18th to 20th Century. The improvement of the building technics and the growing quality of new materials as iron, steel and glass help the avant guardes to develop a new architectural language that can be defined 'modern'. The course will offer introductory lectures to the main periods, the analytic examination of the changes into the cities, architecture and landscape. The biographical profiles of architects and engineers and clients will be a key part of the lectures and seminars. A specific space for 'cinema and architecture' will be included. The students are requested to take part to a seminar named 'Portrait of Cities' which will propose a comparative study of European and American cities.

Development of the course and examination
LEARNING EVALUATION METHODS
Oral exam including the presentation of the seminar chosen during the course.

LEARNING EVALUATION CRITERIA
The students must prove the capacity of presentation of the seminar and of discussion on the main

topics of the subject using also sketches and drawings to describe spaces, ideas, languages of the architecture and city and landscape.

LEARNING MEASUREMENT CRITERIA
Marks between 0 and 30 points

FINAL MARK ALLOCATION CRITERIA
The final mark is the result of the presentation of the seminar and of the questions discussed. Each question will be evaluated with points between 0 and 10. The LODE will be given to the student who reached the maximum marks and shows a complete and mature comprehension of the subject.

Recommended reading
J-L. Cohen, The Future of Architecture. Since 1889, Phaidon 2012 William J.R. Curtis, Modern Architecture since 1900, Phaidon 2006 Bruno Zevi, History of Modern Architecture, Einaudi 1975

Strategie e Sistemi di Controllo Gestionale

Diego D'Adda

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
Economia e organizzazione aziendale, Economia dell'impresa

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course will give to the students an advanced knowledge of management control systems and in business administration/accounting. This knowledge will complement the knowledge gained in previous classes in business economics and business management, economics and marketing. Therefore, it will further enrich management skills of the student. This course will cover management control systems in general, the indicators and their use in management control systems, cost-accounting systems, the architecture of the management control system, the budget process and the use of the management control system for evaluation and motivational purposes.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will learn the main features of a management control system, understand how this has impact on the whole strategy process from the definition of objectives to the evaluation of results. This will reflect in the acquisition of a number of skills, such as 1) the ability to understand the characteristics and limitations of the indicators and their impact on agent incentives; 2) the ability to allocate costs to the cost centers and the cost objects (for example the products); 3) the ability to understand issues related to the evaluation of the different responsibility centers; 4) the ability to perform and interpret the analysis of variances; 5) the ability to understand and develop a budget.
TRANSVERSAL SKILLS:
The students will be asked to solve exercises related to some aspects of the course (for example the cost allocation). This task will be conducted in groups and will lead to develop a report, will help the student in improving his judgment skills, communication skills thanks to the teamwork and his ability to learn and to draw conclusions.

Program
Management control systems - Economic, financial ad non-financial indicators - Balance Score Card (BSC) - Cost accounting systems: JOC costing, process costing, ABC, Just In Time Costing - Corporate costs allocation - Transfer prices - Responsibility centers: cost-, revenue-, profit-, investment- centers - Budget and budgeting process

Development of the course and examination
LEARNING EVALUATION METHODS
written (or group assignment) and oral examination. The exam consists of an oral examination. The students are given the chance to complete group assignments aimed at gaining a critical and deeper understanding of the topics covered in the class.

LEARNING EVALUATION CRITERIA
during oral examinaion, the student have to present and discuss the group assignments and to

prove her knowledge about management control systems. In order to be given a passing mark, the student are required to prove a sufficient knowledge of the topics covered in the class using an appropriate specific terminology. Maximum mark requires a deep understanding of the topics exposed using the appropriate terminology.

LEARNING MEASUREMENT CRITERIA
Final marks between 18/30 (pass) and 30/30 cum laude (highest mark)

FINAL MARK ALLOCATION CRITERIA
Three oral questions, at least one about group assignements. Laude will be given to studends reaching the maximum mark and demonstrating a full understanding of the subject.

Recommended reading
Azzone - Innovare il sistema di controllo di gestione - ETAS

Strutture in Acciaio

Sandro Carbonari

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Concepts of statics and structural mechanics, as well as properties of the main classes of materials used in the Civil and Environmental Engineering are assumed to be known. Furthermore, the ability to understand and produce a technical drawing is considered acquired.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide the student with the basic theoretical knowledge and practical skills required to design and assess steel structures through lectures and a designing exercise. Starting from the knowledge gained from basic courses, and specifically from the course of structural mechanics, students learn the structural conception, analysis methodologies and the professional aspects of structural design.

CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to successfully solve problems relevant to the design of steel structures, the student must gain critical judgment skills of typical engineering problems as well as the capability to solve the problems using methods, techniques and tools provided within the course. These skills are developed through lectures and a design tutorial.

TRANSVERSAL SKILLS:
The designing exercise, involving a critical review of several solutions, help improving the student s critical judgment skill, as well as the self-learning skill.

Program
Concepts of structural safety are briefly recalled: the method of partial safety factors (limit state design). Actions on structures are briefly recalled, with particular focus on live loads due to wind, snow and thermal actions; load combinations for the ultimate (ULS) and serviceability (SLS) limit states. Steel materials and products: steel grades, mechanical properties and laboratory tests, flat products, long products and production processes, thermal treatments and imperfections; cross-sectional shapes of hot-rolled and cold-formed commercial structural elements. The structural conception of steel buildings: single storey and multi storey steel framed buildings. Structural analysis approaches: elastic and plastic analysis with relevant methods for the evaluation of the elements capacity; second order analyses and effects of imperfections. Design of structural steel members: design of members subjected to axial compression or tension, bending moment, shear and torsion, and combined actions, according to EC3 and the Italian Technical Code; design at service conditions (deformability and vibrations). Welded, bolted and pins connections. Technology and capacity of bolted connections subjected to shear, tension and combined tension and shear, pretensioned bolted connections. Technology and capacity of welded connections: full penetration and fillet welds; design and verification criteria of welded connections. Welded and bolted joints: joints of elements subjected to tensile and compression forces, connections with end plates

(flanges) and splices, examples of beam-to-beam and beam-to-column joints. Structural stability: buckling of columns subjected to axial loads, uniaxial bending and combined actions; introduction to flexural-lateral buckling; Capacity and stability of laced and battened columns.

Development of the course and examination

LEARNING EVALUATION METHODS

The assessment of student learning is based on two tests: - a written test concerning the analysis and verification of a steel structure; - an oral assessment, consisting in the discussion of both the developed exercise and the written test, and in some theoretical questions on the topics covered during the course. The latter may also be in written form (if required by the presence of formulas or demonstrations), followed by an oral discussion. To access the oral examination, the student must have completed the proposed exercise and obtained a sufficient evaluation in the written test. The written and oral examinations must be sustained in the same examination session.

LEARNING EVALUATION CRITERIA

Through the presented exercises, the written and the oral assessments, the student must demonstrate to have learned the topics covered during the course and to be able to present them correctly, by adopting a proper technical terminology.

LEARNING MEASUREMENT CRITERIA

The evaluation of each test is expressed in thirtieths.

FINAL MARK ALLOCATION CRITERIA

After the oral examination, a final mark is defined for the presented exercise and for the written and oral assessments. The student is expected to pass all tests. The final mark of the course will be calculated as the average of the marks received in each test. Summa cum laude will be awarded to students who have correctly completed all the assessments and have shown an outstanding understanding in the subject.

Recommended reading

Bernuzzi C., Progetto e everifica delle Strutture in Acciaio Ed. Hoepli, Milano, 2015 (in Italian).
Ballio G., Bernuzzi C., "Progettare Costruzioni in acciaio", Ed. Hoepli, Milano, 2004 (in Italian).
Ballio G., Mazzolani F. M., "Strutture in acciaio", Ed. Hoepli, Milano., 2004 (in Italian).
Radogna E.F., "Tecnica delle Costruzioni - Fondamenti delle Costruzioni di acciaio", Editoriale ESA, Milano, 1989 (in Italian).

Strutture in Cemento Armato

Sandro Carbonari

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Concepts of statics and structural mechanics, as well as properties of the main classes of materials used in the Civil and Environmental Engineering are assumed to be known. Furthermore, the ability to understand and produce a technical drawing is consi

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide the student with the basic theoretical knowledge and practical skills required to design and assess reinforced concrete structures through lectures and designing exercises. Starting from the knowledge gained from basic courses, and specifically from the course of structural mechanics, students learn the structural conception, analysis methodologies and the professional aspects of structural design.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to successfully solve problems relevant to the design of reinforced concrete structures, the student must gain critical judgment skills of typical engineering problems as well as the capability to solve the problems using methods, techniques and tools provided within the course. These skills are developed through lectures and tutorials that require an active collaboration with the teacher.
TRANSVERSAL SKILLS:
Designing exercises of simple structural elements, involving a critical review of several solutions, help improving the student s critical judgment skill, as well as the self-learning skill.

Program
Contents of lectures (60 hours) Structural safety and design criteria: the method of partial safety factors (limit state design) and brief review of the working stress design approach. Actions on structures: permanent loads and live loads (of anthropogenic or environmental origin). Properties of concrete and of steel reinforcements: constitutive models; compressive and tensile strengths for concrete and reinforcements, creep and shrinkage of concrete. Behaviour of reinforced concrete elements: uncracked phase (stage I), cracked phase (stage II) and at failure (stage III); analysis methods. Ultimate limit states: columns subjected to axial force and to axial force and uniaxial bending; beams subjected to flexural, shear and torsional actions; punching shear strength. Seriviceability limit states: design at service conditions: cracks formation and openings; limits on the stress state and on deformations. Design with strut & tie models. Analysis and design of surface foundations and fundamentals of the design of deep foundations. Classroom tutorials (12 hours) Structural sizing, analysis, design and verification of a reinforced concrete slab, a balcony and a stair.

Development of the course and examination
LEARNING EVALUATION METHODS
The assessment of student learning is based on two tests: - a written test concerning the design of a reinforced concrete structure; - an oral assessment, consisting in the discussion of both the

developed exercises and the written test, and in some theoretical questions on the topics covered during the course. The latter may also be in written form (if required by the presence of formulas or demonstrations), followed by an oral discussion. To access the oral examination, the student must have completed the proposed exercises and obtained a sufficient evaluation in the written test. The written and oral examinations must be sustained in the same examination session.

LEARNING EVALUATION CRITERIA
Through the presented exercises, the written and the oral assessments, the student must demonstrate to have learned the topics covered during the course and to be able to present them correctly, by adopting a proper technical terminology.

LEARNING MEASUREMENT CRITERIA
The evaluation of each test is expressed in thirtieths.

FINAL MARK ALLOCATION CRITERIA
After the oral examination, a final mark is defined for the presented exercises and for the written and oral assessments. The student is expected to pass all tests. The final mark of the course will be calculated as the average of the marks received in each test. Summa cum laude will be awarded to students who have correctly completed all the assessments and have shown an outstanding understanding in the subject.

Recommended reading
Radogna E.F., Tecnica delle Costruzioni. Costruzioni composte acciaio calcestruzzo c.a. c.a.p., Masson, Milano, 1996. (In Italian) Toniolo G., Cemento Armato Calcolo agli stati limite, Vol. 2A e 2B, Masson, Milano. (In Italian) Cosenza E., Manfredi G., Pecce M. , Strutture in cemento armato. Basi della progettazione , Hoepli, Milano, 2015 Seconda Edizione. (In Italian) Slides of lectures, lecture notes on the main topics of the course and exam samples are available at the Centro Copie Ingegneria. (In Italian)

Strutture Speciali

Fabrizio Gara

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
Material covered in Structural Analysis and Seismic Engineering is considered as assumed knowledge

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims at providing the fundamentals on some of the most innovative and advanced research topics in the field of civil engineering. By improving skills deriving from the first cycle degree, the student improves his knowledge in the following fields: modelling of beams and bridge decks, structural monitoring, innovative seismic protection systems of both new and existing buildings.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student gains advanced practical skills in specific civil engineering areas by means of practical exercises and individual work, constituted by an in-depth study of one of the topics presented in the course.
TRANSVERSAL SKILLS:
Individual practical exercises improve the student's ability to conduct experiments; the in-depth study of one of the topics presented in the course develops the self-learning and communicative skills.

Program
Modelling of steel-concrete composite beams with deformable shear connection; displacement based approach, shear-lag effect, cross section warping and shear deformability; closed form solutions and numerical solutions with step-by-step procedure, finite element method and finite difference method. Steel structures in seismic areas: hyerarchy rules and design requirements for the main dissipative structural typologies (moment resisting frames and frames equipped with concentric or eccentric dissipative braces). Innovative strategies for seismic protection of structures: base isolation (High Damping Rubber Bearing - HDRB, with lead core - LRB; friction pendulum devices) and dissipative braces (with hysteretic behaviour, Buckling Restrained Braces - BRBs); design methods and safety verifications proposed by codes. Techniques for the seismic upgrading and retrofit of existing structures. Sesimic design of isolated bridges. Evaluation of the seismic response of structures accounting for soil-structure interaction: analysis methodologies. The substructure method: kinematic interaction analysis of the soil-foundation system and inertial interaction of the superstructure on compliant base. Structural dynamic identification: excitation techniques and analysis in the time and frequncy domains.

Development of the course and examination
LEARNING EVALUATION METHODS
The evalulation of student learning is based on an oral exam consisting in a discussion of a short dissertation, developped by the student on one of the topics covered during the course; and in some

theoretical questions on the topics covered during the course. To access the oral exam the student is required to have completed the short dissertation.

LEARNING EVALUATION CRITERIA
Through the short dissertation and the oral exam the student must demonstrate to have learned the topics covered during the course and to be able to present them correctly, by adopting a proper technical terminology.

LEARNING MEASUREMENT CRITERIA
The evaluation is expressed in thirtieths

FINAL MARK ALLOCATION CRITERIA
The student is expected to pass both assessments. The final mark of the course will be calculated after the oral exam as the average of the marks received for these two assessments. The 'lode' will be awarded to students who, having correctly completed the two assessments, show an outstanding understanding in the subject.

Recommended reading
D. J. Ewins: Modal Testing: Theory, Practice and Application. F.M. Mazzolani, R. Landolfo, G. Della Corte, B. Faggiano. Edifici con Struttura di Acciaio in Zona Sismica, IUSS Press. Castellani A., Faccioli E. Costruzioni in zona sismica. Hoepli, 2008. Petrini L., Pinho R., Calvi G.M. Criteri di progettazione antisismica degli edifici. Iuss Press, 2006. M. Dolce, F.C. Ponzo, A. Di Cesare, G. Arleo. Progetto di Edifici con Isolamento Sismico Seconda Edizione IUSS Press Slides of lectures, lecture notes of some topics covered during the course, and several papers published on scientific journals are provided by the lecturer.

Studi di Fabbricazione

Archimede Forcellese

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Knowledge on fundamental aspects concerning the most common engineering materials, technical drawings, mechanical design and manufacturing processes is required.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The student will acquire advanced knowledge on the activities that allow to transform the mechanical design of the product in the manufacturing one. This knowledge, by integrating notions acquired in the courses of metallurgy, mechanical drawing, machine design, integrated manufacturing systems and manufacturing processes in mechanics, will form the insights that will enrich the knowledge of the field of manufacturing processes and systems, so that the student acquires a clear awareness of the wider multidisciplinary context of engineering
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to address advanced design themes, even of considerable complexity, and treat the innovation and development of new products and new processes through the application of knowledge, the student will have able to generate process plans for manufacturing mechanical components, also by means of computer aided techniques, in view of the reduction of manufacturing inefficiencies. This capacity will appear through a series of professionalising skills, such as: 1. the ability to generate the process plan of a product also assessing the industrial cost; 2. the ability to select the type of computer aided process planning approach best suited to the solution of a specific problem; 3. the ability to use the concurrent engineering approach which involves the teamwork
TRANSVERSAL SKILLS:
The resolution of individual and group exercises in lecture room will contribute to improve both the learning skills autonomously and the degree of independent judgment, both the communication skills that also stems from teamwork

Program
INTRODUCTION. Definition, production typologies, product life cycle stages, serial and parallel approaches, concurrent engineering. MECHANICAL DESIGN AND PROCESS SELECTION. Steps of the mechanical design, project typologies, design tools, selection of the manufacturing processes, process classification, process selection strategies, process selection tools, role of the process cost, economic criteria for the process selection, models for the process cost estimation. PROCESS PLANNING. Fundamental aspects, process planning activities, route sheet, process tolerances, tolerance transfer, relationship between tolerance and process plan. COMPUTER AIDED PROCESS PLANNING (CAPP). Definitions, variant CAPP system (group technology, preparatory phase and production phase), generative CAPP system (integration between the CAD and CAPP systems, decision logic), semigenerative CAPP system, comparison among the different CAPP systems. COST ACCOUNTING. Definitions, cost classification and configurations, cost centers, allocation in cost centers, allocation of general production costs (single and multiple

allocation bases), direct costing, make or buy decision. INTEGRATED DESIGN OF PRODUCTS AND PROCESSES. Characteristics and advantages of concurrent engineering, metodologies for the implementation of concurrent engineering, product development multidisciplinary teams, team typologies, virtual teams.

Development of the course and examination

LEARNING EVALUATION METHODS

The evaluation is based on an oral exam in which the student must answer four questions chosen among the topics of the course.

LEARNING EVALUATION CRITERIA

The student has to demonstrate, in addition to the ability to deal with the main manufacturing processes used in the mechanical industry, the knowledge and the methodological and technological expertises for the design and development of process plans, their optimization and the determination of the associated costs. Aspects, such as the mastery of technical language and clarity of exposition, will also be assessed. Finally, the ability to properly use the acquired knowledge in solving complex problems must be proven.

LEARNING MEASUREMENT CRITERIA

The ability to independently deal with the topics of the course by applying the methods and tools of the process planning, the clarity of exposition, the mastery of technical language are evaulated.

FINAL MARK ALLOCATION CRITERIA

The four questions asked in the oral test have the same weight in the assignation of the final grade. The minimum score, equal to eighteen points, will be achieved by the students who demonstrate sufficient capacity to answer to all the questions raised. The maximum grade, equal to thirty points with honors, will be given to students who have proven full mastery of the topics, exposed in full autonomy and with appropriate technical language.

Recommended reading

F. Giusti, M. Santochi. Tecnologia meccanica e studi di fabbricazione , II Edizione, Casa Editrice Ambrosiana, Milano, 2000. F.Gabrielli, R. Ippolito, F. Micari. Analisi e tecnologia delle lavorazioni meccaniche , McGraw-Hill, Milano, 2008. P. Scallan. Process planning: the design/manufacture interface , Butterworth-Heinemann, 2003. Slides of the lectures uploaded to the Moodle platform of the Polytechnic University of Marche.

