2/61/049 - ENGLISH LANGUAGE 2

Academic Year 2021/2022

Free text for the University

Professor
MICHELA GIORDANO (Tit.)
Period
First Semester
Teaching style
Convenzionale
Lingua Insegnamento
INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[2/66] INTERNATIONAL RELATIONS	[66/00 - Ord. 2018] PERCORSO COMUNE	9	54

Objectives

Teaching aims, expected knowledge and skills
The course takes into consideration the social function of the English language and it also considers it to be an international method of academic communication in a historical, political, judicial, economic and sociological context. It therefore aims at deepening the knowledge of and consolidating the four fundamental linguistic skills, concerning both comprehension (LISTENING and READING) and production (SPEAKING and WRITING), with particular attention given to the comprehension of specific texts. The course is divided into two teaching modules: 1. General English: aimed at deepening the phonological, morphological, grammatical and syntactic aspects of the English language, promoting the acquisition of general learning and comprehension skills, expanding vocabulary and enhancing students communication skills (Level B2); 2. Specific English: aimed at analyzing specialized texts relating to the lexical, syntactic, textual, discursive and rhetorical features of the language of politics and institutions in English-speaking countries (Level B2).

1) (Knowledge and understanding) Develop and consolidate the knowledge and understanding of morphological, lexical, syntactic and textual concepts along with the communicative strategies, acquired during the first cycle of university studies.
2) (Applying knowledge and understanding) Develop and strengthen skills in the use and application of grammatical concepts and rules and communicative strategies, in order to be able to address unfamiliar and interdisciplinary issues.
3) (Making judgements) Develop and strengthen linguistic and discursive awareness and critical processing skills to make the right choices in the written and oral production and in

the understanding of specialised texts in a specific context.
4) (Communication skills) Develop the ability to communicate knowledge and competence through the specific jargon acquired from specialised readings and texts.
5) (Learning skills) Be able to approach the study of the discipline independently and carry out research in the specific field, elaborating and developing original ideas that embrace even broader or interdisciplinary contexts.

The level of knowledge and competence required at the end of the course is Level B2 Intermediate/Post-Intermediate, according to the Common European Framework.
B2
Can understand the main ideas of complex text on both concrete and abstract topics, including technical discussions in his/her field of specialisation. Can interact with a degree of fluency and spontaneity that makes regular interaction with native speakers quite possible without strain for either party. Can produce clear, detailed text on a wide range of subjects and explain a viewpoint on a topical issue giving the advantages and disadvantages of various options.

Prerequisites

Students who wish to attend Lingua Inglese II classes should have a working knowledge of the English language at the pre-intermediate level (Level B1 of the Common European Framework of Reference for Languages). Students are required to attend grammar practice classes taught by the tutors and lab lessons with CELs, Collaboratori ed Esperti Linguistici (Language Assistants) which complement the official 54 hour-course during the semester.

Contents

General English: grammatical and linguistic structures according to the Common European Framework for level B2 (intermediate/post-intermediate).
• Past simple
• Present perfect simple
• The passive
• Future plans, future possibilities
• Modals of obligation and prohibition
• Modals of ability
• Zero and First conditional
• Present perfect continuous
• Past perfect simple
• Second conditional
• Third conditional
• Gerunds and Infinitives
• Phrasal verbs
• Reported Speech
• I wish/if only
Specific English: Students will have the opportunity to increase their ability to understand and interpret specialized texts in English on the lexical, syntactic, textual, discursive and rhetorical features of the language of politics (Reading comprehension at Level B2).
Topics to be covered:
• Politics/politician/political/politicise

• Connotation/denotation
• Left/right/centre
• Political satire
• Parody
• Utopia/Dystopia
• The problem of truth
• Metaphor and metonymy
• Synecdoche
• Intertextuality
• Analogy
• The art of spin and spin doctors
• Opinion polls
• Making speeches
• Rhetoric
• Ethos, Pathos and Logos
• The soundbite
• The three-part list
• Prosodic features
• Contrastive pairs
• The use of pronouns
• Political campaigns: positive and negative campaigning
• Party slogans
• Ellipsis
• Modal verbs
• Active or passive voice
• Conjunctions
• Comparative forms
• Party posters

Teaching Methods

The contents to be addressed during the course are distributed in 54 hours of class, in about 10 weeks. Attendance is compulsory.
In the first week of classes the provisional CLASS SCHEDULE will be provided, with a punctual weekly distribution of topics and contents. The list of contents and topics covered during the lectures will constitute the STUDY GUIDE which will be useful for the preparation of the written test and the oral examination. Additional and complementary activities are represented by the grammar classes held by tutors and the lab lessons held by mother tongue speakers language assistants. These complementary activities are FUNDAMENTAL for the developing of grammatical knowledge and the development and improvement of SPEAKING, LISTENING and WRITING skills and competences.
During the week, grammar classes with tutors and lab practice classes with language assistants are provided. Timetables will be provided in the first week of classes.
During the course, students can present in class their analysis of a political speech and the presentation will be considered part of the oral exam. Because of the epidemiological situation classes could also be taught online and topics could be covered even through assignments that students will have to hand in before the final exam.