Tecnica del Freddo

Giovanni Di Nicola

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
Basic knowledge of Applied thermodynamics, Heat transfer, Fluidynamics.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The aim of the course is to enable students to acquire advanced knowledge on systems for the cold production and the foods storage. Such knowledge, integrated with the ones gained on the fundamentals of applied thermodynamics, heat transfer and fluid dynamics, will provide the insights that will increase the knowledge in the field of components and thermal systems by deepening the aspects specifically related to systems for the energy transformation, as well as the techniques for environmental impact assessment, so that the student could acquire a clear awareness of the wider multidisciplinary context of engineering, with a clear reference to the aspects specifically related to systems and technologies for the production, transportation and end-use of energy, and optimized design of components and energy systems
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to address advanced design themes, even of considerable complexity, and treat the innovation and development of new products and new technological processes through the application of knowledge, the student will have to know how to design with optimization criteria the systems for the exchange and thermal energy conversion. This ability will be possible through a number of professional skills, such as: 1. ability to perform energy analysis on components and systems for the cold techniques; 2. ability to perform optimal choices in the design of systems for the cold production with particular attention to the foods storage aimed at saving energy and costs while minimizing environmental impact; 3. ability to apply alternative methods for the cold production also through the use of alternative energy sources
TRANSVERSAL SKILLS:
The ability to solve numerical problems will help the student to improve the general degree of independence of judgment, the communication ability that comes from knowing his own skills, the ability to learn independently and to draw conclusions

Program
Contents (42 hours). Basic Thermodynamics. Reverse Carnot cycle. First and second Law efficiency. Thermodynamic charts. Vapour compression refrigerating cycle. Refrigerant fluids. Functional and environmental requirements for the working fluids. Synthetic and natural refrigerants. Application domains for the specific refrigerants. Liquid subcooling and suction superheating. Liquid/suction heat exchanger. Applicative limits of single stage cycles. Two stages cycles. Assessment of optimal intermediate pressure. Dual temperature cycles. Cascade cycles. Main components for the vapour compression cycles. Dynamic and volumetric compressors; volumetric and isentropic efficiency. Modulation of the refrigaration capacity. Condensers and evaporators. Throttling valves. Gas liquefaction. Linde cycle. Inversion temperature. Claude cycle. Alternative reverse cycles. Absorption cycle: working fluids and their applicative domains; first law analysis. Air

cycle. Adsorption cycle. Thermoelectric refrigeration. Cooling Towers. The cold chain. Temperature influence in the deterioration of foodstuffs. Storage conditions for fresh products. Controlled atmosphere. Frozen and quick-frozen products. Assessment of freezing time. Freezing techniques. Thawing. Cold rooms. Thermal load of cold rooms. Exercises (6 hours). Exercises on the compressors. Design of cold rooms.

Development of the course and examination

LEARNING EVALUATION METHODS

The assessment of student learning consists of a test, consisting of a few questions of a theoretical nature and application regarding the topics covered in the course, to be completed in two hours. During the test the student is required to synthetically expose the theoretical basis and the main application topics of refrigeration.

LEARNING EVALUATION CRITERIA

To successfully pass the exam, the student must demonstrate, through the test described above, to have understood the concepts of refrigeration exposed during the course. In particular, the student will have to know how to design with optimization criteria the systems for the exchange and thermal energy conversion. He will have to show the ability to perform energy analysis on components and systems for the cold techniques, the ability to perform optimal choices in the design of systems for the cold production with particular attention to the foods storage aimed at saving energy and costs while minimizing environmental impact, the ability to apply alternative methods for the cold production also through the use of alternative energy sources.

LEARNING MEASUREMENT CRITERIA

For each one of the questions of the test, it is assigned a score between zero and thirty. The overall grade, thirty, is the average of the marks obtained in the two tests, with rounding to the entire excess.

FINAL MARK ALLOCATION CRITERIA

Because the overall outcome of the evaluation is positive, the student must achieve at least eighteen points in the test described above. The highest rating is achieved by demonstrating a thorough understanding of the course content in the tests.

Recommended reading

Lecture notes (available on-line at https://lms.univpm.it/enrol/index.php). Cavallini, L. Mattarolo, Termodinamica applicata, CLEUP, Padova, 1992; W.F. Stoecker, Industrial Refrigeration Handbook, McGraw-Hill, New York, 1998

Tecnica delle Costruzioni

Luigino Dezi

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Material covered in statics and structural mechanics is considered as assumed knowledge.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course allows students to gain advanced theoretical knowledge in the topic of reinforced concrete structures. By improving skills deriving from the first cycle degree, the student improves his knowledge in the framework of design and assessment of reinforced concrete, prestressed concrete and composite steel-concrete structures.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student develops modelling capabilities, as well as design and analysis skills, of spatial frame structures. These skills are gained through lectures and a designing exercise, developed in working groups, which implies the drafting of technical executive documents.
TRANSVERSAL SKILLS:
The designing exercise, which is developed in working group and requires the use of specific software for the solution of practical problems, contributes to improve the student s capability of identifying, formulating and solving problems, as well as the communicative skill, necessary for the teamwork.

Program
Contents of lectures (56 hours) Structural design criteria: design of structural elements in reinforced concrete in accordance with strength and serviceability limit states; thin-walled elements. Deep beams. Punching, Instability of beam-column reinforced concrete element. Framed buildings: modelling, assumptions and analysis by means of the displacement method of plane frames with fixed and hinged joints; matrix method for the analysis of spatial frames. Foundations: design of surface foundations, strip footings, footing grids, slabs, pile caps, beam on elastic foundation: governing equilibrium equations and relevant boundary conditions; Winkler beam. Thin-walled theory: Kirchhoff plate; governing equilibrium equations and relevant boundary conditions; applications on balconies and retaining walls. Shrinkage and creep of concrete. Prestressed concrete structures: prestressing tecniques, stress losses, tendon layers. Steel-concrete composite structures: elastic and plastic strength limit state, shear connection design, shrinkage and creep effects. Retaining walls: typologies, design and analysis methods. Classroom tutorials (16 hours) design of a reinforced concrete frame building.

Development of the course and examination
LEARNING EVALUATION METHODS
The evalulation of student learning is based on two assessments: - a written test concerning the analysis and design of a reinforced concrete frame; - an oral exam consisting in a discussion of the design project and in some theoretical questions on the topics covered during the course. To access the oral exam the student is required to have completed the project and have obtained a

sufficient evaluation in the written test.

LEARNING EVALUATION CRITERIA
Through the design project, the written test and the oral exam the student must demonstrate to have learned the topics covered during the course, such as analysis and design methods for structure typologies studied in the course.

LEARNING MEASUREMENT CRITERIA
The evaluation of each assessment is expressed in thirtieths.

FINAL MARK ALLOCATION CRITERIA
During the oral exam a mark is attributed to the design project and the final mark of the course will be calculated as the average of the marks received for the written and oral exams, as well as for the design project. The 'lode' will be awarded to students who, having correctly completed the three assessments, show an outstanding understanding in the subject.

Recommended reading
Radogna E.F., Tecnica delle Costruzioni. Costruzioni composte acciaio calcestruzzo c.a. c.a.p., Ed. Masson, Milano, 1996. (in Italian) Giangreco E., Teoria e Tecnica delle Costruzioni, Vol. I, Ed. Liguori, Napoli. (in Italian) Toniolo G., Cemento Armato Calcolo agli stati limite, Vol. 2A e 2B, Ed. Masson, Milano. (in Italian) Slides of lectures, lecture notes on the main topics of the course and exam samples are available at the Centro Copie Ingegneria. (In Italian)

Tecnica delle Costruzioni (EA)

Roberto Capozucca

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 90
Period 1s

Prerequisites
Knowledge of differential calculus and basic concept of theory of elasticity.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course gives knowledge and comprehension s ability on the complexity of design structural process. It allows students to acquire advanced knowledge on the structural behavior of reinforced concrete, steel and masonry. By integrating the already given and acquired notions from the basic courses of physic and mechanical structures, this knowledge is useful for a clear awareness of engineering s multidisciplinary context. In the course fundamentals concepts on actions, models and probabilistic methods of analysis are discussed as even the main concepts of design.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
For the purpose of facing structural design themes- even very complex ones- and of illustrating the innovation and development of new technological processes throughout the knowledges application, students will be able to express a gamut of professionalizing abilities, such as: 1. The ability of giving the appropriate dimension to the structural elements so that building s execution will reveal itself compatible also with architectural needs. 2. The ability of identifying the developing behavior of structural elements under the provided actions.
TRANSVERSAL SKILLS:
The students dedication in a design field which will be confronted in groups will give its contribute for the improvement of both the degree of independence in the analysis of structural problems, and the communicative capacity which comes from the team work too.

Program
Fundamental concepts for structural design of reinforced concrete, prestress reinforced concrete, steel and masonry are developed during the course lessons. Reinforced and prestressed concrete: materials; concrete and steel for RC and pre-stressed structures; bond of steel bars embedded in concrete; linear elastic analysis of RC structures and ultimate state: normal force; bending of RC beams; shear. Limit analysis of RC and pre-stressed RC structures: flexural design of beams and one way slabs. Pre-stressed concrete strength design. Calculus of thin plates. Common foundation structures. Basic concepts of project in seismic area. Steel structures: materials and methods of analysis; trusses, frames, joints and constraints. Design of steel frames. Masonry structures: materials; compression and shear capacity. Design of masonry structures in common buildings.

Development of the course and examination
LEARNING EVALUATION METHODS
Examination is developed through written test and oral tests. During the written test the student has to develop problems shown in theoretical lessons and exercises; oral test concerns the analysis of project developed during the course of Laboratorio Tecnica delle Costruzioni.

LEARNING EVALUATION CRITERIA
Examination is positive if the student demonstrates knowledge about theoretical and practical concepts developed during the course of Tecnica delle Costruzioni and Laboratorio di Tecnica delle Costruzioni.

LEARNING MEASUREMENT CRITERIA
Criteria of measure are linked to the level of knowledge of structural engineering problems and methods of calculus.

FINAL MARK ALLOCATION CRITERIA
The written test and the discussion about the project are evaluated from 0 to 30 points; the positive final vote is equal or higher than 18 points.The exam is considered positive with a vote equal or higher than 18 points. Maximum vote 30 points is reached with a very good structural knowledge; a maximum vote cum laude is assigned to excellent students.

Recommended reading
R. Giannini Teoria e Tecnica delle Costruzioni Civili Ed. CittàStudi, 2011; R. Capozucca Teoria e Tecnica delle Strutture in Muratura Ed. Pitagora, BO, 2014.

Tecnica delle Misurazioni Applicate

Stefano Pirani

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
This course introduces students to the knowledge and understanding of the methodologies and techniques for the organization and management of the quality control of an industrial product.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The course provides ability to organize and manage the quality control of an industrial product
TRANSVERSAL SKILLS:
The course will help to gain the knowledge of non-technical implications of engineering practice

Program
The discussion on the "design of the experiments (DOE)" techniques will show how it is possible to optimize the performances of the experimental activity with respect to the " information vs cost " and the "information vs noise" performances. The study of the main "statistical tests" will provide the tools necessary to perform "inferences" through tests carried out on a limited sample. The study of the theory of the electrical devices ageing will provide the tools necessary to perform "accelerated life tests". The study of the architectures of the automatic test systems will allow to acquire the skills necessary to plan an Automatic Test Equipment (ATE) with real and/or virtual instrumentation.

Development of the course and examination
LEARNING EVALUATION METHODS
Written and oral (optional) exam.

LEARNING EVALUATION CRITERIA
Student has to demonstrate his knowledge on the topics.

LEARNING MEASUREMENT CRITERIA
numeric mark up to 30/30 for written and oral exam (minimum sufficient mark is 18/30).

FINAL MARK ALLOCATION CRITERIA
Final mark is equal to the mean of the marks.

Recommended reading
G. Vicario, R. Levi, "Calcolo delle probabilità e statistica per gli ingegneri", Esculapio Editore - Progetto Leonardo, Bologna; Norma ISO 9000; Norma UNI-UNIPREA 4546 "Misure e misurazioni: termini e definizioni fondamentali.

Tecnica delle Strutture

Roberto Capozucca

Seat Ingegneria
A.A. 2016/2017
Credits 12
Hours 96
Period E

Prerequisites
Knowledge of differential calculus and basic concept of theory of elasticity.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course gives knowledge and comprehension s ability on the complexity of design structural process. It allows students to acquire advanced knowledge on the structural behavior of normal reinforced concrete and steel elements. This knowledge integrates the already acquired notions from the courses of mathematical analysis, physics and structures mechanics, and constitute those detailed studies, which are going to increase knowledge in the structural field, and in particular, for what concerns the building s design. The educational path consists of a study, which, staring from requests for reinforced concrete and/or steel buildings, allows to define the method to calculate service and ultimate conditions. Modality and didactic instruments for the learning are frontal lessons in class or individual exercises.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
For the purpose of facing structural design themes - even very complex ones - and of illustrating the innovation and development of new products and technological processes throughout the knowledges application, students will be able to interpret structural behavior, already introduced in the structure s mechanics, and to develop correct engineering applications. This capacity will be expressed through a gamut of professionalizing abilities, such as: 1. the ability of choosing the appropriate structural elements; 2. The capacity of elaborating static models and schemes for structural elements related in particular, to building elements; 3. The ability of interpreting the laboratory analysis and monitoring s results.
TRANSVERSAL SKILLS:
The students elaboration of a design related with practice - which will be confronted in groups and will bring to a written report together with tables of calculus - will give contribute for the improvement of the degree of independence in the structural choice. The communicative capacity, which comes from the team work too, will improve the ability to analyze many structural aspects.

Program
Fundamental concepts for structural design of reinforced concrete, steel and masonry are developed during the course lessons. Calculus of plane frames with force method and displacement method. Reinforced concrete: materials; concrete and steel for RC ; bond of steel bars embedded in concrete; linear elastic analysis of RC structures and ultimate state: normal force; bending of RC beams; shear. Limit analysis of RC structures: flexural design of beams and frames. Common foundation structures. Steel structures: materials and methods of analysis; trusses, frames, joints and constraints. Elements of design of steel frames. Masonry structures: materials; compression and shear capacity. Design of masonry structures in common buildings.

Development of the course and examination

LEARNING EVALUATION METHODS
Examination is developed through written test and oral tests. During the written test the student has to solve a frame with methods of calculus shown in theoretical lessons and to design a member of frame; oral test concerns the analysis of project developed during the course and theoretical topics of course.

LEARNING EVALUATION CRITERIA
Examination is positive if the student demonstrates knowledge about theoretical and practical concepts developed during the course of Tecnica delle Strutture.

LEARNING MEASUREMENT CRITERIA
Criteria of measure are linked to the level of knowledge of structural engineering problems and methods of calculus.

FINAL MARK ALLOCATION CRITERIA
The written and oral tests are evaluated from 0 to 30 points; the positive final vote is equal or higher than 18 points.The exam is considered positive with a vote equal or higher than 18 points. Maximum vote 30 points is reached with a very good structural knowledge; a maximum vote cum laude is assigned to excellent students.

Recommended reading
R. Giannini Teoria e Tecnica delle Costruzioni Civili Ed. CittàStudi, 2011; R. Capozucca Teoria e Tecnica delle Strutture in Muratura Ed. Pitagora, BO, 2014.

Tecnica ed Economia dei Trasporti

Amedeo Virgili

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course intends to provide technical and scientific background for planning and managing road infrastructures and transportation systems in urban area. In particular, the course will provide knowledge related to design techniques, analysis methods for critical state and verification and validation tools of technical solutions aimed at improving traffic and road safety.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The course will provide students with specific knowledge about analysis techniques of road infrastructures systems which enable the identification of the design and construction issue in order to plan the most adequate technical solution.
TRANSVERSAL SKILLS:
The acquired analytical and methodological skills aimed to the project definition (from the techniques of territorial investigations to the practice of technical solutions) will be helpful for organizing the course into a widely multidisciplinary context of the Building Engineering. Such an aspect will promote and improve decision-making, communication and learning skills of students in an interdisciplinary framework.

Program
Planning and control of the urban traffic: private offer of transportation, signalized and unsignalized urban interchanges, traffic flow analysis in the urban areas, weaving sections, roundabouts. Public offer of transportation, public transportation systems, bus stations, tramways, subways, innovation systems with automatic driving, mechanized pedestrian paths. Classification of urban road: throughway, district, local and service roads. Roadways, lanes, shoulders, sidewalks, lanes for public transportation. Passages, pedestrian crossings, passage ways for vehicles, service stations, cycle-paths. Crossroads, road junction on different levels; directional, non-directional, semi-directional ramps. Cloverleaf interchange, partial cloverleaf interchange, collector/distributor road, diamond interchange, trumpet. Roundabouts. Automated, synchronized and coordinated traffic-lights. Calculation of traffic-lights cycle. Parking on one level and multi-levels. Fireproof standard specifications. Design methods. Urban traffic planning: standard specification, design general criteria. Traffic flow survey, O/D investigations, parking supply and demand. Networks traffic management. Pedestrian areas and limited traffic zones.

Development of the course and examination
LEARNING EVALUATION METHODS
The examination consists of an oral discussion, based on more questions on general and/or specific topics argued at the lessons and chosen as representative

LEARNING EVALUATION CRITERIA
The student should show an overall knowledge and an adequately correct exposition of discussed contents, with the use of proper technical terminology. Learning level is considered sufficient if the assessment achieved for each question is sufficient. The full marks is achieved on the basis of a complete understanding of discussed topics, with proper exposition and complete use of technical language

LEARNING MEASUREMENT CRITERIA
Allocation of the final mark which is expressed out of 30 with possibility of laude

FINAL MARK ALLOCATION CRITERIA
The final mark is given as weighted average of the assessments of learning level demonstrated during the oral discussion. It is right clarify that, in accordance with the learning assessment criteria adopted, even a single question with negative mark is prejudicial for the examination success

Recommended reading
Marino de Luca, Tecnica ed economia dei trasporti , ed. Cuen. Highway Capacity Manual , Transportation Research Board. Ennio Cascetta, Teoria e metodi dell ingegneria dei sistemi di trasporto , ed. Utet. G. Ferrari, M. Riccardi POSTO AUTO Ed. BE-MA V. Dell'Aquila, V. Vannucci MANUALE DI TECNICA DELLA CIRCOLAZIONE E METODI DI MISURA DEL TRAFFICO - Ed. Maggioli R. Bortoli, IL TRAFFICO NEI CENTRI STORICI Ed. MPF P. Ferrari, F. Giannini INGEGNERIA STRADALE Vol. I Geometria e progetto di Strade, Ed. ISEDI G. Da Rios PROGETTO DI INTERSEZIONI STRADALI Ed. UTET T.Esposito, R.Mauro FONDAMENTI DI INFRASTRUTTURE VIARIE Ed Hevelius Slide presentation shown in classroom that are available on the official teacher page on UNIVPM website in the Section Allegati-Download paper . This material is password-protected; the teacher will give the password to the students.

Tecnica Urbanistica

Giovanni Marinelli

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course allows students to acquire advanced basic knowledge of the different urban and regional components: technological infrastructures, settlement patterns and fabrics, historical and identity values, environmental resources, widespread settlements and rural contexts, in order to develop the technical skills required to define projects on different scales and plan actions to programme and manage interventions.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student must be able to correctly interpret urban and territorial phenomena, identify critical aspects and the potential of the systems analysed, propose alternative intervention scenarios of structure and spatial organisation, prepare reports and regulations. This design procedure will be expressed by means of written and graphic exercises developed in work groups.
TRANSVERSAL SKILLS:
The application of the basic concepts is integrated with the acquisition of cross-disciplinary skills whose scope is to develop multi-sectoral integration skills of the territorial critical-interpretative analysis processes and the ability to prepare design intervention actions to resolve urban and territorial problems, even specifically for road and technological networks, and hydrogeomorphological protection.

Program
The course allows students to acquire advanced basic knowledge of the different urban and regional components: technological infrastructures, settlement patterns and fabrics, historical and identity values, environmental resources, widespread settlements and rural contexts, in order to develop the technical skills required to define projects on different scales and plan actions to programme and manage interventions. The student must be able to correctly interpret urban and territorial phenomena, identify critical aspects and the potential of the systems analysed, propose alternative intervention scenarios of structure and spatial organisation, prepare reports and regulations. This design procedure will be expressed by means of written and graphic exercises developed in work groups.