Verification of learning

The final examination consists of two parts: the written test will assess the language proficiency and in particular the ability of understanding and writing, while the oral test will evaluate the ability of listening and speaking and the communication skills. Both written test and oral examination will test the knowledge of the specific topics (the language of politics and social institutions) covered during the course. Dictionaries, textbooks and notes of any kind are not allowed during the written test. The written test will be divided into two sections: SECTION 1- General English: Grammatical structures included in the Units 1-10 of the textbook New Total English, Intermediate, Student's Book and Workbook, Longman (new edition). SECTION 2- Specific English: The questions will focus on the reading passages taken from A. Beard, The Language of Politics, Unit 1, 2, 3, 4. Methods of written test: multiple choice, gap filling, reading comprehension, true / false, composition and translation from Italian into English. To pass the written test, students must obtain at least 18/30 in each of the two sections (General English and Specific English). The final evaluation of the written test will be the arithmetic mean between the two marks obtained in the two sections. A test with no Writing (Composition) and Translation is considered FAIL, and should be repeated.

Oral examination Students who pass the written test will be admitted to the oral examination which consists of a conversation in English about the general and specific topics covered during the course. It will also require the oral presentation and discussion of the general and specific texts analyzed in class and constituting the course contents. The final grade will be based on: 1) the grade obtained in the written test 2) the active participation to lectures, grammar classes and lab classes 3) the knowledge of the general and specific contents 4) the acquired language skills and communicative competence. The final grade will start from 18/30 for elementary knowledge of topics and achieved competence in the language, and will reach 30/30 cum laude when the knowledge of topics and competences achieved are excellent.
Topics for the oral exam:
1) General Conversation
2) General English: (you have to choose two from these eight readings):
Reading 1: Malala wins Nobel Peace Prize
Reading 2: Speaking more than one language could sharpen your brain
Reading 3: Self-Defense Instructor. Pakistan Nighat Dad is teaching women how to protect themselves online
Reading 4: Tunisia's Jihadist Pipeline: ISIS recruiters are finding volunteers in the birthplace of the Arab Spring
Reading 5: ‘Maestro of humanity’: Italian surgeon Gino Strada dies at 73
Reading 6: Jeff Bezos launches to space
Reading 7: Gender disparities at Olympic Games
Reading 8: Wildfires in Sardinia
3) Political speech/political debate analysis (choose one in English. This part can be also presented in class during the course and the presentation will be considered and assessed for the oral exam)
4) I am Malala-Epilogue Analysis and summary
5) Specific English: A. Beard, The Language of Politics, Units 1, 2, 3, 4 (look at questions at the end of the slides on the instructor's website)

Texts

General English: R. ACKLAM, A. CRACE, New Total English Intermediate, Student's Book and Workbook, Longman (new edition).
Specific English: A. Beard, The Language of Politics, Units 1, 2, 3, 4.
A. Partington & C. Taylor, The Language of Persuasion in Politics
Grammar Book:
1. D. SELLEN, New Total Grammar, Grammar and Practice for Italian Students (with Answer Key and CD-Rom), Black-Cat-CIDEB.
2. L. PALLINI, How do you say …?, Black Cat-CIDEB.
Additional readings, handouts, ppt presentations and mock tests may be used during classes (to be collected from the copy center or downloaded from the course or instructor's webpage).

More Information

Attendance of lessons and lab practice classes is compulsory and will be verified by the lecturer by collecting students' signatures or through other means. The requirement of attendance is considered satisfied if 80% of the lectures and lab practice classes have been attended.

Art. 11, clause 4, in the Regolamento didattico of the International Relations course sets exemptions to compulsory attendance upon request for work, health or maternity reasons.

The exam can be taken in each one of the 6 scheduled sessions (June, July, September, November or April, January, February). If the written exam is taken in a session with two calls (June-July or January-February) with positive results, the oral exam can be taken either a week later in the same session or the following month (within the same session). In September and November the written test and oral examination must necessarily be taken within the same session (the oral examination is generally a week after the written test). In the June-July and January-February sessions, if students do not get a positive result in the written test, they can have the opportunity to repeat it the following month, after discussing it with the lecturer who can advise the student on necessary revision of the materials and topics. However, the possibility of repeating the written test a month later in the same exam session must be previously discussed with the lecturer.
Additional info, materials, exercises and mock tests are posted on the instructor's website.

2/61/067 - EUROPEAN INTEGRATION

Academic Year 2021/2022

Free text for the University

Professor
CHRISTIAN ROSSI (Tit.)
Period
First Semester
Teaching style
Convenzionale
Lingua Insegnamento
INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[2/66] INTERNATIONAL RELATIONS	[66/10 - Ord. 2018] Diplomatic and Area Studies	9	54

Objectives

The students of the course of European Integration, that is entirely taught in English, at the end of the course will get a general knowledge about the actual politics and problems that the European Union is facing. The course will give a general framework of the issues that the European Union manages today. There will be an illustration of History of the European Union, of the services, policy and rules of the Union. The course's aim is to give a basic knowledge that can help the students in understanding the functioning of the European Union and its action. A the end of the course the students will acquire the necessary tools to critically analyze the interaction between the EU ant the international and global dynamics. Students will also master the historiographic and political debate concerning the European Union issues; and will be able to elaborate analytical interpretative and autonomous judgement on the international role of the European Union.

Prerequisites

General knowledge of History of International Relations and International Politics and Contemporary History. English Level at least B1 is recommended

Contents

Achieving the European Union from 1992 to the European Common Currency;

The Enlargement and its challenges;

The political and historical reason for the Treaty of Amsterdam; The Treaty of Nice; The idea of a constitution for Europe; and for the Lisbon Treaty;
Foreign and Security Policy;

The relationship between the EU and the rest of the world in the XXI Century: the USA; Africa; South America, Russia, China and the Far East; and The Middle East;

The EU and the Cooperation Development Policies;

The European External Action Service;

Cultural Diplomacy of the European Union;

The EU by topics: Business, Culture and Education; Customs and tax; Humanitarian Aid and Development; Economy and Finance; Employment and Social Affairs; Environment and Energy; Health, Justice and Citizens' Rights; Regions and Local Development; Transport and Travel; European Policies on Culture, Cinema and Creative Arts; Bologna Process on Higher Education;

The European Union and its opportunities; Agencies and others EU bodies.

The EU and the Brexit Process.

Teaching Methods

Lectures (54 hours), use of PPTs; distribution of copies of documents, texts, and maps.
The course includes a test the first day and at the end of the course.
The attendance of the lectures is highly recommended.
Mode of acquiring methods and didactic tools: The knowledge and comprehension capacity will be acquired through the lectures, with texts and documents. In particular there will be tests during the lecture in order to understand the level of knowledge and comprehension of the students.
The Students will be ask to make presentation during the lectures in order to analyse topics and discuss them together.
There will be from time to time guest speakers through the Erasmus Teaching Staff Mobility.
Moreover, if needed there will be the possibility to ask for extra explanation during the office hours.

Verification of learning

Talks on the experience done during the course. Evaluation of essays and evaluation of the learning process; mid-term test and final oral exams.
Mode of verification of the results: Evaluation of the active participation of the students at the lectures, exercise, seminar activities, mid-term tests, self-evaluation, and final exams.

The evaluation of the exam will be expressed marks up to 30/30 cum laude.
In the evaluation the determination of the final mark will take into consideration the following elements:
1. Capacity of the student of using the arguments with respect to the resolution of the

proposed question;
2. Capacity of link different historic periods;
3. Knowledge of the different topics of the course;
4. Adequate historic and political language.
In order to pass the exam and get a vote not less than sufficient (18/30), the student should demonstrate of having acquired a sufficient knowledge of the different topics of the course (point 3) and be able to link different historic periods (point 2) with acceptable argumentation (point 1) and a good general language (point 4).
In order to get 30 cum laude the student should demonstrate to have acquired an excellent knowledge of all the topics of the course (point 3), with an excellent argumentation (point 1), an excellent ability of linking different periods (point 2) with an excellent language (point 4).

Texts

Ian Bache, Simon Bulmer, Stephen George and Owen Parker, Politics in the European Union, Oxford University Press, 2015

Web sites:

www.europa.eu

http://www.europarl.europa.eu/portal/en

http://www.consilium.europa.eu/homepage.aspx?lang=en

http://www.european-council.europa.eu/home-page.aspx?lang=en

http://ec.europa.eu/index_en.htm

More Information

The Course of European Integration is taught entirely in English and there will be seminars by Visiting Scholars that will talk on specific topics during the lectures.

2/62/026 - POLICY EVALUATION

Academic Year 2021/2022

Free text for the University

Professor
ADRIANA DI LIBERTO (Tit.)
Period
First Semester
Teaching style
Convenzionale
Lingua Insegnamento
ITALIANO

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[2/68] PUBLIC ADMINISTRATIONS SCIENCES	[68/00 - Ord. 2019] PERCORSO COMUNE	6	36

Objectives

In recent years, there is a growing demand for rigorous evaluation of public programs and policies resulting from public investment.
This course aims to introduce students to quantitative approaches to the evaluation of policies and public programs, and provides the necessary tools for this purpose.

The course will make students familiar with the main tools of evaluation of projects and policies, and it will enables them to understand the strengths and weaknesses of different methods in different contexts;
Some case studies of policy evaluation (impact assessment) will provide a broad picture of the current international practice;
Students will learn the methods needed to carry out autonomously evaluation research.

Prerequisites

The students are expected to possess basic knowledge of Economics, Statistics and Econometrics

Contents

The course will cover the methodologies of impact evaluation. In particular:

Introduction to the counterfactual evaluation design

Randomized Evaluations (Experiments)
Non-experimental approaches and the difference-in-differences methodology
The use of regression analysis
The propensity score matching
The regression discontinuity design
Interrupted time series analysis
Some examples of analysis of the impact of policies

Teaching Methods

To meet specific educational needs related to the epidemiological situation, the possibility of live streaming lessons or recordings of the same available online is provided. Furthermore, the exercises can be carried out by means of remote interaction forms with the available IT supports.
The course will entail frontal lectures and tutorials with practical exercises and case-study analysis. The frontal lessons will cover about 80% of the planned teaching hours while the remaining time will be devoted to the activities where the students will use Excel. Although not mandatory, attendance is strongly recommended, as it is a proactive attitude to learning the topics.
To meet specific educational needs related to the epidemiological situation, the possibility of live streaming lessons or recordings of the same available online is provided. Furthermore, the exercises can be carried out by means of remote interaction forms with the available IT supports.

Verification of learning

The standard written exam method of carrying out the exam reported below may be modified due to the COVID-19 restrictions.

The verification of learning implies a final exam consisting of a written examination in which you will be asked to answer 2 questions out of 3 in an hour and five minutes concerning the topics carried out during the program.
The final mark is expressed in thirtieths for both attendant and non-attendant students.In the assessment of the exam, in addition to the overall preparation, the determination of the final mark takes into account the active participation of students in the lessons and exercises planned during the course. To report a grade between 18/30 and 21/30, the student must demonstrate that he or she is able to report the basic notions of the methodologies studied. For a grade between 22/30 and 26/30 the student must demonstrate that he or she has acquired at least a sufficient knowledge of the topics, and that he or she is able to correctly interpret the results of policy evaluations seen during the course. For a grade between 27/30 and 29/30 the student must demonstrate to have acquired high skills on the methodologies analyzed, and to be able to correctly interpret the results of evaluations of policies seen during the course. In order to achieve a score of 30/30 (or 30/30 with honors), the student must instead demonstrate that he or she has acquired an excellent knowledge of all the topics dealt with during the course and that he or she is able to critically report the specific in-depth subjects seen during the course.
International and Erasmus students may take the exam in English.