Development of the course and examination
LEARNING EVALUATION METHODS
The evaluation of the 'students' learning by a written test on the content of the course. The trial to be completed in two hours, is divided into five questions. The trial is conditional on the delivery of the documents prepared during the class exercises

LEARNING EVALUATION CRITERIA

The student must demonstrate that they understand the concepts presented in the course by passing the written test and the activities proposed exercises in the classroom

LEARNING MEASUREMENT CRITERIA
The final score, expressed out of thirty points, is given a final overall assessment relates to the commitment demonstrated during the course, the skills acquired by the student, the score of the work done during exercises and the marks obtained in the written test.

FINAL MARK ALLOCATION CRITERIA
The success of the evaluation is given by the attainment of a positive final rating on the elaborate exercises and at least a score of 18/30 in the written test. The highest rating is attributed to show a thorough understanding the contents of the course in the written test e classroom activities.

Recommended reading
Bronzini F., Bedini M.A. Imbesi P. Marinelli G. The measure of the Urban Plan , Vol 2, Gangemi, Roma, 2014; Secchi B. First lesson of Urban Studies , Laterza, Roma ristampa 2013; Gasparrini C. In the city on the cities , edizioni List, collana Babel, 2015

Tecnica Urbanistica (EA)

Fabio Bronzini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 90
Period 1s

Prerequisites
None

Program
The aim of the course is to provide skills in the editing of the PRG and sub ordered plans. Topis Communications based on the interpretation of the forms and functions of the contemporary city. Critical study of the city and government of the territory. The course covers the topics of urban design, urban planning, landscape and infrastructures. Specific topics: 1. Aspects of Urban Design. (Hands-on application. The urban); 2. Urban zoning: tables of analysis and project values. (Hands-on graphical representation and calculation procedures);3. implementation plans; 4.Infrastutture and Landscape, case studies and experiences in Europe; 5. The urban green networks, case studies and experiences in Europe; 6. Innovative tools for urban regeneration: STU, Project Financing and program agreements; 7. Masterplan and urban transformation; 8. Ecocitys and eco-friendly neighborhoods, new national and international experience; 9. New Italian Urbanism legislation; 10. Priority projects for urban regeneration in the urban city of Ancona new tool; 11. Examples of urban transformation project: The Green Comet Conero from the historic town , ecological networks and the system of pedestrian and cycle paths as part of connection / improvement of the city; 12. Experiences of urban planning: The PRG of Jesi, the Structure Plan in Bologna and Milan; 13. The Shanghai Expo, Better City Better Life , to new modes of urban quality; 14. The governance of the territory of the suburbs: the critical settlement pattern Marche Region exercises in progress. The course aims to provide students with basic knowledge to interpret the general planning and implementation tools. We produce maps for analysis and design tutorials and graphic analysis of urban space and territory

Development of the course and examination
LEARNING EVALUATION METHODS
The evaluation of the 'students' learning by a written test on the content of the course. The trial to be completed in two hours, is divided into five questions. The trial is conditional on the delivery of the documents prepared during the class exercises.

LEARNING EVALUATION CRITERIA
The student must demonstrate that they understand the concepts presented in the course by passing the written test and the activities proposed exercises in the classroom.

LEARNING MEASUREMENT CRITERIA
The final score, expressed out of thirty points, is given a final overall assessment relates to the commitment demonstrated during the course, the skills acquired by the student, the score of the work done during exercises and the marks obtained in the written test.

FINAL MARK ALLOCATION CRITERIA

The success of the evaluation is given by the attainment of a positive final rating on the elaborate exercises and at least a score of 18/30 in the written test. The highest rating is attributed to show a thorough understanding the contents of the course in the written test and exercise, and expressing a good display capacity in the presentation of the works of the laboratory.

Recommended reading

TEXT BOOKS: F.Bronzini, M.A.Bedini, G.Marinelli, Il respiro italiano, Gangemi Editore 2015; Fabio Bronzini, Paola Nicoletta Imbesi, Maria Angela Bedini. Il Corsivo di Giuseppe Imbesi, La misura del Piano. Valutazione comparata della qualità nei piani urbanistici , Vol. 1, Gangemi Editore, Roma, 2014. Fabio Bronzini, Paola Nicoletta Imbesi, Maria Angela Bedini, Giovanni Marinelli, Francesco Alberti, Giuseppe Michelangeli, introduzione di Paolo Colarossi, La misura del Piano. Strumenti e strategie , Vol. 2,, Gangemi Editore, Roma, 2014 OTHER REFERENCE BOOKS: M.A. Bedini, F. Bronzini, The new territories of urban planning: The issue of the fringe areas and settlement filaments, Land Use Policy, Volume 57, pp. 130 138, 30 November 2016. F.Bronzini, M.A.Bedini, G.Marinelli (a cura di), Mterritorio numerotre, Ancona Univerity Press, Ancona, 2015

Tecniche del Controllo Ambientale

Costanzo Di Perna

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Heat transfer

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire advanced knowledge of fundamental techniques of environmental control in buildings. This knowledge, by integrating the knowledge gained in the teachings of Technical Physics, will form the insights that will enrich the knowledge of the field of thermal comfort, in the acoustic and lighting comfort, so that the student acquires a clear awareness of the wider multidisciplinary context of with a clear reference to the aspects specifically related to the sustainability of the living environment.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to address advanced design themes, even of considerable complexity, and treat the innovation and development of new products and new technological processes through the application of knowledge, the student will be able to face an evaluation of the parameters characterizing the thermal comfort, acoustic and lighting of an environment. This ability consists in a number of vocational skills, such as: 1. the ability to choose the building components and systems to achieve thermal comfort; 2. the ability to choose the building components and systems for acoustic comfort; 3. the ability to choose the building components and systems to achieve a lighting comfort.
TRANSVERSAL SKILLS:
The execution of a series of design exercises, which will be conducted in class during the course will help improve the design capacity, and the use of IT tools for the construction of thermal plants by the student.

Program
Analysis of calculation methods in the field of building energy efficiency of the system / equipment and thermal and visual comfort of the indoor environment. Systems and plant components for the lighting and air conditioning. Technical assets and liabilities for the environmental control of the building. Estimation of thermal loads winter and summer. Calculation of the energy required for hot water. Energy certification of buildings.

Development of the course and examination
LEARNING EVALUATION METHODS
The exam consists of an oral examination. If necessary, the questions, whose answer requires the execution of short calculations, will be carried out in writing together with the oral test.

LEARNING EVALUATION CRITERIA
The student, in the course of the oral examination, must demonstrate knowledge of the major techniques for environmental monitoring. To pass the oral exam, the student will demonstrate an

overall knowledge of the contents with the use of appropriate terminology technique. The highest rating will be achieved by demonstrating in-depth knowledge content, shown with complete mastery of technical language, using appropriately such knowledge to solve simple problems related to techniques for environmental monitoring

LEARNING MEASUREMENT CRITERIA
Attribution of the final grade in thirty

FINAL MARK ALLOCATION CRITERIA
The oral exam will consist in three questions, each of which will be evaluated with a score ranging between 0 and 10 points. The praise will be given to students who, having achieved the highest rating, have demonstrated full mastery of the subject

Recommended reading
Notes provided by the lecturer

Tecniche Diagnostiche per l'Edilizia

Alberto Giretti

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Knowledge of the building materials and of the main building technologies

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to deepen students' knowledge of the diagnostic process, as well as their knowledge and expertise of the main techniques of analysis and survey of the anomalies of technical systems, also through the analysis of case studies. This course strengthens and widens the knowledge acquired within the courses called Technology of Building Materials and gives student the capability of working out assumptions regarding the reasons connected with building pathologies.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Students will learn the methodologies for the diagnosis of building pathologies, as well as the techniques for the control of related consequences.
TRANSVERSAL SKILLS:
The course will widen the ability of students of dealing with problem solving situations. In addition, they will be able to management legal controversies and will develop skills relative to team-working.

Program
Lesson topics (57 hours) 1. The process of Diagnosis. 2. Diagnistic models. 3. Degradation of materials and building sub-system faults (resume). 4. Measurement and surveying techniques. 5. Case Studies. Exercises (15 hours) 1. Analysis of common building pathologies. Application off FMEA to the definition of building pathology scenarios 2. Application of probability calculus to the assessment of results of technical surveys 3. Analsys of siple structural anomalies and assessment of the results of the main measurements and survey techniques. 4. Analisys of Radargrams (A-Scan and B-Scan) of Ground Penetrating Radar surveys 5. Analysis of building thermographies and assessment of vapour condensation in wall surfaces.

Development of the course and examination
LEARNING EVALUATION METHODS
Learning assessment is achieved through an oral discussion of the results of the course exercises. Then knowledge about course topics and skills concerning the testing procedures and on-site surveys techniques will be evaluated though questions and brief exercices.

LEARNING EVALUATION CRITERIA
The student's learning degree will be assessd by testing the knowledge level on a sample of the course topics, by assessing the competence level reached on the usage of varius measurement equipments introduced during the course, and on the ability of identifying specific pathologies and of planning coherently the diagnostic process.

LEARNING MEASUREMENT CRITERIA
Knowledge level is measured through the quality of the answers provided by the learner. Competence about testing equipment usage is assessed through the oral discussion of practical cases simulated during the exam. Finally, the diagnostic process planning skill will be evaluated through the discussion typical building pathology scenarios.

FINAL MARK ALLOCATION CRITERIA
The learner achieves the minimum mark by demonstrating good knowledge on all the topics of the exam questions.The leraner achives higer marks, progressively,by showing good competence in conducting on-site testing (procedural aspects), by by demonstrating ability in processing testing results, and, finally, in planning more complex diagnostic processes.

Recommended reading
Course materials will be provided during the lectures

Tecniche per l'Informatica Distribuita

Luca Spalazzi

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Operating systems, Software engineering.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire the technical knowledge and skills for distributed computing, especially service-oriented architectures, cloud computing and cyber security. This knowledge, integrated with the notions acquired throughout the course of Software Engineering", will give students insights into software design, so that they will gain a clear understanding of opportunities and risks related with the most recent technologies.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to deal with advanced and complex design issues and with innovation and development of new software systems, the student must be able to properly apply the mot recent design methodologies and techniques for distributed computing. This ability will be expressed through a number of professional skills, such as: 1. designing and developing a software with a service-oriented architecture; 2. designing and developing a software based on cloud computing; 3. designing and evaluating the security of a cyber system.
TRANSVERSAL SKILLS:
Working in team to solve a problem and writing the related report will improve the independence of judgment in general, the communication ability (also stemming from teamwork), and the ability to autonomously learn and draw conclusions of the student.

Program
Service Oriented Architecture (web services and RESTful services). Cloud computing (IaaS, PaaS, SaaS). Computer and network security (requirements, tools, and methods)

Development of the course and examination
LEARNING EVALUATION METHODS
The learning evaluation consists of two parts: 1) individual oral exam - a discussion about three topics from the syllabus; 2) group project - a group of 4 or 5 students must design a software agreed with the teacher and present the results. The group can choose a project that is also valid for the course: Software Engineering

LEARNING EVALUATION CRITERIA
1) Individual oral exam - students must know what are methods, techniques, and standards to be used in distributed computing. 2) Group project - the group must be able to apply such methods and techniques to the development of a software and to produce a final project report.

LEARNING MEASUREMENT CRITERIA
1) Individual oral exam: each one of the three topics assignes a score up to 10. The final mark for

the oral exam is the average score. 2) Group project - the review process takes into account the completeness and correctness of the final report (up to 20 marks), the software quality (up to 20 marks), and the presentation (up to 20 marks). The final mark for the group project is the average score. Up to 1 bonus mark is assigned according to group autonomy.

FINAL MARK ALLOCATION CRITERIA

Individual oral exam: up to 10 marks Group project: up to 21 marks Final mark: the sum of the previous two marks. 31 marks is equivalent to 30 e lode (full mark with distinction).

Recommended reading

K. Hwang,J. Dongarra,G. Fox. Distributed and Cloud ComputingFrom Parallel Processing to the Internet of Things . Elsevier

Tecnologia degli Elementi Costruttivi (EA)

Massimo Lemma

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 90
Period E/1s-2s

Prerequisites
Basic Knowledge of building systems and building components

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
In this course the basic knowledge about UE basic requirements for Construction Works will be provided. The fundamentals of Performance Based Building Design (PBBD), basics and detailed analysis in multi-disciplinary projects will be performed. The difference between top-down and bottom-up design will be clarified. In the Workshop, students will look into building construction techniques and their relationship with the architectural constraints and viewpoint.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
This course provide students with the ability to set up any complex design process. In order to do that, the basic building actions assessment and design aims (Mechanical resistance and stability, Safety in case of fire, Safety and accessibility in use a.s.o.) will be considered. Every design choice must be justified by regulation or technical reasons. In the Workshop module, students will acquire knowledge about technical drawings and building specifications.
TRANSVERSAL SKILLS:
Students will be able to assess performance level assessment as connected with Design targets. They will acquire the technical knowledge needed to convey in the correct language technical choices. They will develop team co-working and self-sufficiency abilities in sources search (e.g. ISO, EN specifications).

Program
Basics of Performance Based Building Design (PBBD). UE-Requirements satisfaction in Building Design. Performances in Buildings and their technologies Safety in Building Contructions: Loadbearing Capacity; Fire Safety and Safety in Use. Customer planning documents (contents, techniques a.s.o.) are discussed. Building requirements and features are analysed (three levels foreseen by the standards) Management of the building design. In-depth analysis of the contents and methods expected in the different design steps Knowledge of the EN and ISO standards (building materials, building elements, design methods).

Development of the course and examination
LEARNING EVALUATION METHODS
Design and schemes of the lectures: discussions

LEARNING EVALUATION CRITERIA
Knowledge, Ability and Behaviours are evaluated

LEARNING MEASUREMENT CRITERIA
Know how, how do, being in work are main measurement criteria

FINAL MARK ALLOCATION CRITERIA
Average score of discussions

Recommended reading
Materials necessary would be provided during the lectures

Tecnologia dei Materiali

Gabriella Roventi

Seat Ingegneria
A.A. 2016/2017
Credits 3
Hours 24
Period II

Prerequisites
the student should have a basic culture of chemistry

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to give students knowledge about the most common families of materials for engineering purposes and their structural micro and macroscopic characteristics. This knowledge, by integrating the knowledge gained in the teachings of the basic sciences, are intended to implement technical training and scientific base of the students on the physical and mechanical behavior of materials and direct their preparation taking into account the interdisciplinary nature of the topics covered.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to address the design project successfully, which are the basis of the practical applications of knowledge, the course aims to provide students with the information to know correctly interpret the reasons for the behavior of various metallic materials, when used in engineering practice. These qualities will be acquired through the illustration of the microstructural characteristics related to those macroscopic ones, and with the aid of practical examples. The professionalism of the students will be demonstrated by means of different capacities, such as: 1- the identification of the appropriate technology to obtain a material with the desired characteristics; 2- the ability to identify the type of the material based on the analysis of the microstructure; 3- the ability to indicate what are the appropriate tests for the characterization of the mechanical properties.
TRANSVERSAL SKILLS:
The knowledge acquired from the students allow the group discussion of topics related to a type of material, which will result in the drafting of a report. What the student will get used to working in partnership with others to improve the capability of independent assessment, communication skills and awareness also of any related issues such as environmental and economic ones.

Program
Classification of materials. Solid state: cristalline and amorphous structure of solids. Identification of crystallinity in solids. Lattice defects, point and linear defects. Mechanical properties of metallic materials, elastic and plastic deformation; stress-strain curves; concept of ductility, brittleness and hardness. Family of metallic materials (carbon steel, stainless steel, aluminum and copper alloys). Basis concepts of metallic corrosion: theoretical an practical nobility of metals; Pourbaix diagrams; active-passive behavior of metals; short account of some typical forms of corrosion. Polimeric materials: mers and polymers. Polimerization grade and average of molecular mass. Polimerization by addition mechanism. Polimer structure: amorphous and crystalline state. Structure and properties of some polimer materials obtained by addition or step or cross-linking polymerization. Structure and properties of principal technopolimers. Industrial methods of polymerization. Workability of thermoplastic and thermosetting polimers. Elastomers: natural and SBR rubbers. Vulcanization process.

Development of the course and examination

LEARNING EVALUATION METHODS

The assessment of student learning consists of two tests: - A written test, consisting in the solution of some exercises and some theoretical questions, for a total of 5-6 problems that will focus on topics covered in the course. The written test will be completed in two hours. - An oral test, consisting in the discussion of one or more topics covered in the course. During the oral test it will also be discussed the performance gaps found in the written test. The written test is preparatory for the oral exam and for accessing to it, the student must have obtained at least a pass in the written test. The oral examination must be taken in the same session of the written test. In case of failure of the oral exam, the student will have to repeat the written test.

LEARNING EVALUATION CRITERIA

To successfully pass the whole examination, the student must demonstrate, by means of the tests described above, to have an overall knowledge of the topics covered during the course. The highest points are achieved by demonstrating an exhaustive understanding of the course contents and the ability to relate the material properties with their structure.

LEARNING MEASUREMENT CRITERIA

For each of the tests specified before, it is assigned a mark between zero and thirty. The final mark, related to thirty, is the average of the marks obtained in the two tests, with the approximation by excess to the upper integer.

FINAL MARK ALLOCATION CRITERIA

In order to obtain an overall positive evaluation, the student must achieve at least a pass, amounting to eighteen points in each of the tests described above. Full marks with distinction is given to students who, having done all the tests correctly, have demonstrated a complete knowledge of the course topics.

Recommended reading

W.F. Smith, J. Hashemi Scienza e tecnologia dei materiali , McGraw-Hill; AIMAT, Manuale dei materiali per l ingegneria , McGraw-Hill.

Tecnologia dei Materiali da Costruzione

Saveria Monosi

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Knowledge, even if not deep, of chemistry and solid state physics.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The aim of the course is to supply knowledges on traditional materials, as concrete, steel, masonry and innovative materials as fiber reinforced polymers and other types largely used in building construction.These materials are addressed to produce new constructions and to recovery existing building heritage. The matter is to increase the critical capacity in order to issue diagnosis and to select interventions, without losing sight of the sustainability of choices.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Students have to connect knowledge of the structure to mechanical properties and durability of the materials. Students achieve positive results if they are able to demonstrate a thorough knowledge of the contents and to use them to solve problems related to material properties and sustainable development. The knowledge acquired must be correctly exhibited by using appropriate technical terms.
TRANSVERSAL SKILLS:
Critical capability, achieved by means problem solving exercises, have to be demonstrated by written examination and oral short exposition of several themes; in addition, the skill of learning and judgment and the communication ability, suitable to work in team, must be shown.

Program
Building materials: an outline of production technologies. Durability and deterioration of building materials and their rehabilitation opportunities. Air setting and hydraulic binders; their historical development. Concrete: cement, aggregates and admixtures. Concrete at early ages: workability, compacting factor. Hardened concrete: curing conditions, mechanical properties and durability (EU standard classification). Ceramic materials: stones and bricks for buildings. Modern and ancient masonry: role of water as deterioration agent of porous solids; materials for restoration. Wood for buildings: timber structure, mechanical properties and durability; treatments of maintenance and/or restoration. Steel for structural use and metal alloys in relation to their use in buildings. Metals and environments: corrosion and a short account about protection methods. Polymers in buildings: mechanical and physical properties together with ageing. Exercices(12): Computing mix proportions for some widely used concrete. Concrete manufacturing in materials laboratory; compressive and bending tests on concrete specimens and tensile test on steel specimens.