Texts

Martini A. and M. Sisti, Valutare il successo delle politiche pubbliche, Il Mulino.
Additional readings might be provided by the instructor during the lessons and exercises

BF/0034/EN - BIOINFORMATICS

Academic Year 2021/2022

Free text for the University

Professor
- CARLA MARIA CALO' (Tit.)
- NICOLE GRANDI
- SIMONA DISTINTO

Period
- First Semester

Teaching style
- Convenzionale

Lingua Insegnamento
- INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[60/71] CELLULAR AND MOLECULAR BIOLOGY	[71/10 - Ord. 2021] Advanced cellular studies	9	84

Objectives

The course aims to provide students with good knowledge for the analysis of human DNA variation, cellular transcriptome and three-dimensional protein structures. In details:
Module of human genome variability aims to analyze and identifying the actions of selective pressure on human genome. Particularly, at the end of the course the students are able to use software for genomic data analysis, correctly interpret results and plan genetic studies in a proper way. Moreover, students, starting from the knowledge of the mechanisms of molecular evolution, will be trained in the study of phylogenetic inference and will be able to reconstruct phylogenetic trees based on several molecular markers.
Module of transcriptomics aims to introduce the student to the analysis of the cellular transcriptome, presenting the main wet-lab and bioinformatics techniques used to study the complete set of RNA transcripts that are produced by the genome and its variation under specific circumstances. The skills acquired during the course will be applied to the analysis of gene expression in public transcriptomic data and the study of their differential modulation in relation to a condition of interest.
Module of protein modeling aims to initiate the student to a thorough study of protein structure considering both experimental and computational methods. The course will guide the students from the analysis and comparison of sequences to the 3D structure. In this regard, bioinformatic tools and computational methods will be applied. Combined with the sequence information the 3D structure, gives insights for the development of effective rational strategies for experiments such as site directed mutagenesis, studies of disease related

mutations, or the structure-based design of specific inhibitors.

• KNOWLEDGE AND UNDERSTANDING
• The course introduces students to the main concepts of bioinformatics and computational chemistry applied to compare, study and predict the 3D structure of a protein allowing them to gain insight of their molecular/biomolecular structure and function.
Moreover, students should reach the capacity to discuss the theoretical basics of DNA sequence analysis, apply phylogenetic analysis to simple genomics data, and detect selective pressure traces.
Finally, the course will consider the main methods of extraction and quantitative and qualitative analysis of RNA, the characterization of RNA expression using high-throughput methods, and the main bioinformatics tools to quantify such expression and assess its statistical variation under a specific condition.
APPLYING KNOWLEDGE AND UNDERSTANDING
Students, through practical activities autonomous and piloted, will acquire knowledge and understanding in the application of the analysis of DNA variability, expression of genomic sequences of interest in RNA-seq data and its variation under specific circumstances, and computational methods and bioinformatics tools to study the structure and function of biological macromolecules.
MAKING JUDGMENTS:
The use of theory and case studies will enable students to acquire the skills needed for problem setting, problem solving and judgement making.
COMMUNICATION SKILLS:
The students will reach a good level of communication skills to explain concepts and problems of the discipline properly, and an appropriate scientific language.
LEARNING KNOWLEDGE: Students will acquire learning skills to undertake further studies and to deal with complex problems. The course aims to empowering students to be independent in the use of open-source databases and software for DNA, protein modeling and transcriptome expression analyses, to apply them to the specific conditions and scientific questions encountered along their research experience.

Prerequisites

Knowledge of genetics, molecular biology, biology, biochemistry, and organic chemistry.
Basic knowledge of informatics (to use a computer, to use internet for database searches and software download)

Contents

Module of Human Genome Variability (CFU 2+1)
• Introduction to Human Evolutionary Genetics.
• Microevolution and genetic factors: non random mating, genetic drift, gene flow, mutation, natural selection.
• Genetic Database and data sharing: NCBI, The Genographic Project, the 1000 Genome Project, mitoMap.
• Making inference from genetic diversity: measures of molecular diversity, neutrality test, mismatch distribution.
• Phylogenetic inference: sequence allineament, genetic distances, genetic tree (UPGMA, Neighbor joining, Maximum Likelihood and maximum parsimony). Consense tree (Bootstrap method), Evolution Molecular Models. Coalescent approach to reconstruct population

history.
• Bioinformatics tools for searching traces of selective pressure.
• Laboratory (12 hours): alignment of DNA sequences, use of principal programs for the analysis of genetic diversity, use of programs for the analysis of selective pressure (Pophuman,1000 Genomes Selection Browser), use of programs for genetic distance and genetic tree (Mega, Phylip).

Module of transcriptomics (CFU 2+1)

• Introduction to the concepts of transcriptome and transcriptomics
• Main methods for the extraction and quantitative/qualitative analysis of RNA in a sample
• High throughput techniques for RNA expression analysis
• Common open-source reference databases for gene expression studies
• RNA-seq data analysis: quality control, mapping, read count and expression quantification
• Bioinformatics techniques for differential expression analyses
• Transcript prediction and visualization in the genome context

Module of protein modeling (CFU 2+1)
• Introduction to protein structure and the folding mechanism
• Uniprot and other useful biological DBs
• Protein Data Bank and overview of experimental methods to obtain the 3D structure model of a macromolecule
• File formats for small- and macro-molecules
• PDB models analysis
• 3D visualization tools
• Sequence alignments
• 3D alignments
• Methods for secondary structure prediction
• Methods for 3D structure prediction
• Validation and analysis of models
• Overview of structure-based computational methods
• Introduction to System Biology

Teaching Methods

Teaching will be organized in frontal classes, integrated and "augmented" with online strategies, in order to guarantee its use in an innovative and inclusive way.
Seminars, practical experience in the bioinformatics laboratory
The teaching method includes classroom lectures with oral presentation, structured as follows:
• introduction aimed at providing an overview of what will later be discussed;
• development, which presents in detail the contents highlight the connection between ideas and key points.
• conclusion, or summary, aimed at reinforcing the learning of the lesson content and reconnecting with the general goals.
• Furthermore, the issues discussed in class will be exercised in the computer lab.

Verification of learning

Students are required to demonstrate their level of knowledge by oral examination and an easy computer simulation where they are asked to show critical understanding of the key concepts and of the methodology's application.
The final grade considers the following factors:
-Quality of the knowledge, skills, competences showed:
a) appropriateness, accuracy and consistency of knowledge
b) appropriateness, accuracy and consistency of skills
c) appropriateness, accuracy and consistency of expertise
-Presentation method:
a) Expressive capacity and proper use of the specific language of the discipline;
b) Logical ability also in the consequential fitting of the contents;
c) Ability to connect different subjects by finding the common points and establish a consistent overall design;
d) Ability to summarize through the use of symbolism on the matter, and including the graphic expression of ideas and concepts, for example scheme of biological processes and structures.
-Relational qualities:
Ability to talk and interact with the teacher during the interview.
-Personal qualities:
a) critical spirit;
b) ability to self-evaluation.
Consequently, the judgment can be:
a) Fair (from 18 to 20): the student demonstrates little knowledge acquired, superficial level, several gaps. Expressive abilities modest, but sufficient to argue the contents of the program. Poor capacity for synthesis, and lack of logical connections between subjects.
b) Moderate (from 21 to 23): the student demonstrates a discreet acquisition of knowledge but lack of depth, some gaps. Expressive abilities more than sufficient to support a coherent dialogue the exposure, acceptable mastery of the language of science, capacity of synthesis, and ability to graphic expression acceptable.
c) Good (from 24 to 26): the student demonstrates a broad knowledge, moderate depth, minimal gaps, satisfactory mastery of the expressive capabilities and significant scientific language; critical ability, good capacity for synthesis and ability to graphic expression more than acceptable.
d) Outstanding (from 27 to 29): the student demonstrates excellent knowledge of the program well depth, with marginal gaps. Remarkable powers of expression and high mastery of scientific language; remarkable dialogue capacity, good competence and relevant aptitude for logic synthesis, high capacity for synthesis and graphic expression.
e) Excellent (30): the student demonstrates an excellent knowledge of the subject with no gaps (or irrelevant) and excellent exposition skills. Excellent ability dialogical aptitude to make connections between different subjects, excellent ability to synthesize and very familiar with the expression graphics.

The praise (30/30 cum laude), is attributed to the candidates that demonstrate an excellent knowledge of the whole program, arguing the subjects correctly and fluently, absence of gaps, have excellent scientific language skills and demonstrate ability in the practice use of bioinformatics tools.

Texts

Human genomics variation: Jobling, Hollox, Hurles, Kivisild, Tyler-Smith. Human Evolutionary Genetics. Garland Science, 2014"
Protein modeling: From Protein Structure to Function with Bioinformatics -Daniel John Rigden -Springer
Transcriptomics: RNA-seq Data Analysis: A Practical Approach (by Eija Korpelainen, Chapman & Hall/CRC Computational Biology Series)

BF/0035/EN - ADVANCED BIOLOGICAL METHODOLOGIES

Academic Year 2021/2022

Free text for the University

Professor
- FLAMINIA CESARE MARINCOLA (Tit.)
- BARBARA MANCONI
- TIZIANA CABRAS
- DARIO PIANO

Period
- First Semester

Teaching style
- Convenzionale

Lingua Insegnamento
- INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[60/71] CELLULAR AND MOLECULAR BIOLOGY	[71/10 - Ord. 2021] Advanced cellular studies	9	76

Objectives

The course is taught in English

AIMS
At the end of the course, the student will have:
1) a general overview of the main techniques applied in structural biology and will develop clear awareness about concepts and critical steps in data collection, processing, and validation.
2) an advanced knowledge about the applications of spectroscopic techniques, the analysis and interpretation of spectroscopic data.
3) an indispensable knowledge to understand and apply the basic notions of mass spectrometry and proteomic techniques in biochemistry and biomedical research.

KNOWLEDGE AND UNDERSTANDING
The course introduces students to:
1) a general overview of the main techniques used for studying macromolecular complexes. Particular emphasis on proteins and nucleic acids will be given.
2) the main concepts of the main spectroscopic techniques used in the biological field

3) the main concepts of mass spectrometry and techniques applicable to different proteomic approaches to study proteins in several biological samples.