Development of the course and examination
LEARNING EVALUATION METHODS
The assessment of learning will take place by means of a written test consisting of one or two exercises of mix design and questions about the topics covered during the lessons, aimed at verifying the correct learning and understanding of the transferred knowledge. The instructor

reserves the right to perform any additional oral evidence.

LEARNING EVALUATION CRITERIA
The student will demonstrate the ability to connect knowledge on the structure , mechanical properties and durability of materials. To successfully pass the written test and the oral test, if necessary, the student will demonstrate a general knowledge of the contents, exposed correctly with the use of proper technical terminology . The highest rating is achieved by demonstrating a thorough understanding of the content and being able to use that knowledge to solve problems related to the relationship between structure and properties of the material.

LEARNING MEASUREMENT CRITERIA
The vote will be attributed to adding the evaluation of the written test and the the oral examination. The student will be able to achieve up to a maximum of 30 marks in the written test. The oral test consists of two or three questions, can confirm the grade obtained with the written test or could lead to a positive change or negative. The praise will be given to students who, having achieved the highest rating, have demonstrated full mastery of the subject

FINAL MARK ALLOCATION CRITERIA
Awarding of the final mark into thirtieths

Recommended reading
G.D Taylor, Materials in Construction. Principles, Practise and Performance, Pearson Longmann; M. Collepardi, Il Nuovo Calcestruzzo, Tintoretto, Villorba (TV); L. Bertolini, Materiali da costruzione, CittàStudi edizioni AIMAT; Manuale dei materiali per l ingegneria, McGraw Hill, Italia, Milano, 1996.

Tecnologia delle Materie Plastiche e dei Compositi

Gabriella Roventi

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
the student should have a basic culture of chemistry, physics and material science

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course has the aim to give to the students the useful knowledge to relate the structure of polymeric materials with their technological properties. This knowledge, by integrating the knowledge gained in the basic science courses, are intended to extent the students education in Industrial Engineering on polymeric materials and their applications, with particular attention to their biocompatibility, where necessary.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to address the issues related to the engineering applications and innovations, the course aims to provide to the students the tools for designing and producing articles made of polymeric material and, more generally, to provide to the students the ability to solve problems, to formulate suitable solutions. This ability will be gained through a number of vocational skills, such as: 1. the ability to distinguish the various types of polymeric materials in order to be able to choose the one most suitable for a specific application; 2. the ability to identify the problems associated with a given material and/or plastic articles in order to suggest the best strategies for their solution; 3. the ability to perform experiments, even complex ones, with or without laboratory equipment and the ability to perform critical analysis of possible experimental data.
TRANSVERSAL SKILLS:
The knowledge gained by the students allow them to improve their independent judgment skill on issues and their solution strategies, using critically specialist literature and always keeping in mind the respect of human health. This last point provides the ability to the Biomedical Engineer to work with other professionals, especially in the medical field.

Program
Definition of polymeric materials. Simple polymerization processes for thermoplastic and/or thermosetting polymers. Structure of polymer materials. Amorphous and semi-crystalline materials. Mechanical and rheological properties in relation to the structure of polymeric materials. Characterization tests on plastic materials. Modification of the properties of virgin polymers with additives and/or fillers to obtain the compounds used in the processing technologies. Concepts of shear viscosity, elongation viscosity, viscoelasticity and relaxation time. Theoretical models for studying the viscoelasticity. Obtaining a master curve with exercises by means of PC. An outline of compression and transfer moulding. Injection moulding. Analysis of designing critical parameters for the products and the moulds; analysis of process parameters. Volume shrinkage. Moulding cycle. Examples of industrial problems met on injection moulding. Extrusion of solid and hollow profiles. Particular characteristics of the screw. Simplified rheological study of the plasticizing barrel-screw system. Extrusion operating point. Forming dies and calibrators. Production of plastic sheets and films. Processes of calendering, thermoforming, injection-blow moulding, extrusion-blow moulding.

Examples of industrial processes. Mechanical properties of composite materials with polymer based matrix. General characteristics of the filler elements as fibers and particles.

Development of the course and examination

LEARNING EVALUATION METHODS

The assessment of student learning consists of two tests: - a written test, consisting in the solution of some exercises and some theoretical questions, for a total of 6-7 problems that will focus on topics covered in the course. The written test will be completed in two hours. - an oral test, consisting in the discussion of one or more topics covered in the course. During the oral test it will also be discussed the performance gaps found in the written test. The written test is preparatory for the oral exam and for accessing to it, the student must have obtained at least a pass in the written test. The oral examination must be taken in the same session of the written test. In case of failure of the oral exam, the student will have to repeat the written test.

LEARNING EVALUATION CRITERIA

To successfully pass the whole examination, the student must demonstrate, by means of the tests described above, to have an overall knowledge of the topics covered during the course. The highest points are achieved by demonstrating an exhaustive understanding of the course contents and the ability to relate the properties of polymeric materials with their structure, as well as the basic principles of their production processes.

LEARNING MEASUREMENT CRITERIA

For each of the tests specified before, it is assigned a mark between zero and thirty. The final mark, related to thirty, is the average of the marks obtained in the two tests, with the approximation by excess to the upper integer.

FINAL MARK ALLOCATION CRITERIA

In order to obtain an overall positive evaluation, the student must achieve at least a pass, amounting to eighteen points in each of the tests described above. Full marks with distinction is given to students who, having done all the tests correctly, have demonstrated a complete knowledge of the course topics.

Recommended reading

H. Saechtling, Manuale delle materie plastiche 7° ed., Tecniche Nuove, Milano, 1996. S. Bruckner, G. Allegra, M. Pegoraro, F. P. La Mantia, Scienza e Tecnologia dei Materiali Polimerici 2° ed., EdiSES, Napoli, 2007. G. Gozzelino, Materie Plastiche, Hoepli, Milano, 2007.

Tecnologia Edile

Fabio Bufarini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Basic notions typical of Building Construction, ie basic principles of analysis of the problems related to the design and implementation of construction projects of medium complexity

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The relations between buildings components and technologies on one hand and their performances on the other hand will be analyzed. The performances of building components will be analyzed based on the framework of EN Building Standards about fire safety, safety in use, thermal and acoustical performances and sustainability. The course extends the knowledge provided by the other course Building Performance, by means of a bottom-up approach, that relates any building component with all the technical issues of buildings. Regular construction works will be discussed within classes.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to be able to control the design and execution of quite complex buildings, students will be able to relate building components one another, and to assess their respective operational potentials. Proper drafting of technical specifications is the main expertise acquired during the course.
TRANSVERSAL SKILLS:
Students will be able to carry out performance level assessment of any building component straight from qualification documents and to compare them with the ones provided about competitive components. They will be able to properly draft technical documents and to search relevant standards (ISO, EN specifications).

Program
THE BUILDING : The Systems and Types Constructive aspects of the main mechanical requirements, stability and usability, accessibility in use: The continuous structures (load-bearing masonry) and punctate structures (steel, reinforced concrete) - The frame structures - Foundations - the elevation facilities - the containment structures - Closures external Vertical - Horizontal Closures basic - intermediate Horizontal Closures - the Covers - the internal Partitions

Development of the course and examination
LEARNING EVALUATION METHODS
The evaluation will be through an oral exam, during which the student is asked to present the main concepts and intellectual frameworks / practices of the construction technology of building systems and individual components shown in class. It also requires the student to extend the analysis of issues relating to design and construction of building projects at different design levels, particularly at the executive level (the special conditions of contract) in relation to the technical characteristics of the components and their operational capabilities

LEARNING EVALUATION CRITERIA
In the exam, the student must demonstrate the ability to use independently and correctly, the methodologies, models and tools of design of construction technology of building systems and individual components presented in class; Furthermore, the student must demonstrate sufficient capacity to judge, seleazionare and clearly presented ideas, concepts and technological solutions of its own building system.

LEARNING MEASUREMENT CRITERIA
Is evaluated during the exam, the student's independent ability to set, analyze and provide response (ie typical methodology of the "know how" in the ways and means used by the candidate to address the specific unit of information, abstraction schemes) to problems that are placed. also is evaluated, the ability to use it properly and relevant metodologies, own models and tools for the design and technological solutions of its own building system.

FINAL MARK ALLOCATION CRITERIA
The maximum vote, equal to thirty with honors, is awarded to students who demonstrate, in the exam, full autonomy to set and solve problems and complete mastery of methods, models and tools of design and technological solutions own building system. The minimum voting, equal to eighteen, is assigned to students who demonstrate to be able to solve problems that are placed and sufficient knowledge of the methods, their models and tools for the design and technological solutions of their building system.

Recommended reading
ecture notes and slides of the course

Tecnologia Meccanica (M/Z)

Archimede Forcellese

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Knowledge on fundamental aspects concerning the most common engineering materials, technical drawings and stress and strain states is required.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire advanced knowledge on the processes required to transform the raw material into finished products with market value, through processes carried out on machines or systems. This knowledge, by integrating notions acquired in the courses of metallurgy, machine design and mechanical drawing, will form the insights that will enrich knowledge and operational capabilities in the field of manufacturing processes in mechanics, so that the student acquires a clear awareness of the wider multidisciplinary context of engineering
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to address advanced design themes, even of considerable complexity, and treat the innovation and development of new products and new processes through the application of knowledge, the student will have able to determine method of carrying of the main manufacturing processes. This capacity will appear through a series of professionalising skills, such as the ability to appropriately choose the process able to produce the product with the design specifications and to evaluate the effect of the process parameters on the product costs and properties.
TRANSVERSAL SKILLS:
The resolution of individual and group exercises in lecture room will contribute to improve both the learning skills autonomously and the degree of independent judgment, both the communication skills that also stems from teamwork

Program
INTRODUCTION. Definition, the product life cycle, the main manufacturing processes, relationship between processes and materials, technological system, accuracy of transformations. METAL CASTING. Fundamentals of casting and classification, mold, pattern, core, undercut, pouring of the molten metal, cooling effects, castability. Expendable mold casting processes: sand casting and mold making, other expendable mold casting processes. Permanent mold casting processes: the basic permanent-mold process, low pressure casting, die casting (cold-chamber and hot-chamber die casting). METAL FORMING. Fundamentals of plasticity, constitutive models, tension test, axysimmetric and plane strain compression tests, friction, strain energy method, workability, classification of metal working processes. Forging: definitions, forgiability, forging machines, factors affecting the die filling, flashing, open die forging, close die forging and other related processes, flash formation, preforming, forging forces. Sheet forming: anisotropy and formability of sheet metals. Shearing, blanking, and punching. Sheet bending: V bending, elastic springback, bending force, other bending processes. Deep drawing of axysimmetric parts: engineering analysis, choice of process parameters, calculation of the blank diameter. Deep drawing of non axsimmetric parts and sheet stamping. MATERIAL REMOVAL PROCESSES. Definitions, cutting and feed motions,

cutting parameters, theory of chip formation in metal machining, actual chip formation, types of chip, build up edge, cutting forces, specific energy, thermal aspects in cutting, threedimensional cutting, machinability, tool wear and tool life, Taylor tool life, cutting tool technology: Machining operations: turning, drilling, reaming, milling and grinding. WELDING PROCESSES. Fundamentals of welding. Welding processes: arc welding, protective gas arc welding. Resistance welding. LASER welding.

Development of the course and examination

LEARNING EVALUATION METHODS

The evaluation is based on an oral exam in which the student must answer four questions chosen among the topics of the course.

LEARNING EVALUATION CRITERIA

The student has to demonstrate the ability to deal with the analysis of the main manufacturing processes used in mechanical engineering by applying, autonomously, the metodologies and tools of manufacturing technologies. Aspects, such as the mastery of technical language and clarity of exposition, will also be assessed. Finally, the ability to properly use the acquired knowledge in solving simple problems must be proven.

LEARNING MEASUREMENT CRITERIA

The ability to independently deal with the topics of the course by applying the methods and tools of the manufacturing technologies, the clarity of exposition, the mastery of technical language are evaluated.

FINAL MARK ALLOCATION CRITERIA

The four questions asked in the oral test have the same weight in the assignation of the final grade. The minimum score, equal to eighteen points, will be achieved by the students who demonstrate sufficient capacity to answer to all the questions raised. The maximum grade, equal to thirty points with honors, will be given to students who have proven full mastery of the topics, exposed in full autonomy and with appropriate technical language.

Recommended reading

F.Gabrielli, R. Ippolito, F. Micari, Analisi e tecnologia delle lavorazioni meccaniche , McGraw-Hill, Milano, 2008. Slides of the lectures uploaded to the Moodle platform of the Polytechnic University of Marche.

Tecnologie Applicate al Trattamento dei Rifiuti Solidi

Gabriele Fava

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables to acquire knowledge about current practices and state-of-the-art developments as well as the organizational and legislative framework to prevent and handle urban and hazardous waste. Particularly, knowledge on the quantity and quality of the waste, the regional per capita production and collection, agricultural and small and medium scale industry wastes will be considered. By-products, reuse, recovery and disposal according to sanitary landfill, mechanical-biological treatment, gasification, incineration and composting plants will provide insights that will enrich the knowledge of the solid waste sector. At the end of the course, the student will acquire a clear awareness of the wider multidisciplinary context of environmental engineering, with a clear reference to the strictly connections between management technologies of solid waste and other potentially hazardous materials with the risk assessment for the protection of the environment and human health.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to address the environmental issues related to the multi-sector waste management and polluted sites, upon completion the student should be able to correctly interpret the concepts, and the principles for the acquired knowledge, or those commonly addressed in the actual engineering practice. This ability will be expressed through a number of vocational skills, such as: 1. Regulatory requirements and the attribution of CER code for the correct classification of the waste; 2. the ability to identify the appropriate technologies for the disposal of waste into an environmentally safe conditions; 3. the ability to properly interpret the results of the of environmental monitoring, working in a team with other elements involved in the study of the evaluation.
TRANSVERSAL SKILLS:
The execution of problem solving done within a joined panel will lead to a reports and will help to improve either the degree of judgment independence in general and the ability to communicate deriving from the teamwork aptitude or the ability to learn independently and to draw conclusions, by the student.

Program
Municipal, industrial and Hazardous Wastes. Reuse. Legislation and disposal Technologies. Source Reduction, Collection and Transfer Operations, Recycling. Packaging waste, recovery and disposal. Solid Waste Management and Resource Recovery, MSW sanitary Landfills, gas and leachate production, gas production models, quality and control. Waste-to- Energy. RDF Production. Thermal destruction plant, Incinerators technologies. Gaseous pollutant emissions and control technologies. Mass and energy analysis. Composting Technologies, Compost production, Compost quality. Odor assessment. Discarded Materials. Risk Assessment. Material Life-Cycle Assessment perspective. . Cleaner Production and SGA.

Development of the course and examination
LEARNING EVALUATION METHODS

Oral assessment

LEARNING EVALUATION CRITERIA
student's ability to identify and manage the key issues of waste disposal

LEARNING MEASUREMENT CRITERIA
Attribution of the final mark out of thirty

FINAL MARK ALLOCATION CRITERIA
the exam will fail for more than 30% of unanswered questions

Recommended reading
C.Francia. La termodistruzione del rifiuto urbano:recupero energetico ed emissioni. Hyper s.r.l Tchobanoglous, Integrated solid waste management. Ed. Mc Graw Hill - J.R Conner Chemical fixation and solidification of hazardous wastes Ed Van Nostrand

Tecnologie dei Materiali

Valeria Corinaldesi

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
Basic knowledge on chemistry and physics.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire advanced knowledge on the main characteristics of three kinds of materials: metals, polymers and ceramics. Such knowledge, by integrating that acquired on the course of metallurgy, will be a deepening, which should increase the knowledge on the materials' technology sector. In this way, the student will acquire clear awareness of the wider multidisciplinary contest of engineering, with clear reference to aspects directly related to production systems and technologies
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to address advanced design themes and treat the innovation and development of new products and new technological processes through the application of knowledge, the student should be able to correctly interpret the structural behaviour of materials as well as the related technological aspects already analysed in other courses and usually encountered in the engineering practice. This will be reflected in a range of professional skills, such as: 1. the ability to choose the most suitable material in relation to the required properties; 2. the ability to correlate the materials' structure with their mechanical properties
TRANSVERSAL SKILLS:
The problem solving will contribute to improve the independent judgement skills of the students, the communication skills as well as their ability to learn and draw conclusions.

Program
Classification of materials. The solid state: crystalline and amorphous structure. Materials properties: microstructure, porosity, density, mechanical properties and thermal properties. Main properties of metals depending on their microstructure. Ceramic materials: silicates structure and fundamental concepts on clay and clay minerals. Traditional and innovative ceramics and their crystalline structure. Silica glasses. Technology of production of glasses and ceramics. Binders. Polymers: monomers, polymers, copolymers. Degree of polymerization and number-average molecular weight. Addition polymerisation. Stereoisomerism. Polymer structure: amorphous and crystalline state. Structure and properties of the thermoplastic polymers obtained by means of the addition polymerization. Poly-condensation reaction: synthesis of nylon 6,6 and polyethylene terephthalate (PET). Structure and properties of thermoplastic and thermosetting polymers obtained by means of the condensation polymerization. Industrial methods for polymerisation. Processing of thermoplastic and thermosetting polymers. Creep of polymer materials. Fracture of polymer materials. Aging of polymer materials. Elastomers: natural rubber and SBR rubbler and vulcanization process. Structure of composite materials: matrix and reinforcing material. Composite materials durability. Polymer-, metal- and ceramic-based composites. Wood. Ageing, corrosion and deterioration of materials. Metals, polymers and ceramics deterioration. Deterioration causes of

cement-based materials.

Development of the course and examination
LEARNING EVALUATION METHODS
The exam will consist of an oral examination, in which the topics of the course will be discussed; it will consist of three questions related to three different topics among them illustreted in the course.

LEARNING EVALUATION CRITERIA
During the oral examination, the candidate should exhibit a proper knowledge of the properties, behaviour, production technology and applications of the different classes of materials.The student will get maximum score if able to show deep knowledge on the varior topics of the course as well as if able to coherently describe concepts.

LEARNING MEASUREMENT CRITERIA
A score will be attributed to each of the three questions with a grading scheme based on a scale of 30 points: 0 score menas question not answered; 18 score means sufficently answered question, while 30 score means fully answered question; intermediate scores as a consequence.

FINAL MARK ALLOCATION CRITERIA
The final grade (to a maximum scale of thirty) will be the mean value of the scores obtained for each answer. The mean value will be calculated on three answers, but if the difference in the scores is higher than 10, a fourth question will be made and the final score will be the mean value calculated on four scores, the last included.

Recommended reading
W.D. Callister Jr., "Materials Science and Engineering. An introduction", John Wiley & Sons.
PDF-format files of the slides presented during lectures, uploaded on the Moodle platform.

Tecnologie e Sistemi di Lavorazione

Mohamad El Mehtedi

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Fundamentals of the basic tools of the scientific method.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire advanced knowledge on the manufacturing industry manufacturing processes as well as the design mode and production management systems. This knowledge, by integrating the knowledge gained in the teachings of metallurgical technologies, materials technology and design, will form the insights that will enrich knowledge and operational capabilities in the area of manufacturing technologies, so that the student acquires a clear awareness of the wider multidisciplinary engineering framework.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to address advanced project issues, even of considerable complexity, and treat the innovation and development of new products and new technological processes through the application of knowledge, the student will be able to define manufacturing and machining cycles suitable to realize manufactured products. Such ability is expressed through a number of vocational skills, such as the ability to appropriately choose the process capable of realize the product with the desired design specifications and the capability to assess the effect of the process parameters on the economy of the processing and on the properties of the product made, using a systemic approach.
TRANSVERSAL SKILLS:
The resolution of individual and group exercises in classroom will help to improve both the learning skills autonomously and the degree of independent judgment, both the communication skills that also stems from teamwork.