At the end of the course, the awareness will be developed in such a way that:
1) the main critical aspects related to a given macromolecular system will be identified and taken into account while developing an experimental strategy.
2) students will be able to understand the use of spectroscopic techniques for the study of the structure and reactivity of biological systems
3) students will be able to understand the basic notions of mass spectrometry and proteomic techniques and their application in the biochemistry and biomedical research.

APPLICATION CAPABILITIES
The course will provide:
1) basic notions essential to design an experimental strategy for macromolecular complexes studies. In particular, the learned knowledge will make it possible to understand the most suitable techniques to be chosen. In this respect, the strategy chosen will be a conscious consequence of the critical aspects and properties of the experimental system studied.
2) the tools to use the acquired knowledge in the spectroscopic field for acquiring information on the structure and reactivity of molecules of biological interest.
3) the tools to use the acquired knowledge in the proteomic field for qualitative and quantitative characterization of proteins and peptides of biological interest.

AUTONOMY OF JUDGMENTS
At the end of the course, the student will be able:
1) to develop the ability to choose an experimental strategy in complete autonomy and will be able to perform a preliminary data validation in structural biology.
2) to formulate their own judgment on spectroscopic data, mass spectrometry-based proteomics and discuss them logically based on the interpretation of the available information.

COMMUNICATION SKILLS:
The course will provide students with the ability to explain the main concept laying at the base of the main techniques exploited to study macromolecular complexes in biology, spectroscopic, and mass spectrometry data. This will imply the use of appropriate technical language both written and spoken.

ABILITY TO LEARN:
Acquisition of adequate scientific knowledge on the main techniques used in structural biology with a particular focus on spectroscopic techniques, crystallography/cryo-EM and mass spectrometry-based proteomics. Concepts will be acquired through lectures and specific scientific books as well as recent publications in the field. Indications on how to find updated sources will be provided showing how to proceed in building a bibliography and in consulting databases.

Prerequisites

Fundamental knowledge of organic chemistry, physics, and biochemistry.

Contents

Mass spectrometry-based proteomics module (16 h of classroom lectures and 12 h of Laboratory experiences):

* Proteomics: aims, structural, expression and functional proteomics, application fields.
* Mass spectrometry (MS) applied on protein study. Basic concepts of MS. Ionization sources (MALDI, ESI, and AI). Low and high resolution mass analyzers.
* Gel-free and gel-based proteomic approaches. Principles of chromatography: reverse phase chromatography (RP-HPLC). Electrophoretic separations: SDS-PAGE, Two-dimensional electrophoresis (2D PAGE). Spot picking and processing.
* Bio-informatics tools for analysis of mass spectrometry data.
* MS Methods for protein identification. Peptide Mass Fingerprinting. Tandem mass spectrometry, principles and application for protein sequencing, de novo sequencing.
* Bottom-up, shut-gun, middle-down and top-down proteomics. Imaging mass-spectrometry.
* Quantitative strategies, label-free and label-based, relative and absolute, SILAC, AQUA-peptide, XIC, SIM, SRM, MRM and PRM.
* Laboratory: 2-DE electrophoresis of protein mixture. Spot picking and protein digestion. Mass spectrometry analysis. Interpretation of data by Proteome Discoverer software. Manual inspection and interpretation of mass spectrum.

Structural Biology module (16 h of classroom lectures and 12 h of Laboratory experiences):

X-rays and Neutrons sources, Three-dimensional crystallization of proteins and crystals diffraction analysis by X-rays and Neutrons, advantages and limits of Neutron vs X-ray diffraction; Structure and dynamics of proteins studied by X-ray Free Electron Laser, laser sources, pump probe systems. Small Angle X-ray Scattering and Small Angle Neutron Scattering and coupled with Size Exclusion Chromatography. Extended X-ray Absorption Fine Structure and X-ray Absorption Near Edge Structure. Electrons sources, Transmission and Scanning Electron microscopes, Two-dimensional crystallization of proteins and crystals diffraction analysis by Electrons (Electron crystallography). Cryogenic electron microscopy, Single Particles Analysis, cryo-electron tomography and subtomogram averaging; Protein structure determination by Nuclear Magnetic Resonance Spectroscopy; Analysis of extended structures (e.g. cells, organelles, membranes) by Atomic force microscopy. Practicals: Quality check of proteins samples by Size Exclusion Chromatography and Native electrophoresis, oligomeric profiles, mono-dispersion of the components; Two-dimensional and Three-dimensional crystallization of proteins.

Spectroscopy Module: (24 h of classroom lectures)

* Electromagnetic spectrum. Electromagnetic radiation (emr): the classical and quantum-mechanics model. Absorption and emission of emr: basic principles
* UV-visible spectroscopy. Priciples. Chromophore. Lambert-Beer Law. UV spectra of proteins and nucleic acids. Applications of UV-visible spectroscopy for the study of biological systems.
* Linearly polarized light and circularly polarized light. Optical activity and circular dichroism (CD). CD spectra of protein and DNA. Conformational studies by CD spectroscopy.
* Fluorescence spectroscopy. Singlet and triplet states. Radiationless and radiation transitions. Internal conversion. Intersystem crossing. Quencing. Quantum yield. FRET.
* IR spectroscopy. Molecular Vibrational modes. The harmonic oscillator. The anharmonic

oscillator. Selection rules. The IR spectrum. IR spectroscopy applications to the study of biological systems. Reading and analysis of a scientific paper.
* Raman spectroscopy. Basic principles. Selection rules. Resonance Raman spectroscopy
* Nuclear Magnetic Resonance spectroscopy (NMR). Basic principles. Larmor frequency. Chemical shift. Spin-spin splitting. NMR spectroscopy applications to the study of biological systems. Reading and analysis of a scientific paper.

Teaching Methods

Lectures will be prevalently held in classrooms, also integrated with online teaching resources, by using specific online platforms managed by the University of Cagliari.
The teaching method includes classroom lectures with oral presentations (56 h), during which the students are guided to the understanding of the basic and applicative concepts of Spectroscopic Methodologies, Structural Biology and Mass spectrometry-based proteomics and laboratory experience (24 h).

Each lesson will be structured as follows:

- introduction: this includes a clear presentation of the objectives, the key ideas, and their relation to the objectives of the entire course. The fundamental aims of the introduction are to consolidate attention, reinforce motivation, and provide an overview of what will be subsequently developed.
- development: this presents in detail the contents and highlights the links among ideas or key points.
- conclusion or summary: this aims at reinforcing the learning of the lesson content.

Verification of learning

The evaluation of the student's learning is done through an oral evaluation* that is conducted to verify:
(a) the acquisition of the basic concepts in structural biology, mass spectrometry and proteomics;
(b) the understanding of how X-rays, electrons, spectroscopic and proteomic techniques can be exploited to study biological macromolecules;
(c) the ability of the student to expose complex concepts in a clear way, adequately using the technical-scientific language;
(d) the ability to design an experimental strategy to acquire specific information from biological samples;
(e) the ability to use the acquired knowledge to proactively solve new problems.

* For needs due to an epidemiological emergency, the exam could be carried out remotely via Teams.

In the evaluation of the exam and in the assignment of the final mark, the following aspects will be taken into account:
(1) level of knowledge of the contents;
(2) ability to apply the theoretical concepts:
(3) personal qualities (critical spirit, ability to self-evaluate);
(4) exhibition mode (expressive capacity: appropriate use of the specific language of the discipline; logical skills and consequentiality in the connection of content; ability to link

different topics finding common points and to establish a consistent overall design; the ability of synthesis also through the use of the symbolism proper of the material and the graphic expression of notions and concepts, in the form, for example, of formulas, schemes, equations)

Consequently, the judgment will be express with a mark (in thirtieths) that can be:
a) Sufficient (from 18 to 20): The candidate demonstrates little knowledge acquired, superficial level, many gaps; expressive abilities modest, but still sufficient to support a coherent dialogue, logical and consequential in the fitting of the subjects of the elementary level; poor capacity for synthesis and ability to graphic expression rather stunted, lack of interaction with the teacher durations interview.
b) Moderate (from 21 to 23): The applicant demonstrates the discreet acquisition of knowledge but lack of depth, a few gaps; expressive abilities more than sufficient to support a coherent dialogue; acceptable mastery of the scientific language, logical and consequential in the fitting of the arguments of moderate complexity, more than enough capacity for synthesis and the ability to graphic expression acceptable.
c) Good (from 24 to 26): The candidate demonstrates a wealth of knowledge rather large, moderate depth, with small gaps; satisfactory mastery of the expressive capabilities and significant scientific language; abilities dialogical and critical well detectable, good capacity for synthesis and ability to graphic expression more than acceptable.
d) Outstanding (from 27 to 29): The candidate demonstrates a wealth of notions very extensive, well depth, with marginal gaps; remarkable powers of expression and high mastery of scientific language; remarkable capacity dialogue, good competence and relevant aptitude for logic synthesis, high capacity for synthesis and graphic expression.
e) Excellent (30): The candidate demonstrates a wealth of very extensive and in-depth knowledge, gaps irrelevant, high capacity and high mastery of scientific language; excellent ability dialogical and aptitude to make connections between different subjects, excellent ability to synthesize, and very familiar with the expression graphics.

The praise “30/30 cum laude” is attributed to the candidates clearly above the average, and whose expressive, conceptual, logical, and notional limits are completely irrelevant as a whole.

The final grade is obtained by computing the weighted average of the grade obtained in the three modules.

Texts

Materials for studying the subject (reviews and publications) will be provided at the lesson.

** For the "Mass spectrometry-based proteomics" module (free choice among the following texts):
Peter Wyatt Proteomics: Principles, Techniques and Analysis. Syrawood Publishing House
Edmond De Hoffmann, Vincent Stroobant Mass Spectrometry: Principles and Applications-Wiley
Throck Watson O. David Sparkman. Introduction to Mass Spectrometry: Instrumentation, Applications and Strategies for Data Interpretation, Wiley-Backwell
Josip Lovric’: Introduciong Proteomics. Wiley-Backwell

** For the "Spectroscopy" module:

Gordon G. Hammes “Spectroscopy for the Biological Sciences”, Wiley
Robert M. Silverstein, Francis X. Webster, David J. Kiemle Spectrometric Identification of Organic Compounds, Wiley

More Information

• The slides of the lectures will be available for students

• Teachers are available every day by appointment (via e-mail) for further information or clarification on the topics discussed in the lectures.

BF/0036/EN - METABOLIC BIOCHEMISTRY

Academic Year 2021/2022

Free text for the University

Professor
ALESSANDRA OLIANAS (Tit.)
FRANCESCA PINTUS
Period
First Semester
Teaching style
Convenzionale
Lingua Insegnamento
INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[60/71] CELLULAR AND MOLECULAR BIOLOGY	[71/10 - Ord. 2021] Advanced cellular studies	7	60

Objectives

The course is taught in English.
The course provides specific and applicative knowledge and skills on human biochemistry at the level of tissues by studying the biosynthesis and catabolism of biological molecules with a high impact on metabolic balance from a biomedical point of view. The course aims to clarify the molecular mechanisms underlying metabolic and hormonal regulation and biochemistry pathways of specific biological processes. In the final part of the course will be considered the inhibition of specific enzymes of biomedical interest by exogenous molecules such as drugs.