Program
The transformation of raw materials into products. Description of simple process plans . Metal casting. Fundamentals of casting. Casting processes: sand casting and mold making, other mold casting processes, permanent mold casting processes. Metal forming. Fundamentals of metal forming and plasticity. Bulk deformation processes in metal working, forging and other related processes. Sheet metal forming processes. Dies and presses for bulk and sheet metal forming. Material removal processes.Theory of metal cutting. Machining operations: turning, drilling, reaming, milling, slotting, broaching and grinding. Grinding and finish operations. Welding mentions. General purpose machines and components.

Development of the course and examination
LEARNING EVALUATION METHODS
The exam consists in a written test composed of questions and exercices. Once obtained a sufficient score it is possible to integrate the written test with an oral one consisting in oral questions. It is expected to make in itinere tests to be performed individually or group tests. The

Dublin descriptors will be taken into account.

LEARNING EVALUATION CRITERIA
In the written test the student should demonstrate to have completely, correctly and clearly understood the arguments and the methodologies and to be able to solve simple exercices in a complete, correct and clear way. The oral exams have the end to allow an improvement in the score obtained in the written test. The student will be able to know the arguments and the methodologies and to solve simple individual or group tests evaluated taking into account the Dublin descriptors.

LEARNING MEASUREMENT CRITERIA
The score is in thirtieths.

FINAL MARK ALLOCATION CRITERIA
The final score in thirtieths is obtained by the sum of the scores obtained in each question and excercise. The score is considered sufficient when it is equal to eighteen and maximum when it is equal to thirthy. While in the first case a general knowledge is required, in the second case the student should be able to achieve the objectives defined though the Dublin descriptors. In the case of group tests it will be necessary to extrapolate the contribution of the individual student.

Recommended reading
slide of the course and text books.

Tecnologie Metallurgiche

Marcello Cabibbo

Seat Ingegneria
A.A. 2016/2017
Credits 3
Hours 24
Period II

Prerequisites
none.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
At the end of the course, students will be able to master the main mechanical properties of the most diffuse metallic materials. They will also have to develop a skill of the use of the given theoretical tools for the metallic material selection procedures in the mechanical engineering filed.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
At the end of the course, students will have to: 1. acquire the skill to select a specific metallic material, or a narrow range of metallic materials, for the engineering production of specific components; 2. acquire the knowledge of the major mechanical properties of the most diffuse metallic materials for the engineering.
TRANSVERSAL SKILLS:
The proposed practical exercise on the metallic material selection methods will give to the students a sufficient confidence of the theoretical means for a proper selection methodology of metallic materials, for many of the engineering fields.

Program
Mechanical properties of metallic materials. Steels: properties, classification and specific application fileds. General purposes steels. Construction steels. Tool steels. Stainless steels. Cast irons. Elements of Aluminum alloys, Titanium alloys and Superalloys. Metallic materials selections criteria for the structural and design engineering (included 3-hour trial on a specific case study).

Development of the course and examination
LEARNING EVALUATION METHODS
The student will have to pass a written and oral evaluation. The written part refers to the metallic material selections critera, and, in particular, to a practical case study to solve. The oral exam focuses on the metallic materials properties.

LEARNING EVALUATION CRITERIA
The student will have to show a sufficient level of knowledge of all the topics included in this course.

LEARNING MEASUREMENT CRITERIA
Base 30 points for both the written and oral evaluation. The final mark will be the mean evaluation between the two.

FINAL MARK ALLOCATION CRITERIA
The oral examination will be structured in three queries, each of them will be evaluated from a minimum of 0 to a maximum of 10. The lode will be assigned to those students that will show

excellent knowledge in all the three queries, and the written case study proposed.

Recommended reading

Walter Nicodemi: Metallurgia Principi Generali e Gli Acciai , Zanichelli.

Tecnologie per i Sistemi Informativi

Claudia Diamantini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Knowledge of the functioning principles of computers acquired in courses of fundamentals of computer science.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire advanced knowledge of architectures and technologies of modern information systems and of the relationship between information technology and organizational structure. It also provides basic knowledge of the management of information at the operational level and of the principles and models behind Business Intelligence and Data Analysis
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will be able to apply the knowledge to adopt the correct computer technology according to the needs of the particular application and organizational context, to manage, query and analyze corporate data.
TRANSVERSAL SKILLS:
The course provides students with the opportunity to improve their autonomous judgment and learning skills, in addition to communication skills, also thanks to the opportunity to develop and discuss in-depth work and synthesis of topics from different information sources or the possibility to participate in project activities.

Program
- Introduction to enterprise information systems: basic definitions, the information perspective of organization theory, classes of enterprise information systems. - Operational information systems, ERP systems, Databases and database management systems, relational model, database querying, SQL language, database design and ER model. - Decision support information systems: data warehouse, olap, elements of data mining techniques.

Development of the course and examination
LEARNING EVALUATION METHODS
The assessment of student learning consists of two parts: - A written test consisting of open-ended and closed-ended questions on the course topics related to databases and database management systems. The written test may be replaced by the design of a data base or the development of a survey on advanced course topics; - An oral examination, on topics related to enterprise information systems, and on any shortcomings detected in the course of the previous test. To access the written exam, the student must have obtained at least a pass in the written test or project. The project can be done in groups, with a maximum of three students. A positive outcome of the project gives access to the oral examination in the same appeal or in subsequent appeals. Conversely, the written test must be performed in the same session of the oral examination In case of failure of the oral exam, the student must also repeat the written test.

LEARNING EVALUATION CRITERIA
To successfully pass the assessment of learning, the student must demonstrate, through the tests described above, a good understanding of the concepts related to the technologies for the management of information systems presented in the course, and must demonstrate to be able to correctly apply methodologies for design and management of a data base.

LEARNING MEASUREMENT CRITERIA
During the tests it is assessed the degree of completeness and depth achieved in knowledge and understanding of issues and technical solutions presented. It is also assessed the ability to use in a correct and autonomous way models and methodologies for solving problems.

FINAL MARK ALLOCATION CRITERIA
A score between zero and 30 is assigned to each of the two tests indicated above. The overall grade is between zero and 30, calculated as the average of the marks obtained in the two tests. In order for the overall outcome grade to be positive, the student must achieve at least a pass, amounting to eighteen points in each of the two tests, showing a basic knowledge and understanding on all the questions proposed, and the ability to autonomously solve simple problems, or problems of medium complexity with the help of the teacher. The highest rating is achieved by demonstrating a thorough understanding of the course content in the tests. The praise is reserved for students who have demonstrated a particular brilliance in the oral and in the preparation of written assignments.

Recommended reading
- C. Batini, B. Pernici, G. Santucci (curatori), Sistemi Informativi, Franco Angeli, 2005. - G. Bracchi, C. Francalanci, G. Motta, Sistemi Informativi d'Impresa , McGraw-Hill, 2010. - P. Atzeni, S. Ceri, P. Fraternali, S. Paraboschi, R. Torlone, Basi di dati , 4° ed. , McGraw-Hill, Italia - Further material provided by the teacher on the course site hosted by the University learning management system, https://lms.univpm.it

Tecnologie per i Sistemi Informativi (IA)

Claudia Diamantini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Models and languages for relational database management, basic concepts of algebra e logics, basic concepts of probability theory

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire advanced knowledge on the management and analysis of data in centralized and distributed environments. In particular: logical models, architectures and methodologies for the design and management of Big Data in modern distributed information systems, understaning advantages and limitations of the different solutions; data base management systems technologies both in a centralized and distributed environment; models and techniques for Business Intelligence and Data Analytics (multidimensional model and OLAP analysis, DataWarehouse, Data Mining techniques).
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will be able to use and configure in an advanced way database management systems, to design and manage the distribution of data in the most suitable manner for the particular application context, ensuring efficiency, flexibility, autonomy and cost containment, to extract knowledge from data evaluating the quality of results.
TRANSVERSAL SKILLS:
The development of a project that will be done in small groups, and that will lead to the writing and presentation of a report, will help to improve student's ability to make judgments as well as the ability to communicate that also stems from teamworking. Along with the study based on different materials this will also help developing student's learning and synthesis skills.

Program
- Technologies for centralized data management: physical organization of data on secondary storage, DBMS architecture, query management, transaction processing management. - Architectures for the manamagement of data in distributed information systems: distributed DBMS, fragmentation and allocation, transparency, elements of distribution design. Federated DBMS, database integration. - Technologies for distributed data management: distributed query and transaction processing. Big Data management in cloud systems: NoSQL models, replication and inconsistency, CAP theorem. - Business Intelligence e Data Analytics: datawarehouse architecture and multi-dimensional model, data warehouse design, Data Mining.

Development of the course and examination
LEARNING EVALUATION METHODS
Evaluation is based on two tests: - The development of a project or term paper in which the student deepens one of the topics of his interest. The project can be done in groups, composed of a maximum of three students. For the development of the projects periodic reviews are planned, in which students are required to organize an oral presentation of the project results, and the

production of a report documenting the activities undertaken and the results obtained. - An oral exam, consisting of the exposition of concepts and theoretical aspects on one or more topics covered in the course. The two tests can be performed in any order.

LEARNING EVALUATION CRITERIA
To successfully pass the assessment of learning, the student must demonstrate, through the tests described above, a good understanding of the concepts presented in the course on technologies for the management of information systems and must demonstrate the capability of personal reflection and deepening, critical thinking and problem solving abilities in the execution of project activities.

LEARNING MEASUREMENT CRITERIA
During the tests it is assessed the degree of completeness and depth achieved in knowledge and understanding of the issues. It is also assessed the ability to use in a correct and autonomous way models and methodologies for solving problems.

FINAL MARK ALLOCATION CRITERIA
For the first test a maximum of 6 points are awarded for projectual/experimental activities, and a maximum of 4 points to survey reports summarizing others studies, comparing results an so on. This score is added to the marks obtained in the oral exam, which ranges between zero and 24, for an overall grade ranging between zero and 30. In order for the overall outcome grade to be positive, the student must achieve a pass, equal to 15 points in the oral test, demonstrating a basic level of knowledge and understading on the topics covered in the test, and a score greater than zero in the project, linked to the achievement of the objectives set. The highest rating is achieved by demonstrating a thorough understanding of the course content and excellent ability to carry out the project. The praise is reserved for students who have demonstrated a particular brilliance in oral exposure and development of the project.

Recommended reading
- P. Atzeni, S. Ceri, S. Fraternali, S. Paraboschi, R. Torlone, Basi di Dati: architetture e linee di evoluzione , McGraw-Hill. - M.T. Özsu and P. Valduriez, Principles of Distributed Database Systems, 2nd edition , Prentice-Hall - Further material provided by the teacher on the course site hosted by the University learning management system, https://lms.univpm.it

Tecnologie per il Controllo dell'Inquinamento

Luca Riderelli

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course allows students to obtain advanced skills in the selection of technological measures for pollution mitigation and evaluation of equilibria established in the environmental compartments. The new acquired topics are integrated in bachelor s and master s degrees in civil environmental engineering.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
New professional and technical learnt skills permit students to argue and independently manage the application of solutions for pollution mitigation and technological measures for air quality in specific case studies. In addition, students will be able to identify, interpret and deal with planning issues. Similarly, they are involved in managing air quality, air pollution, indoor air quality and health and safety at work topics.
TRANSVERSAL SKILLS:
Personal technical skills, autonomous decisions, data analysis, knowledge of both new and available widespread technologies and communication skills are developed and strengthened. The study of real cases, application and explanation of national and international regulations allows to relate to international contexts in order to boost personal skills in the future professional career.

Program
Indoor and outdoor air quality. Norms and regulations. Air pollutants strategies for prevention and control of air pollutants. Emission factors. Uncontrolled pollutant emission rates. Measurements of process gas stream. Pollutant material balance. Pollutants dispersion and stack design. Height computation and evaluation of emitting stacks. Stability classes. Box model. Gaussian plume models, plume rise. Capturing gases and vapors. Condensation. Indoor air pollution and workplace safety evaluation. Harmful compounds, toxicity, threshold limit values. Industrial ventilation. Adsorption and chemical reaction thermal oxidation. Bioscrubbers and biofilters. Gravimetric settling in chambers. Capturing particles. Overall collection efficiency. Cyclone collector particulate scrubbers, electrostatic separators, fabric filters. Water pollution in rivers and lakes. Streeter and Phelps model for oxygen-sag. Environmental control technologies for air, water and soil. Greenhouse gas control technologies. Cleaner production and environmental management. Practice exercises about indoor pollution modeling, emissions and stack design.

Development of the course and examination
LEARNING EVALUATION METHODS
Written and oral assessment.

LEARNING EVALUATION CRITERIA
Both written and oral questions to assess student s ability to identify and manage the main environmental pollution issues.

LEARNING MEASUREMENT CRITERIA
Attribution of the final mark out of thirty.

FINAL MARK ALLOCATION CRITERIA
Students are supposed to be confident on 70% at least of the course program.

Recommended reading
P.M. Berthouex, "Strategy of Pollution Control", John Wiley and sons; J.H. Seinfeld, "Atmosferic Chemistry and Physics of Air Pollution, John Wiley & sons, 1986; A.C. Stern, R.W. Bonbel, D.F. Fox, "Fondamentals of Air Pollution (II Ed.), Academic Press, 1984; R. Vismara, "Ecologia Applicata", Hoepli.

Tecnologie per l'Automazione e la Robotica

Gianluca Ippoliti

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Elements of automation and control; Elements of computing engineering; Elements of electronics

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide students with knowledge on the technologies needed for the design and implementation of systems and equipment for automation and industrial robotics. Such knowledge, integrating the notions of automatic control, computer science and electronics acquired in the teachings of the previous years, will be the insights that will enrich knowledge on automatic systems for the control and management of systems and equipment for automation and industrial robotics. In this way, students can gain a clear awareness of the wider multidisciplinary context of the engineering, with a clear reference to the aspects strictly connected with the application of the principles underlying the analysis of dynamical systems and analysis, design and synthesis of control systems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student will be able to apply the acquired know to design and implement systems for automation and industrial robotics. This ability will give skills to the students , such as: 1. the ability to appropriately select the most suitable technology for the design and development of automatic control systems; 2. the ability to find models, approaches, and the most appropriate algorithms for the formalization of simple control problems; 3. the ability to work in the laboratory, to design and conduct appropriate experiments, interpret the data and draw conclusions, working in teams with other elements involved in the study of the problem.
TRANSVERSAL SKILLS:
The execution of an exercise to solve a problem that will be done in team and that will lead to a report, will improve in the students the degree of independence of judgment, the ability to communicate with others members of a team, and the ability to learn independently and to draw conclusions.

Program
Introduction to the process control. Control system architectures. Measurements in control systems. Measuring devices. Data acquisition systems. Electric drives. Static and dynamic analysis of DC motors, stepper motors, brushless motors and AC motors. Power semiconductors devices. Electric power converters. Programmable logic controllers (PLC). Local area networks for automation. Elements of industrial robotics.

Development of the course and examination
LEARNING EVALUATION METHODS
The evaluation is oral. In the oral exam the student is asked to present the knowledge gained on the technologies and methodologies for the design and development of systems and equipments for automation and industrial robotics, illustrated during lessons. An optional project on one of the

topics covered during the lessons is proposed to each student.

LEARNING EVALUATION CRITERIA
The student, during the oral test, has to, independently and correctly, present and discuss the eventual developed project and demonstrate that she/he has the necessary knowledge and expertise on the technologies and methodologies for the design and development of systems and equipments for automation and industrial robotics, illustrated during lessons. In addition, students must demonstrate sufficient capacity to judge, select, synthesize and clearly explain ideas, concepts and technological solutions presented during lectures.

LEARNING MEASUREMENT CRITERIA
During the exam, is evaluated the student's independent ability to set and solve the posed problems. It is also evaluated the ability to properly use the technologies and methodologies for the design and development of systems and equipments for automation and industrial robotics.

FINAL MARK ALLOCATION CRITERIA
The final mark is assigned summing up the evaluation of the oral examination and of the eventual developed project. The student can achieve up to a maximum of 10 points in the project. The oral exam is divided into two or three questions, depending on whether or not the student will present the project. Each question is evaluated with a score ranging from 0 to 10 points. The maximum mark, equal to thirty points cum laude, is awarded to students who demonstrate a full autonomy to set and solve problems and complete mastery of the technologies and methodologies for the design and development of systems and equipments for automation and industrial robotics. The minimum mark, equal to eighteen, is assigned to students who demonstrate to be able to solve placed problems and sufficient knowledge of the technologies and methodologies for the design and development of systems and equipments for automation and industrial robotics.

Recommended reading
G. Magnani, G. Ferretti, P. Rocco, Tecnologie dei Sistemi di controllo , McGraw Hill, seconda edizione, Milano, 2007. P. Chiacchio e F. Basile, Tecnologie Informatiche per l Automazione , McGraw Hill, Milano, 2004. G. Marro, Componenti dei Sistemi di Controllo , Zanichelli, Bologna, 1984. M. E. Penati, G. Bertoni, Sistemi di controllo: modellistica e tecnologie , Zanichelli, Bologna, 1989. Teaching materials: https://lms.univpm.it/

Tecnologie per le Telecomunicazioni

Ennio Gambi

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Basic concepts on mathematical analysis

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
Through the study of the signal theory and of the most important telecommunication elements, the course enables students to acquire knowledge needed to understand the issues related to transmission of information, to the definition of the trasmission technology and to know how to apply design procedures of communication systems. The course, by integrating the knowledge gained in previous courses like mathematical analysis and electromagnetic fields, provides the student with a technical background on telecommunication.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student must be able to identify the time/frequency relationship for signals, the basis of signal modulations and of deterioration causes, and to implement appropriate design choices of engineering practice related to TLC systems. This ability will be developed in practice through a number of vocational skills, such as the ability of system dimensioning, to correctly choose the right transmission medium, and the associated system architecture and to identify the causes of performance degradation, and the suitable countermeasures.
TRANSVERSAL SKILLS:
Training activities on time/frequency relationship and laboratory sessions will help improve the student s ability to learn independently and to draw conclusions. Both the student s ability to communicate and his/her independence of judgment in general, will be stimulated and refined, through oral discussions.

Program
Contents (Classroom lessons 64 hours): Introduction to communication technologies: wired and wireless solutions. Fundamental quantities in telecommunications. Telecommunication signals. Concepts of probability Transmission channels end media. Quality of telecommunications systems: noise and distortion. xDSL and Optical Fiber technologies Radiomobile technologies. Computer network: wired and wireless solutions. Sensor networks Domotic systems. Laboratory activity (8 hours): Signal generation and their study in time/frequency domain Noise and distorsion effects

Development of the course and examination
LEARNING EVALUATION METHODS
The exam consists of an oral test, during which the student is asked to present the main concepts and technological solutions related to the Technologies for TLC.

LEARNING EVALUATION CRITERIA
The student, during the oral test, will demonstrate the knowledge and methodological and technological expertise about the Technologies for TLC. To successfully pass the oral exam, the

student must demonstrate an overall understanding of the teaching content, with a sufficiently corrected use of technical terminology. The highest rating will be achieved by demonstrating a thorough understanding of teaching content, exposed with complete mastery of technical language.

LEARNING MEASUREMENT CRITERIA
During the examination the student's independent ability to set and solve problems that are placed will be evaluated. It shall also assess the ability to use properly the relevant methodologies and models of the Technologies for TLC.

FINAL MARK ALLOCATION CRITERIA
The highest rating is awarded to students who demonstrate during the exam, full autonomy to set and solve problems and complete mastery of the methodologies and models of the Technologies for TLC. The minimum grade is assigned to students who demonstrate during the exam, to be able to solve problems that are placed and sufficient knowledge of the methodologies and models of the Technologies for TLC.

Recommended reading
Couch Digital and Analog Communication Systems Pearson

Tecnologie Web

Alessandro Cucchiarelli

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
basic knowledge of computer programming.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide students with the ability to understand the technologies underlying the World Wide Web and the knowledge required to build applications in this domain. The acquisition of such knowledge will allow the students to expand the skills acquired in the other courses, related to programming languages and programming methodologies and architectures of computer systems and computer networks.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
At the end of the course the students will be able to design Web applications of medium-complexity, by correctly and efficiently using state of the art technologies and architectures. In particular, they will be able to: 1. Structure documents with the HTML language; 2. Dynamically change the document content, by using the JavaScript language, in response to actions performed by the application s user; 3. Code server side programs in PHP to produce dynamic contents; 4. Use advanced development tools such as JavaScript libraries and PHP framework; 5 Use asynchronous interaction models between Client and Web Server, based on AJAX and JSON encoding technology in the Web applications.
TRANSVERSAL SKILLS:
The creation of a Web application in order to test the students acquired skills, developed within small autonomous groups, will enhance the ability to work in teams, to define solutions to problems in a collaborative perspective, to autonomously gain specific knowledge aimed at reaching the solutions to problems (learning skills), to refine the ability of making judgements and formulation of goals achievable in a given time. The effort to produce the application documentation, required for final assessment, will sharpen the ability to describe both concisely and effectively the result of the work done. Finally, the oral presentation of the application will stimulate the improvement of the students communication skills.

Program
introduction to the fundamental World Wide Web (W3) technologies. The Client/Server architecture: definition, principles and relevant aspects. Its application to the W3. HTML: structure and fundamental tags. Javascript language. PHP language. Zend Framework. jQuery library.

Development of the course and examination
LEARNING EVALUATION METHODS
the examination is organized in two steps: the development of a Web application, aimed at assessing the student's ability to solve a real problem using the concepts and the technologies illustrated in the course and an oral examination, aimed at verifying the level of the conceptual knowledge acquired by the student. A positive evaluation of the Web application (equal to or higher

than 18/30) is a prerequisite for the access to the oral examination, consisting in a preliminary analysis of the application code, followed by a set of questions on the course topics.

LEARNING EVALUATION CRITERIA
the Web application will be evaluated on the basis of the correspondence of its functional characteristics with the given specifications, the correct and effective use of the technologies, as well as in terms of work organization, as emerged during the project revisions. In the oral examination, the candidate must show an adequate knowledge of concepts and technologies used for the development of a Web applications, a proper use of the technical language and the ability to solve simple specific problems. The maximum mark will be achieved by demonstrating in-depth knowledge of the course topics.

LEARNING MEASUREMENT CRITERIA
the student's learning will be measured with a maximum of 30 points.

FINAL MARK ALLOCATION CRITERIA
in order to pass the exam, the student must attain a mark equal to or greater than 18/30 in both the Web application evaluation and the oral examination. The final mark is the average of the evaluations of the two steps and the laude is given to the students who have demonstrated a thorough understanding of the course topics along with the ability to give efficient and effective solutions to the application problems proposed.

Recommended reading
slides copies and code of the examples used for the lectures, downloadable from the course site.

Tecnologie Web (GEST)

Alessandro Cucchiarelli

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
basic knowledge of computer programming.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide students with the ability to understand the technologies underlying the World Wide Web and the knowledge required to build applications in this domain. The acquisition of such knowledge will allow the students to expand the skills acquired in the other courses, related to ICT.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
At the end of the course the students will be able to understand the capabilities of Web applications as tools able to support business management and production, and will have the ability to develop simple Web applications, by correctly and efficiently using state of the art technologies and architectures. In particular, they will be able to: 1. Structure documents with the HTML language; 2. Dynamically change the document content, by using the JavaScript language, in response to actions performed by the application s user; 3. Code simple server side programs in PHP to produce dynamic contents.
TRANSVERSAL SKILLS:
The creation of a Web application in order to test the students acquired skills , developed within small autonomous groups, will enhance the ability to work in teams, to define solutions to problems in a collaborative perspective, to autonomously gain specific knowledge aimed at reaching the solutions to problems (learning skills), to refine the ability of making judgements and formulation of goals achievable in a given time. The effort to produce the application documentation, required for final assessment, will sharpen the ability to describe both concisely and effectively the result of the work done. Finally, the oral presentation of the application will stimulate the improvement of the students communication skills.

Program
introduction to the fundamental World Wide Web (W3) technologies. The Client/Server architecture: definition, principles and relevant aspects. Its application to the W3. HTML: structure and fundamental tags. Javascript language. PHP language. Zend Framework. jQuery library.

Development of the course and examination
LEARNING EVALUATION METHODS
the examination is organized in two steps: the development of a Web application, aimed at assessing the student's ability to solve a real problem using the concepts and the technologies illustrated in the course and an oral examination, aimed at verifying the level of the conceptual knowledge acquired by the student. A positive evaluation of the Web application (equal to or higher than 18/30) is a prerequisite for the access to the oral examination, consisting in a preliminary analysis of the application code, followed by a set of questions on the course topics.

LEARNING EVALUATION CRITERIA
the Web application will be evaluated on the basis of the correspondence of its functional characteristics with the given specifications, the correct and effective use of the technologies, as well as in terms of work organization, as emerged during the project revisions. In the oral examination, the candidate must show an adequate knowledge of concepts and technologies used for the development of a Web applications, a proper use of the technical language and the ability to solve simple specific problems. The maximum mark will be achieved by demonstrating in-depth knowledge of the course topics.

LEARNING MEASUREMENT CRITERIA
the student's learning will be measured with a maximum of 30 points.

FINAL MARK ALLOCATION CRITERIA
In order to pass the exam, the student must attain a mark equal to or greater than 18/30 in both the Web application evaluation and the oral examination. The final mark is the average of the evaluations of the two steps and the laude is given to the students who have demonstrated a thorough understanding of the course topics, along with the ability to give efficient and effective solutions to the application problems proposed.

Recommended reading
slides copies and code of the examples used for the lectures, downloadable from the course site.

Telecomunicazioni

Franco Chiaraluce

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
The Course requires the knowledge of the basic concepts of mathematical analysis and signal theory.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
To know and understand the techniques for information transmission in a generic communication system, both analog and digital, and its protection against noise and disturbances, in such a way as to guarantee link reliability. To be able to measure the amount of information generated by an information source and the means to represent it by physical signals.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student shall be able to interpret correctly the main elements of a communication system, both analog and digital, and to measure the amount of information and the transmission quality. The basic skills so acquired will provide the student with a series of vocational skills, such as: 1. the ability to identify the problems appearing in the design of a TLC system; 2. the ability to convert an analog signal into a digital signal, in an efficient way, and to measure the amount of information relative to the message transmission; 3. the ability to propose suitable solutions to the problems identified; 4. the ability to compare the performance obtainable by using the various possible solutions, identifying the most convenient ones on the basis of existing constraints and prefixed requirements.
TRANSVERSAL SKILLS:
The characterization of a communication system requires different skills: from the information theory to the signal theory, from electronics to informatics. The student shall exploit fruitfully the knowledge acquired in other courses, harmonizing the contents in a unitary vision. At the same time, the course provides basic elements for subsequent courses, more specialized and application oriented. Through the solution of numerical examples, the student will deepen his own ability to analyze critically the results obtained and to solve problems. The capacity to present properly the work done will also stimulated and checked.

Program
Contents (Frontal lectures, 64 hours) - AWGN channel. - Analog modulations. - Quantization. - Information sources and source coding. - Representation of digital signals. - Demodulation and quality in digital transmissions over the AWGN channel. - Spread spectrum techniques. - Outline of channel coding. Classroom exercises (8 hours) - Numerical exercises on the main topics of the course.

Development of the course and examination
LEARNING EVALUATION METHODS
The evaluation of the learning level is organized in two tests: - A written test, consisting in the solution of one numerical exercise, to be completed in approximately one hour (the exact time is

determined by the difficulty level established for the exercise). - An oral test, consisting in the discussion of two or more topics of the course and the critical review of possible mistakes made in the written test. In the written test the student must face a problem of analysis or design for one or more parts of a telecommunication system, by employing the methods, models and maths tools presented in the classes. In the oral test, the student is asked to discuss the techniques for transmission in a telecommunication system and the procedures for measuring, representing and protecting information from superposed disturbances. The written test is propaedeutic to the oral test, in the sense that the student is admitted to the oral test only if he has received a sufficient evaluation in the written test. The oral test should be stood, preferably, in the same session of the written test. Deviations from this rule are possible, but must be agreed with the teacher before starting the written test. In case of negative evaluation of the oral test, the student can decide to retain the result of the written test or to repeat it in the subsequent sessions. The chosen option must be communicated to the teacher before starting the new exam session the student wishes to attend.

LEARNING EVALUATION CRITERIA

Learning evaluation is based on the verification, through the tests, that the student has acquired a sufficient level of understanding and a suitable capacity of employing the topics presented throughout the course, as regards both the theoretical foundations and their application in telecommunication systems.

LEARNING MEASUREMENT CRITERIA

During the exam tests, the teacher evaluates the capacity of the student to analyze properly the basic elements of a telecommunication system and to propose effective solutions to the problems emerged, by using the tools and methods presented during the classes. For the written test, the teacher assigns a mark that, as a function of the quality of the paper, can be: not sufficient, sufficient, fair, good, very good, excellent. The student is non admitted to the oral test if his mark is not sufficient. Any positive mark (sufficent or more), by which the student has been admitted to the oral test, permits the student to reach the maximum final mark (thirty, cum laude if applicable) if he is able to demonstrate that the gaps shown in the written test do not correspond to real deficiencies in the preparation. The final mark, in thirtieths, is the result of the global evluation on the oral and written tests

FINAL MARK ALLOCATION CRITERIA

In order to pass the exam, the student must reach at least a sufficient mark in the written test and show an adequate preparation in the oral test. The maximum mark is reached by showing a deep knowledge of the course topics throughout the tests. Laude is reserved to those students who are particularly brilliant in the oral test, even able to compensate in an excellent way possible gaps emerged in the written test.

Recommended reading

- Esercitazioni numeriche sugli argomenti principali del corso. 1. Set of lectures provided by the teacher, that can be found in the university Moodle platform. 2. John G. Proakis, Masoud Salehi, Communication Systems Engineering , 2nd Edition, Prentice Hall, 2002.

Teoria dei Segnali

Franco Chiaraluce

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
The Course requires the knowledge of the basic concepts of mathematical analysis.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
To know and understand the basic elements for the description and characterization of signals, both deterministic and random, and the problems related with their processing. To be able to apply, in specific scenarios, the techniques learned, with special focus on the representation of signals in the frequency domain and the usage of basic instruments of the probabilistic calculus.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to correctly model the signals of interest (in particular, those of interest in telecommunication systems) the student shall be able to use properly the theoretical and software tools developed for signal analysis and processing. Such a capacity will become evident through some specific abilities that the student shall show, like: 1) the capacity to describe, in suitable domains, an assigned signal and to extract its fundamental features; 2) the capacity to evaluate quantitatively the changes that the signal suffers because of controlled or uncontrolled manipulations; 3) the capacity to use software tools, like Matlab, for the automatic description of the signal. The skills relative to the usage of Matlab will be acquired by the student through specific exercises in the classroom, complementary to the traditional lectures.
TRANSVERSAL SKILLS:
Capacity to use the tools of classic maths (Fourier transform, probabilistic calculus, etc.) in different application environments. Capacity to use software tools adaptable to different contexts (like Matlab). Capacity to discuss with criticism the results obtained on the basis of a comparison between the numerical data and the intuitive expectations. Capacity to present in a concise and clear way the results of his study and elaboration.

Program
Contents (Frontal lectures, 36 hours) - Signal classification: deterministic signals and random signals. - Representation of signals in the frequency domain: continuous time periodic signals and continuous time aperiodic signals. - Linear continuous time monodimensional systems: impulse response, transfer function and linear non distortion conditions. Intersymbol interference. - Sampling theorem: ideal, natural and instantaneous sampling. - Other transforms. - Random variables theory. - Stationary and ergodic processes. Thermal noise. Classroom exercises (12 hours) - Software for the representation and characterization of signals.

Development of the course and examination
LEARNING EVALUATION METHODS
The evaluation of the learning level is organized in two tests: - A written test, consisting in the solution of one numerical exercise, to be completed in approximately one hour (the exact time is determined by the difficulty level established for the exercise). - An oral test, consisting in the

discussion of two or more topics of the course and the critical review of possible mistakes made in the written test. In the written test the student must face a problem of signal analysis or concerning the application of the probability calculus, by employing the methods, models and maths tools presented in the classes. In the oral test the student is asked to explain the basic elements for the description and characterization of signals, both deterministic and random, and the problems related with their processing. Moreover, he is asked to discuss the main concepts of the probability calculus. The written test is propaedeutic to the oral test, in the sense that the student is admitted to the oral test only if he has received a sufficient evaluation in the written test. The oral test should be stood, preferably, in the same session of the written test. Deviations from this rule are possible, but must be agreed with the teacher before starting the written test. In case of negative evaluation of the oral test, the student can decide to retain the result of the written test or to repeat it in the subsequent sessions. The chosen option must be communicated to the teacher before starting the new exam session the student wishes to attend.

LEARNING EVALUATION CRITERIA

Learning evaluation is based on the verification, through the tests, that the student has acquired a sufficient level of understanding and a suitable capacity of employing the topics presented throughout the course, as regards both the theoretical foundations and their application in order to solve specific numerical problems.

LEARNING MEASUREMENT CRITERIA

During the exam tests, the teacher evaluates the capacity of the student to model correctly the signals and to use properly the theoretical and software tools developed for signal analysis and processing. For the written test, the teacher assigns a mark that, as a function of the quality of the paper, can be: not sufficient, sufficient, fair, good, very good, excellent. The student is non admitted to the oral test if his mark is not sufficient. Any positive mark (sufficent or more), by which the student has been admitted to the oral test, permits the student to reach the maximum final mark (thirty, cum laude if applicable) if he is able to demonstrate that the gaps shown in the written test do not correspond to real deficiencies in the preparation. The final mark, in thirtieths, is the result of the global evluation on the oral and written tests.

FINAL MARK ALLOCATION CRITERIA

In order to pass the exam, the student must reach at least a sufficient mark in the written test and show an adequate preparation in the oral test. The maximum mark is reached by showing a deep knowledge of the course topics throughout the tests. Laude is reserved to those students who are particularly brilliant in the oral test, even able to compensate in an excellent way possible gaps emerged in the written test.

Recommended reading

1. Set of lectures provided by the teacher, that can be found in the university Moodle platform. 2. Marco Luise, Giorgio M. Vitetta, Teoria dei Segnali , Terza Edizione, McGraw-Hill, 2009.

Teoria dei Sistemi di Trasporto

Andrea Graziani

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
Basic notions of physics (kinematics, dynamics, thermodynamics), calculus (derivation/integration), differential equations.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The objective of the course is to provide the theoretical background required to analyse and understand the engineering issues related to transportation systems, on a scientific basis. In particular, the course will cover the functional characteristics of road infrastructures and the main operative and safety features of airport infrastructures.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The course will provide students with the ability to analyse and solve practical problems commonly related to the functional design of road and airport infrastructures.
TRANSVERSAL SKILLS:
Analytical and methodological skills acquired during the course will be helpful for solving issues common of other subjects within the framework of Civil and Environmental Engineering, with the aim of improving learning and communication skills in a multidisciplinary context.

Program
Static characteristics, kinematics and dynamics of road vehicles. Traction, friction and adherence. Tyre-pavement interaction, breaking. The road users. Functional classification of roads and road networks. The cross section and its elements. Traffic flow basics. The fundamental diagram and the Greenshielsd model. The law of traffic conservation and the LWR model. Roads apacity and level of service. Functional design of road section, the Highway Capacity Manual approach. The nature of civil aviation and air transport. Aircraft characteristics related to airport design. Computation of runway length, performance curves, the Advisory Circular FAA 150/5325-4B, the ICAO Aerodrome Design Manual. Airside Configuration. Geometric characteristics of the airfield. Obstacle limitation surfaces. Airport lighting, marking and signing. Planning and design of the terminal area. Airfied capacty and delay, the Blumstein model.

Development of the course and examination
LEARNING EVALUATION METHODS
Learning is evaluated through a final exam which consists of a written test and an oral exam. In the written test the student will have to solve practical problems (applications) and answer to theoretical questions. Two hours are generally required to complete the written test. In the oral exam the student will discuss one or more topics treated during the course. A positive score in the written text is necessary for the admission to the oral exam

LEARNING EVALUATION CRITERIA
In order to obtain a positive evaluation, each student shall demonstrate his/her knowledge of the

course topics, with particular reference to the organization and functional design of transportation infrastructures (roads and airports).

LEARNING MEASUREMENT CRITERIA
The score of the written test is calculated by summing the score of each individual question. The final grade is assigned on the basis of such a score and the outcome of the oral exam.

FINAL MARK ALLOCATION CRITERIA
In order to obtain an overall positive grade the student shall obtain a positive score both in the written and the oral exam. Higher grades are obtaind by those student who demonstrate an accurate knowledge of the course topics. The highest grade (30 cum laude) is assigned to the student who also shows an outstanding and brilliant exposition.

Recommended reading
Esposito T., Mauro R., Fondamenti di infrastrutture viarie - Voll. 1 e 2, Hevelius. Torrieri V. Tecnica ed Economia dei Trasporti , Edizioni scientifiche Italiane Horonjeff R., McKelvey F.X., Planning & Design of Airports , McGraw Hill N. Ashford P.H. Wright, Airport Engineering , John Wiley and Sons R. de Neufville, A. Odoni, Airport Systems Planning, Design and Management , McGraw Hill F.A. Santagata, Starde - Teoria a tecnica delle costruzioni stradali

Teoria dell'Informazione e Codici

Giovanni Cancellieri

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
The knowledge of telecommunication systems is recommended.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course allows understanding of the main roles of source and channel coding. Block codes and convolutional codes are treated. Theoretical bounds are discussed regarding encoding and decoding systems. Some practical solutions are presented about radio and cabled transmissions.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student is required to distinguish the main characteristics of a digital transmission. He will be able to understand the different aspects regarding the transmission medium, the channel and the service. He will interpret the need of a coding system, on a single link or end to end.
TRANSVERSAL SKILLS:
The student will use elements of Geometry and Algebraic Calculus for studying the topology describing the best mapping of bit in the signal space. The concept of minimum distance will be introduced from the point of view of generalized metrics. Quality-cost ratios will be adopted for estimating the feature of the transmission system.

Program
- Channel coding applications - Coding gain - Block codes - G and H matrix - Cyclic codes - Shortened and lengthened codes - Examples: Hamming and BCH codes - Convolutional codes - Concatenated codes - Product codes - Turbo codes

Development of the course and examination
LEARNING EVALUATION METHODS
Evaluation of the learning level of the students is based on a single verbal examination. In this test the student is asked for three questions, on different topics: typically one on block codes, one on convolutional codes and one on an encoding-decoding system. The discussion can deal also with quantitative example, of the type developed during the course.

LEARNING EVALUATION CRITERIA
In order to obtain a positive judgment in the evaluation of his learning level, the student has to describe practical situations regarding the questions under consideration, demonstrating the capacity of understanding analogies or differences in them and the possible application fields where error correcting codes are used. He must demonstrate to have a complete ownership of the technical language.

LEARNING MEASUREMENT CRITERIA
To each one of the three questions proposed a proper score is associated. Two correct answers, at least, guarantee the minimum favourable vote of 18/30.

FINAL MARK ALLOCATION CRITERIA
Once established the rules for evaluating the student learning level, the clearness in expressing concepts, the ownership of the language, the capacity of finding connections between different parts of the programme will be elements for increasing the vote, up to 30/30. For attributing the laude, a fourth question is proposed, to which a possible wrong answer, however, does not influence the previous 30/30 result.

Recommended reading
Lecture notes provided by the teacher downloaded from the website https://lms.univpm.it/

Teoria delle Strutture

Lando Mentrasti

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period I

Prerequisites
Fundamentals of theoretical and applied structural mechanics.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course presents the Finite Element Method (FEM) to approximate and discretize an elastic structure that cannot be reduced to elementary models. The focus is both on the mechanical assumptions and on the reliability of the numerical result obtainable. The course is divided into two parts: Part I Matrix analysis of elastic structures. Kinematics and statics (local and global), dof control, duality, assembling, generalized constraints and conditioning. Part II Finite Element Method (FEM). Weak form of the elastic problem via the Minimum of the Potential Energy theorem: general expression of the stiffness matrix. Form functions. Main element typology. Compatibility problems.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student is able to comprehend the principles and the restrictions of a FEM code and to critically assess the reliability of a numerical structural model.
TRANSVERSAL SKILLS:
The presented theory and the discussed issues are the basic theoretical tools to face in autonomy and in a critical way every non-elementary structural design.

Program
The course presents the Finite Element Method (FEM) as a tool to analyse an elastic structure not reducible to elementary models. The focus is both on the mechanical assumptions and on the reliability of the numerical result obtainable. RIGID BODY structures (hints). Kinematics and statics matrix formulation. Principle of the virtual work of the constraint reactions. Virtual Work Theorem, duality. MATRIX ANALYSIS of ELASTIC STRUCTURES. Local stiffness (notable properties), degree of freedom transformation, constraints and kinematical control matrix. External constraints: general treatment, static condensation, mixed variable formulation, releases, non-local constraints (identification). Global stiffness matrix: assembly, topology, bandwidth and profile. Conditioning of the algebraic solution. FINITE ELEMENT METHOD: weak form of the elastic problem (minimum potential energy approach): regularity, discretization, locality. Shape functions: interpolation, completeness, inter-element continuity. FEM morphology: quadrilateral, rectangular, Lagrangean, Serendipity, transition elements, triangular. Derivation of the element stiffness and mass matrices. Placement of distorted element (isoparamentric element properties). Hints on the Weak Formulation of the continuum structural problems (physical meaning). Geometrical, non-linear and dynamics aspects behavior are occasionally sketched. Brief history of the matrix analysis of structures. Training in FEM, numerical and symbolic codes.

Development of the course and examination
LEARNING EVALUATION METHODS
Oral exposition on the main subjects presented in the lectures (with discussion of a possible

numerical application, suggested by the student)

LEARNING EVALUATION CRITERIA
Suitability of the argumentation, from both the theoretical and application pont of view.

LEARNING MEASUREMENT CRITERIA
Correspondence with the arguments presented in the lectures.

FINAL MARK ALLOCATION CRITERIA
Weighted evaluation, with special regards to synthesis, distinctive aspects and completeness. Personal research and evaluation are favorably encouraged.

Recommended reading
Corradi Dell'Acqua, Meccanica delle Strutture Vol 1 e 2, McGraw-Hill 2010 Fish, Belytschko, A first Course in Finite Elements , Wiley 2007 Luongo, Paolone, Meccanica delle Strutture , Casa Editrice Ambrosiana, 1997 Supplementary material is distribuited during the lectures and is available on the UnivPM site (or sent via e-mail on request).

Teoria e Applicazioni delle Microonde

Marco Farina

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
It is assumed that the student be familiar with the theory of electromagnetics

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
This course introduces students to the knowledge and understanding of advanced concepts of the theory of microwave components. Knowledge will be broadband, setting the course in an interdisciplinary context. Students will be able to understand and to know as well as to define-innovative techniques for design and analysis of high frequency components and circuits.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The course provides applying knowledge of the advanced theory of microwave components to problems of analysis and synthesis of microwave components and circuits, emphasizing applications in emerging domains such as nanotechnology.
TRANSVERSAL SKILLS:
This course has been designed in order to highlight link to different disciplines, thereby improving students ability to learn individually. By proposing applications in innovative areas of microwave theory, the course improves the student ability in assessing the possible application of emerging technologies in design problems. By focusing on interdisciplinarity, students are introduced to tools enabling team working with experts from different disciplinary areas.

Program
Lessons (64 hours): Recap on the guided propagation and transmission lines; modal representations and discontinuities in waveguides; Hertz potentials and loaded waveguides; Green functions; analysis and techniques of analysis of planar structures; Galerkin method; resonant cavities; passive and active microwave circuits; advanced microwave measurement techniques; synthesis techniques; SPM microscopy and microwave microscopy (SMM); nuclear magnetic resonance and EPR resonance; Laboratory (8 hours): VNA calibration; SPM scans.

Development of the course and examination
LEARNING EVALUATION METHODS
Assessment of student learning is performed through an oral examination. The oral examination consists of a discussion of some of the topics covered during the course. The number of arguments is not fixed, but is a function of the behavior in the oral examination. Failing an oral test does not preclude registration to the following exams.

LEARNING EVALUATION CRITERIA
In order to successfully pass the assessment, the student must demonstrate ability in mastering the concepts introduced in the course; in particular, students must demonstrate that they are able to derive, demonstrate and connect relations and properties at the base of the theory and design of devices and microwave components.

LEARNING MEASUREMENT CRITERIA
The exam is performed in order to assess: 1) the efforts made by the student in the preparation of the exam 2) what the student has learned, and what actually understood 3) student's ability to develop its own considerations and criticisms of the concepts studied and the skills to use them independently, applying to issues not explicitly covered in the course 4) the possible impact of particular personal circumstances (emotional, communication and learning problems, kind of triennial course previously attended by the student).

FINAL MARK ALLOCATION CRITERIA
The use of the learning measurement criterion 1) enables to establish a rating between 0 and 20; criterion 2) , obviously if criterion 1) is satisfied, allows to rate the student between 20 and 28), while criterion 3) allows to assign marks between 28 and 30. All ratings are weighted by the criterion 4), according to which the duration of the examination may vary greatly. During the course are explicitly mentioned topics of extreme complexity, optional, that, if learned by those who have been proven to meet criterion 3), allow to get the laude mark.

Recommended reading
D. Pozar, Microwave engineering, Wiley; lecture notes

Teoria e Progetto dei Ponti

Luigino Dezi

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Fundamentals of structural engineering are considered as assumed knowledge.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course aims to provide students with theoretical basis and practical skills for the modelling, analysis and design of reinforced concrete and steel-concrete composite bridges, in order to amplify the student s knowledge in the field of civil engineering.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student develops modelling capabilities, as well as design and analysis skills, of reinforced concrete and steel-concrete composite bridges. These skills are gained through lectures and a designing exercise, developed in working groups, which implies the drafting of technical executive documents.
TRANSVERSAL SKILLS:
The designing exercise, which is developed in working group and requires the use of specific software for the solution of practical problems, contributes to improve the student s capability of identifying, formulating and solving problems, as well as the communicative skill, necessary for the teamwork.

Program
Contents of lectures (56 hours) Structural typologies and construction techniques: decks with precast prestressed concrete girders or box-girders; steel-concrete composite decks; arch bridges; cable stayed bridges; substructures (piers, abutments and bearings). Influence lines: generalised Betti s theorem and related theorems; the influence lines of displacements and internal stress resultants due to moving loads and deformations. Loads on bridges: traffic loads, wind loads, thermal loadings, etc. Transverse loading distribution: orthotropic plates and beam grids; simplified methods by Engesser and Courbon-Albenga. Box-girders: effects due to non-uniform torsion and transverse deformability. Creep and shrinkage effects: continuous steel-concrete composite beams, continuous decks with postponed restraints and variable static scheme. Classroom tutorials (16 hours) design of a bridge with a steel-concrete composite deck.

Development of the course and examination
LEARNING EVALUATION METHODS
The evalulation of student learning is based on an oral exam consisting in a discussion of the design project and in some theoretical questions on the topics covered during the course. To access the oral exam the student is required to have completed the project.

LEARNING EVALUATION CRITERIA
Through the design project and the oral exam the student must demonstrate to have learned the topics covered during the course, such as analysis and design methods of structural bridge

typologies studied in the course.

LEARNING MEASUREMENT CRITERIA
The evaluation is expressed in thirtieths.

FINAL MARK ALLOCATION CRITERIA
During the oral exam a mark is attributed to the design project and the final mark of the course will be calculated as the average of the marks received for the oral exam and for the design project. The 'lode' will be awarded to students who, having correctly completed the three assessments, show an outstanding understanding in the subject.

Recommended reading
Petrangeli M.P., Progettazione e costruzione di ponti, Masson Ed. ESA. (in Italian) Raithel A., Costruzione di ponti, Liguori Editore. (in Italian)

Termodinamica e Termofluidodinamica

Gianni Cesini

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Basic knowledges of mathematical analysis and physics

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
To provide a comprehensive treatment of engineering thermodynamics from the classical viewpoint and the basis in fluid mechanics and heat transfer with applications in the field of biomedical engineering.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
This course is part of the base engineering courses, related to Industrial Engineering, and will provide knowledge about the principles that form the basis of thermodynamic processes, the mechanisms of heat transfer and fluid dynamics.This knowledge is acquired through lectures and exercises.
TRANSVERSAL SKILLS:
The theory and exercises of the course will help to improve the degree of autonomy, the ability to learn and to draw conclusions.

Program
Introductory concepts in thermodynamics. Properties of a pure simple compressible substance. Phase change and phase diagrams. The models of ideal gas and of incompressible substance. Energy and the first law of thermodynamics. First law analysis of compressors, pumps, fans, heat engines, throttling devices, heat exchangers. Second law of thermodynamics. Entropy. Thermodynamic analysis of direct gas and vapor cycles and of refrigeration and heat pump systems. Introductory concepts in fluid dynamics and heat transfer. Natural and forced flow. External and internal flow. Laminar and turbulent flow. Introduction to emodynamics. Steady state heat transfer by conduction, convection and radiation. Transient conduction in lumped capacitance systems. Multimode heat transfer by means of the thermal resistance equivalent circuit method. Introduction to finned surfaces and heat exchangers. Thermodynamics of biological systems. Metabolic thermal production. Temperature and termoregulation of the human body. Energy balance of the human body: the Fanger equation. Hygrothermal comfort. Comfort condition and indexes. Moist air thermodynamics. Psychrometric systems and charts. Introduction to air-conditioning processes and systems

Development of the course and examination
LEARNING EVALUATION METHODS
Oral exam

LEARNING EVALUATION CRITERIA
Knowledge of the subjects and ability on solving problems

LEARNING MEASUREMENT CRITERIA
Level of the knowledge of the subjects and of the ability on solving problems

FINAL MARK ALLOCATION CRITERIA
On the basis of an inevitably personal evaluation, that I hope is more objective as possible, of the above mentioned criteria

Recommended reading
Yunus A. Cengel, Termodinamica e trasmissione del calore , McGraw-Hill__ __G. Cesini, Lezioni di Termodinamica e Termofluidodinamica , can be downloaded from the page Allegati of prof Cesini in www.univpm.it

Termotecnica

Fabio Polonara

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
Applied Thermodynamics, Heat Transfer, Fluid Mechanics

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The aim of the course is to integrate the fundamentals of applied thermodynamics, heat transfer and fluid dynamics in order to provide students with the necessary tools for the optimal design of thermal systems operating in the production, transport and final uses of energy. This knowledge completes the previous engineering education and increases the understanding of both thermal energy systems and their components deepening the issues related to the production, conversion of energy and providing techniques for the environmental impact assessment. Students will be aware of the multidisciplinary context of engineering with particular focus on the issues related to the conversion, transmission, final use of energy and to the design of fluid machines and energy systems
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to apply the acquired knowledge, students should be able to face complex design problems and to manage innovation and development of new products and/or new technological processes. In particular, they must be able, in the design phase, to optimize systems for the exchange and the conversion of thermal energy. The main skills acquired in the course are: 1. ability to perform first and second law energy analyses on components and systems with advanced thermodynamics analysis tools; 2.ability to perform first and second law analyses on heat exchangers and heat exchangers networks aimed at process integration for saving energy and costs; 3.ability to perform optimal choices in the design of thermal systems for the production, the transport and the final use of energy aimed at saving energy and costs while minimizing environmental impact
TRANSVERSAL SKILLS:
The ability of solving numerical problems, together with the awareness of their knowledge, will improve the judgement autonomy of students, their communications skills and their learning ability

Program
Class lectures contents (48 hours): First Law, Second Law, Property Relations, Basic Relations for Pure Substannces, Multicomponent Systems, Reacting Mixtures, Exergy, Physical Exergy, Exergy Balance, Control Volume Exergy Balance, Chemical Exergy, Exergy Destruction and Exergy Loss, Exergetic Efficiency, Improving Thermodynamic Effectiveness, Heat Exchangers, LMTD, Epsilon-NTU method, Economic Analysis, Prnciples of Economic Evaluation, Levelization, Fundamentals of Thermoeconomics, Thermoeconomic Variables, Thermoeconomic Evaluation, Costing Considerations, Introduction to Optimization, Analytical and Numerical Optimization Techniques, Cost-optimal Exergetic Efficiency, Thermoeconomic Optimization of Complex Systems, Pinch Analysis, Composite Curve and Process Pinch, Maximum Energy Recovery, Grand Composite Curve, Cost-optimal Hexchanger Network Design. Class exercises (24 hours): numerical exercises related to technological applications learned during the course.

Development of the course and examination

LEARNING EVALUATION METHODS

The assessment of the learning level consists of a test divided into two parts: in the first part, the student must solve two numerical exercises related to technological applications that have been discussed in class. In the second part, the student has to answer 2 questions on theoretical topics chosen from among those discussed in class. The time available for the test as a whole is 120 minutes.

LEARNING EVALUATION CRITERIA

To successfully pass the exam, the student must demonstrate, through the tests described above, to have assimilated the concepts contained in the syllabus and to be able to properly solve numerical exercises related to technological applications learned during the course.

LEARNING MEASUREMENT CRITERIA

The numerical exercises are evaluated with a maximum total score of 60 points out of 100 (each exercise is given a maximum score of 30 points, with a total of 60). The 2 theoretical questions are evaluated with a maximum total score of 40 points out of 100 (each question is given a maximum score of 20)

FINAL MARK ALLOCATION CRITERIA

The vote in hundredths, obtained by adding the vote gained in any exercise and theoretical question, is converted in thirtyeths. The Lode is given to those who, in addition to achieving the maximum score on the test, demonstrate to master very well the subject.

Recommended reading

A.Bejan, G.Tsatsaronis, M Moran, Thermal Design and Optimization, John Wiley & Sons, New York, 1996 - V.Verda, E.Guelpa, Metodi termodinamici per l'uso efficiente delle risorse, Esculapio, 2015

Tipologie Edilizie e Costruttive

Francesca Stazi

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period II

Prerequisites
no

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
Students will acquire advanced knowledge about the design and construction of a building at different scales, as a synthesis between the user s needs satisfaction and building constructive constraints. In particular, the course develops the topic of technological design and construction of buildings with load carrying structure in reinforced concrete, steel and timber. To that aim, the course focuses on the basic concepts related to the requirements to satisfy for different building usage types (not only residential), such as efficiency in structural design, functionality in the use of interior space and outer envelope optimization for both user comfort and energy savings. It also aims to develop specific skills related to the constructive interpretation of existing buildings and the choice of suitable techniques for new buildings, through the deepening of alternative design solutions and realization methods of the constructive elements for buildings in reinforced concrete, steel and timber. This basic knowledge will guide the design choices among several possible solutions.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Students will be able to address complex design themes, to control the whole design process by carrying out critical analyses at every stage in relation to the needs and to elaborate an executive project. Such abilities will applied in several skills, such as: 1. the ability to critically analyse an existing case study in relation to environmental and technological constraints; 2. the ability to identify optimal solutions (related to structural schemes, functional organization of the interior spaces, and materials) through the assessment of the specific requirements for different types of use (residential, offices); 3. the ability to design solutions and constructive details for various building constructive typologies (with structures in reinforced concrete, steel and timber).
TRANSVERSAL SKILLS:
Design exercises in groups will lead to the design of a residential building, to be realized with the 3 studied construction techniques (reinforced concrete, steel and timber). The project drawings will be gathered in a "book". This will help the ability to work in team. The acquisition of independent judgment skills will be evaluated through the discussion of advanced aspects of the discipline during the written and oral exams.

Program
Frontal lessons (50 hours) The performance of buildings for various building types: efficiency of the structural design, functional distribution of the interior space (also considering barrier-free environment and fire protection), outer envelope optimization. Types of constructive components for buildings with load-bearing structure in reinforced concrete, timber and steel: foundations, structures in elevation, envelope layout. General lessons on the building process (relative to the levels and contents of the project) and driving lessons on setting themes of the project (such as site analysis).

Design exercises in the classroom (22 hours). Development, by sampling, of the most significant documents of the executive project of a two-family house with basement with the illustrated construction techniques. The case study is chosen by the student and agreed with the teacher.

Development of the course and examination

LEARNING EVALUATION METHODS

The assessment of student learning is done through two tests: - Written test consisting of 3 questions to be completed in an hour on the topics covered in the lectures; - The oral examination focusing on their written report and if necessary on further topics covered in the lessons. The oral examination also involves the discussion on the technical documents developed during the exercises. The project can also be done in groups, usually including 2/4 students. Also in this case the discussion of the project is carried out individually.

LEARNING EVALUATION CRITERIA

To successfully pass the learning evaluation, the student must demonstrate, through the abovementioned tests, to understand the criteria and design procedures. The student must also know the basic information regarding the functional and structural aspects of the building.

LEARNING MEASUREMENT CRITERIA

During the exams the student's independent ability to solve technical and constructive problems and to identify, among several possible solutions, the most suitable one to the specific needs, are evaluated.

FINAL MARK ALLOCATION CRITERIA

The highest mark, equal to thirty points with honors, is achieved by demonstrating in-depth knowledge of the course contents and to be able to fully develop a project that is technically feasible. The minimum mark, equal to eighteen, is assigned to students who demonstrate sufficient knowledge of the techniques for various constructive typologies.

Recommended reading

M C. Torricelli, R. Del Nord, P. Felli, Materiali e tecnologie dell architettura , Ed. Laterza Koenig G.K., Furiozzi B., Brunetti F. Tecnologia delle costruzioni 12, Le Monnier. Firenze, AA. VV., Manuale di progettazione edilizia , Hoepli Ed., Milano Course lecture notes available on-line (https://lms.univpm.it/)

Topografia

Gabriele Fangi

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
Linear algebra and drawing concepts

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course enables students to acquire theoretical and practical knowledge of surveying, reminding the basic concepts of geodesy and mapping in order then to deepen by means of instruments and ICT technology the surveying process. Such knowledge will be upgraded with photogrammetry, remote sensing and GIS skills, introducing also the statistical processing of the measures, to complete the knowledge of the geomatics. In this manner the student acquires a clear awareness of the use of such techniques which provide the necessary elements for a technical approach to the analysis and understanding of civil and environmental engineering applications.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Students must learn to identify the correct survey methods and the related technologies for a correct data survey acquisition, analysis and interpretation of the results, to employ for different engineering purposes: civil or environmental. This is to enable them to apply this knowledge when tackling advanced design themes, including those of a very complex nature; they should also be able apply the knowledge for the purposes of innovation and for developing new products and technological processes. This will be expressed through the development of a mixture of both organizational and professional skills, including: 1. the ability to appropriately choose the correct survey methods and technologies suitable for their applications; 2. the ability to make a correct analysis of the survey results by means of the statistical data processing; 3. the ability to read, understand and organize into a GIS the cartographic results of a photogrammetric or satellite survey, like maps, orthoimages and digital terrain models (DTM).
TRANSVERSAL SKILLS:
Classroom practice and solution of exercises about the statistical processing of the measures will improve the level of independent judgement, the ability to communicate, the capacity for independent learning and the ability to draw conclusions.

Program
Content (lectures 60 hours) Geodesy and Cartography The surface datum: geoid, ellipsoid, their differences. The coordinate systems. Geodetic elements of these surfaces: meridians and parallels. The cartographic representations. The Italian Official Cartography. Numerical cartography. The Geographical Information Systems (GIS). Surveying Planimetrical Surveying. Measures of angles and distances. Instruments. Schemes of measure: triangulations, intersections, space resections, traverses. Geodetic networks by IGM. Reduction and insertion of the measures in the map of Gauss. Altimetrical Surveying. Geometric and trigonometric levelling. The national heigh network. Equations of the direct measures and the processing of the network. The system of global survey GPS (Global Positioning System). The laser scanning. Photogrammetry and Remote Sensing The analytical-geometrical espressions. The acquisition of the images, their orientation and the graphical

and numerical restitution. The digital products: orthoimages and DEM. The data acquired by the satellite sensor and processed by remote sensing techniques to produce thematic Land Use Land Cover maps. Treatment of the measures Statistic variables. Monodimensional and multi-dimensional distributions . Normal distribution of Gauss and normalization. Theory of the connection, regression and correlation. Parametric and distribution free tests, test of the sigma zero. Propagation of the variances-covariances. Least square adjustment using the indirect measurements. Classroom exercises (12 hours) Instrumental exercises: use of topographic instruments on field, acquisition and management of the measurements. Particular focus is about the new generation surveying instruments (laser scanner and UAV).

Development of the course and examination
LEARNING EVALUATION METHODS
The evaluation of the learning level of the student consists in two written tests: - one written test, related to the topics of the treatment of the measurements, to complete in two hours. Books or other texts are allowed. - another written test, made of thirty questions with multiple answers or free, that interests every topic of the course program. It takes fifty minutes. No books or other tools are allowed. The negative result of one of the tests doesn t invalidate the other test already passed in positive way. The positive assessment of both tests allows the admission to the oral test, that consists in the discussion on one or more topics showed in the class. In case of negative result of the oral test, the student must not repeat the test on treatment of the measurements.

LEARNING EVALUATION CRITERIA
To pass in positive way the exam the student must prove, by means of the two written tests and the oral test, to have well learned the concepts exposed in the class. Each written test weighs 50% on the learning assessment and on the final mark. The treatment of the measurements solved in an unique solution obtains the sufficiency when the principal keys are correct. The questionnaire, which interests the program discussed during the class, must have at least a score equal to 18/30, to pass the exam. The average of the two test evaluations admits to the oral one. To overcome with positive result the oral test, the student must show to have a general knowledge of the contents, sufficiently exposed in correct way with use of suitable technical terminology. The maximum evaluation will be achieved showing a deep knowledge, exposed with complete and accurate use of the technical language.

LEARNING MEASUREMENT CRITERIA
The mark of the treatment of the measurement test provides the 50% of the final assessment but the exam is not fully passed until the questionnaire, that concerns on all the matters of the course program, is solved in positive way. The oral examination can improve the final score.

FINAL MARK ALLOCATION CRITERIA
To pass the exam in positive way, the student must achieve at least the sufficiency, equal to eighteen points, in each of the tests before described and solve the oral exam. The maximum evaluation is reached showing a deep knowledge of the topics discussed during the course and the top marks is obtained performing each of the tests and the oral examination in correct and complete way.

Recommended reading
G. Folloni, Topografia ed. Patron, Bologna. G. Fangi, Note di fotogrammetria , ed. Clua, Ancona. Slides and digital books related to the lessons of the course (Clua-typing office inside to the University)

Trasmissione del Calore

Renato Ricci

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
Basic knowledge of Calculus, Mechanics and Fluidynamics

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course allows to the students to obtain the advanced knowledge about heat transfer topics in order to design advanced and traditional heat exchangers. By means of the integration of expertise gathered in the undergraduate courses (Applied Thermodynamics and Heat Transfer) the students complete their knowledge in the heat transfer area. The students will obtain a deeper knowledge of mechanical engineering sciences with particular emphasis to last developments in this specific area. The ability to design complex heat sinks will be also obtained
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to face complex design problems in the field of heat transfer the student should be able to correctly analyze the main thermal-fluid dynamics phenomena involved in the design and development of heat exchangers and heat sinks. Moreover the students will be able to use and/or develop specific design tools. At the of the course the students will be talented to: 1. design a traditional or compact heat exchanger; 2. design an heat sink; 3. analyze a complex heat transfer phenomenon
TRANSVERSAL SKILLS:
The knowledge and the expertise aforementioned will provide an increment to students free learning abilities

Program
Multi dimensional Conduction heat transfer. Control Volume numerical methods in steady and unsteady state. The heat sinks heat transfer modlelling by means of MATlab platform. Forced convection heat transfer. Natural convection heat transfer. Radiation heat transfer. The infrared thermography in laboratory applications. Heat pipes. Design of compact heat exchangers.

Development of the course and examination
LEARNING EVALUATION METHODS
Interactions with students during the lessons

LEARNING EVALUATION CRITERIA
Evaluation of the learning state

LEARNING MEASUREMENT CRITERIA
Problem solving skills

FINAL MARK ALLOCATION CRITERIA
Level of knowledge and analytical capacity

Recommended reading
Lessons notes available on www.termofluido.univpm.it

Trasmissione di Informazioni

Franco Moglie

Seat Ingegneria
A.A. 2016/2017
Credits 3
Hours 24
Period I

Prerequisites
None

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The student will be able to know, understand and analyze the transmission media, the types of signals, networks, protocols the security of the information transmission.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
This optional course will give to the student the basic concepts related to the transmission of information. It will also allow the student to learn the basics elements to choose a transmission system based on transmission media, protocols, bandwidth and security. The evaluation of the student is based on an oral examination that will give the degree of preparation of the student through the answers to standard questions. The evaluation of the student is based on an oral examination which will assess his skill through his answers to standard questions.
TRANSVERSAL SKILLS:
This course, which emphasizes the transmission of information in its multidisciplinary aspects, will help the student to improve its autonomy from both judgement and learning capacity point of views. It will improve also its capacity of synthesis and its clarity of exposition.

Program
Class lectures (20 hours). Introduction to the signals, to the networks and to the A/D conversion. Hints of modulation and of time-frequency duality. Transmission media: the choice parameters, the line pair, the coaxial cable, the optical fibers. Computer network: protocols, ISO/OSI and TCP/IP. UDP and TCP packets, ports, TCP connections; networks devices. Wireless LAN. NAT networks. Classroom practice (4 hours). During the exercises, some common network software will be used.

Development of the course and examination
LEARNING EVALUATION METHODS
An oral exam will evaluate the student skill. During the exam, two or more topics developed during the course will be discussed.

LEARNING EVALUATION CRITERIA
To obtain a positive evaluation, the student must demonstrate that has understood the concepts presented in the course, and must demonstrate that has completely understood the dimensioning and the operating of a communication network, including the physical medium, the switching and the protocols.

LEARNING MEASUREMENT CRITERIA
The vote is an average of the each response weighted according to the complexity of the question.

FINAL MARK ALLOCATION CRITERIA
The evaluation is positive when the student obtains the sufficiency, i.e. 18/30 points. The highest rating is achieved by demonstrating a very good understanding of the course content. Praise is given to students who have demonstrated an excellent understanding of all the discussed topics.

Recommended reading
A. Pattavina, Reti di telecomunicazione , McGraw-Hill, Milano, 2007, seconda edizione - A. S. Tanenbaum, Reti di computer , Prentice Hall International (UTET Libreria), Torino, 2001. Lecture notes available on the moodle website.

Trasmissioni Numeriche

Franco Chiaraluce

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 72
Period I

Prerequisites
The Course exploits knowledge acquired in the 3-years laurea degree. Though not mandatory, it is useful that the student has some familiarity with the basic concepts of telecommunications.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
To know and understand the new issues in modern digital transmission techniques, with an approach that emphasizes the need for mathematical rigor but which nonetheless preserves its most intuitive aspects.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
The student shall know the modern techniques for generating, transmitting, protecting and detecting, at the receiver, the transmitted information, by employing advanced mathematical tools, suited for the design of new telecommunication systems. This way, he will acquire a series of vocational skills, such as: 1. the ability to design systems for coding, equalization and detction of the information based on soft decision; 2. the ability to analyze the performance of digital transmission systems over unconventional channels, like those affected by jamming; 3. the ability to propose solutions that can guarantee an assigned level of reliability for the transmission, jointly with a good degree of physical layer security. The student shall demonstrate to be able to apply the knowledge acquired also in the framework of a project, based on Matlab, to develop during the course.
TRANSVERSAL SKILLS:
The software project to develop during the course will be executed in groups and will contribute to improve the ability of the students to cooperate, communicate and elaborate, as well as the ability to draw shared conclusions.

Program
Contents (Frontal lectures, 54 hours) - Main transmission formats: fundamental parameters and representation methods. - Structure and features of a digital modulator. - Optimal receiver over the AWGN channel and in the presence of colored noise. - Viterbi's algorithm with soft decision. - Intersymbol interference in the presence of thermal noise and bandwidth limitations (soft detection). - Modulation techniques with high spectral efficiency. - Evaluation of the power spectrum for baseband and passband signals. - Outline of physical layer security. - Jamming channels. Classroom exercises (18 hours) - Software to simulate digital transmission systems.

Development of the course and examination
LEARNING EVALUATION METHODS
The exam consists of an oral test. If necessary, the questions requiring the execution of short calculations are answered in written form during the oral test. The student is asked to illustrate the theoretical foundations and examples of application of the modern techniques for the generation, transmission, protection and detection at the receiver of the transmitted information. Moreover, the student must demonstrate to be able to apply the knowledge acquired in the framework of a sofware

project developed also (though not necessarily) in groups during the course.

LEARNING EVALUATION CRITERIA
The student must demonstrate to possess an adequate knowledge of the course's contents, exposing them in a sufficiently correct way, by using the right technical notation and by showing an adequate capacity to formalize the problems, also as regards the mathematical issues. The maximum mark is reached by demonstrating to have a deep and thorough knowledge of the topics, and a complete control of the technical and formal language.

LEARNING MEASUREMENT CRITERIA
The learning level is measured by the student's capacity to demonstrate his knowledge and comprehension of the innovative aspects in modern digital transmission techniques, through an approach that combines the mathematical rigor with the intuitive interpretation of the phenomena.

FINAL MARK ALLOCATION CRITERIA
The oral exam consists of two or three questions, depending on the topics discussed during the interview. Each answer receives a mark ranging between 0 and 15 (for the case of two questions) or between 0 and 10 (for the case of three questions). Laude is assigned to those students who, having reached the maximum mark, demonstrate a thorough knowledge of the subjects.

Recommended reading
1. Set of lectures provided by the teacher, that can be found in the university Moodle platform. 2. John G. Proakis, Masoud Salehi, Communication Systems Engineering , 2nd Edition, Prentice Hall, 2002.

Turbomacchine

Leonardo Pelagalli

Seat Ingegneria
A.A. 2016/2017
Credits 6
Hours 48
Period II

Prerequisites
Concepts of Technical Physics, Fluidynamics and Machines and Energetic Systems.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course provides the students with an advanced knowledge of main thermofluid dynamics phenomena that drive the operation of turbomachines. In this way, students deepen their knowledge in the field of fluid/energy machines
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
Students must be able to carry out a preliminary design of turbomachines such as turbines and compressors. The main skills acquired in the course are: 1. Ability to plan all the steps for the modeling and the design of turbomachines; 2. Ability to assess the performance of a turbomachine; 3. Ability to properly choose a turbomachine in relation to the application context
TRANSVERSAL SKILLS:
The knowledge in the field of turbomachines will improve the ability of students to develop autonomous judgement during the design phase so that they can be able to discuss with specialist with different expertise

Program
Fludynamic equations for the flow of a non-reacting, compressible and uncompressible, steady and unsteady, viscous and inviscid perfect fluid. Reference systems. Normal shocks. Quasi-one dimensional flow. Nozzles and diffusors. Viscous and adiabatic one dimensional flow (Fanno flow). Heat exchanging inviscid flow (Rayleigh flow). Axial compressors and turbines. The fluidynamic analysis of the stage. The reaction grade. Blade profiles and cascades. Fluidynamic losses and deviation angles. Experimental and numerical methods for the performance previsions. Efficiency. The performance curves. Off design performance for a single and twin-shaft gas turbine.

Development of the course and examination
LEARNING EVALUATION METHODS
The assessment of the level of learning and understanding consists of two parts: 1 - written test containing four questions related to the topics covered in the lectures 2 - oral clarification and/or deepening of the themes of the written test, if necessary, by adding an additional problem of theoretical and/or application nature.

LEARNING EVALUATION CRITERIA
The student has to demonstrate to have understood and acquired the physical principles and theoretical considerations on the basis of turbomachinery running with the addition of a valid competence regarding the construction configurations and nominal operating conditions and in the regulation phase. The responses also include the quantitative knowledge of the topic.

LEARNING MEASUREMENT CRITERIA
The student knowledge is graded through the attribution of a final mark out of thirty. The passing score is 18/30, the highest score is 30/30, brilliant students may receive in addition a praise. The final evaluation results from the weighted average of the pre-trial written examination (25%) and oral (75%). To pass the exam both tests should be sufficient.

FINAL MARK ALLOCATION CRITERIA
In order that the final outcome of the evaluation is positive, the student will have to prove that he has no gaps on basic skills covered in the course. The highest rating is achieved by demonstrating in-depth knowledge of the course content. Praise is given to students who, having done the pre-exam and oral fairly and with good level of detail, have also shown a particular brilliance in exposure and/or have demonstrated particular mastery of the material knowing also the use of the acquired skills to analyze topics not explicitly covered or treating the topics in a way alternative to the proposed one.

Recommended reading
- Lecturer's notes - Cohen, H., Rogers, G.F.C., Gas Turbine Theory, Longman Scientific Technical - Sandrolini, S., Naldi, G., Le turbomacchine motrici e operatrici, Pitagora Editrice-Bologna - Sandrolini, S., Naldi, G., Macchine - Gli impianti motori termici e i loro componenti, Pitagora Editrice-Bologna

Urbanistica 1 (EA)

Francesco Alberti

Seat Ingegneria
A.A. 2016/2017
Credits 9
Hours 90
Period 1s

Prerequisites
Acquaintance of sofware informed Autocad to us 2015 and of Arcgis 10.2.

Objectives of the course
KNOWLEDGE AND UNDERSTANDING:
The course Urban Planning 1 allows students to acquire knowledge on the analytical and design aspects of settlements. The processing techniques of an implementation plan in the context of a general urban plan are examined. Such knowledge will enrich the basic training for the fifth year professional course of Urban Planning Techniques. The course aims at acquiring a clear awareness of the wider multidisciplinary context of urban planning.
CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING:
In order to address design issues through the application of knowledge, the student must know how to correctly interpret and translate evolving situations and possible future scenarios, even in the explanatory documents. This ability will be expressed through a number of skills, such as: 1. the ability to correctly interpret transformation phenomena; 2. the ability to identify the causes of transformations; 3. the ability to appropriately interpret the results of analyses and identify solutions of simple settlement arrangements.
TRANSVERSAL SKILLS:
An exercise will be carried out consisting of producing a document, relevant to an urban or territorial context, of a parcelling, recovery or landscape plan. The exercise will be carried out in a team and entails the drafting of a graphic and written report, which contributes to improving the autonomy of the student. The application activities of the basic concepts will allow the student to acquire multidisciplinary skills.

Program
The Course pursues the objective to supply to the student competences of base for a interpretativa reading of the urbanistici instruments generates them and put into effect to you: Slowly general regolator, Plans of lottizzazione, glide down-volumetric Plans of recovery, Plans for the economic and popular building, Plans productive takeovers, plans. To such aim they will come illustrated cartographies of analysis and plan and norms, therefore to allow to interpret easy the modalities and potentiality of participation in the various zones and the buildings, single or combines to you in participation unit. A short practice will allow moreover the student to recognize, in relation to every manufatto (in the context of a plan of recovery or city requalification) the punctual detailed lists modality of building participation (in the carrying and not carrying structures and in the not structural elements), to second of the building type of tipologia and urban planning and the type and level of degradation of the single building. The objective is that one to make to comprise like the participations in the single elements builds up to you cannot constitute plans to if being, but they go correctly frames in the tie context and potentiality to you urban planning, that is in a context of plan of the recovery or city requalification. In such logic, also in the specificity of the Course of bachelor the student will come invited to hold account also of those aspects architectonic-composites you of

the built up one that they can condition the same building participation. They will come finally exposed synthetically some principles interpreted you for the reading of tables of Formal Order and Works them, inviting the students to recognize indicated progettuali solutions ivi.

Development of the course and examination
LEARNING EVALUATION METHODS
Students have to arrange an essay concerning with topics of the course: meanings and symbols of ancient or ideal towns to be compared with planning choices for the town of the future.

LEARNING EVALUATION CRITERIA
In the practice sessions, a Sustainable Urban Planning Project will be developed, thus enabling the students to recognize the specific modalities of building intervention, from the type of building and urban planning context to the final choices. The students will be organized in workgroups.

LEARNING MEASUREMENT CRITERIA
The course is designed to develop knowledge of how a building project is managed and controlled from town planning to construction, from architectural to detailed construction drawings. The final goal is to learn how the intended works are to be configured within the framework of urban constraints and potentials, also taking into account the architectural-compositional-operational aspects that qualify such works. Particular attention is focused on knowledge of the materials and construction techniques for ecosustainable design.

FINAL MARK ALLOCATION CRITERIA
Oral

Recommended reading
Fabio Bronzini, Francesco Alberti, Maria Angela Bedini, (2014) LA MISURA DEL PIANO. STRATEGIE E STRUMENTI URBANISTICI volume n. 2, prefazione Giuseppe Imbesi, Gangemi Editore Roma ISBN 978-88-492-27604 Francesco Alberti (2012). IL PAESAGGIO TRANSITIVO. Il ruolo del progetto urbanistico per la città e il territorio contemporaneo. Prefazione di Alberto Clementi, Premessa di Fabio Bronzini. Maggioli Editore, Segrate (Milano) ISBN 978-88-387-6101-9