KNOWLEDGE AND UNDERSTANDING
Comprehension of the fundamental rules of lipids, carbohydrate and protein structures and functions. A peculiar attention is dedicated to the synthesis, modification, and destruction of the polypeptide chain, so to better understand how cells functionality is finely managed. Comprehension and analysis of the main metabolic pathways (anabolic and catabolic) and their main regulatory mechanisms.

APPLICATION CAPABILITIES
Practical activities aim to acquire general techniques about protein structures analysis.

AUTONOMY OF JUDGMENTS:
Students will be able to identify the logics underlying the rational study of biochemical processes, avoiding a merely mnemonic study. A deepening of the topics treated during the frontal lessons with the participation of the student, results in a better capacity to evaluate and verify the knowledge acquired. The laboratory experience offers the ability to evaluate and interpret data obtain from experimental activity.

COMMUNICATION SKILLS:
The students will be able to discuss the topics of the course by using scientific terminology typical for Biochemistry. They will acquire the ability to describe specific metabolic events as well as their interrelation and regulation. Capacity to correctly describe the experimental data obtained and demonstrate their understanding through dialogue and by using graphical representations.

ABILITY TO LEARN:
Acquisition of adequate scientific knowledge of biochemistry through specific scientific texts, lectures and the interaction with the teacher. Development of a methodology of study that allows the student to be able to interpret and deepen the information regarding the study of biochemistry that he can find in his future study and career.

Prerequisites

Good knowledge of general biochemistry and molecular biology

Contents

• Lipids: polyunsaturated fatty acids; arachidonic acid cascade; eicosanoids; phospholipases.
• Carbohydrates: glycosaminoglycans and proteoglycans; protein glycosylation (N-, O-glycosylation and GPI-linked proteins);
• Proteins: protein folding and unfolding; control of protein function (phosphorylation, proteolysis, ADP-ribosylation, protein targeting by lipid modifications, calnexin and calreticulin). Proteins of ECM: structure and function of Collagen and Elastin. Proteins involved in immune system: structure and functions of different classes of immunoglobulins. Genetics of immunoglobulins: generation of antibody diversity.
• Metabolism of carbohydrates: Metabolism of glycogen in the liver and muscles. Regulation of carbohydrate metabolism by hormones and transcriptional circuits. Genetic diseases related to carbohydrate metabolism;
• Metabolism of lipids: Biosynthesis of cholesterol, and bile acids. Regulation of lipid metabolism by hormones and transcriptional circuits. Genetic diseases related to lipids metabolism.
• Metabolism of proteins and amino acids: the aromatic amino acids tyrosine and tryptophan hormone precursors and neurotransmitters (dopa, dopamine, norepinephrine, adrenaline, serotonin, melatonin). The amino acids precursor of biogenic amines and ketoacids. Genetic diseases related to proteins and amino acids metabolism.
• Metabolism molecule derived from amino acids : porphyrins synthesis and catabolism. Purine and pyrimidine synthesis and catabolism. Genetic diseases related to heme and purine metabolism.
• The metabolism of alcohol
• Inhibition and regulation of enzymes: enzymatic inhibition mechanisms by specific drugs.

Laboratory (12 hours): Characterization of proteins by electrophoresis. Spectrophotometric determination of biomolecules in solution.

Teaching Methods

The course comprises 48 hours lectures in 8 weeks (2 hours per day, two days a week). At the end of lectures there is the laboratory part of the course (12 hours).
Teaching will be organized mainly in frontal classes, integrated and "augmented" with online strategies, in order to guarantee its use in an innovative and inclusive way.
As regards laboratory activities, on the basis of the contextual conditions linked to the Covid-19 pandemic, online shifts and / or replacement activities may be envisaged.

Verification of learning

The final evaluation is an oral exam that takes into account several factors:
Quality of the knowledge, skills, competences showed:
a) appropriateness, accuracy and consistency of knowledge
b) appropriateness, accuracy and consistency of skills
c) appropriateness, accuracy and consistency of skills
Exhibition mode:
a) Capacity of expression;
b) Proper use of the specific language of the discipline;
c) Logical ability also in the consequential fitting of the contents;
e) Ability to connect different subjects by finding the common points and establish a consistent overall design;
f) Ability to summarize through the use of symbolism on the matter, and including the graphic expression of ideas and concepts, for example scheme of biological processes and structures.
Relational qualities:
Ability to talk and interact with the teacher during the interview.
Personal qualities:
a) critical spirit;
b) ability to self-evaluation.

Consequently, the judgment can be:
a) Fair (18 to 20/30)
The candidate demonstrates little knowledge acquired, superficial level, many gaps. Expressive abilities modest, but still sufficient to support a coherent dialogue, logical and consequential in the fitting of the subjects of the elementary level; poor capacity for synthesis and ability to graphic expression rather stunted, lack of interaction with the examiner.
b) Moderate (21 to 23)
The applicant demonstrates a discreet acquisition of knowledge but lack of depth, a few gaps; expressive abilities more than sufficient to support a coherent dialogue; acceptable mastery of the language of science, logical and consequential in the fitting of the arguments of moderate complexity, more than enough capacity for synthesis and ability to graphic expression acceptable.
c) Good (24 to 26)
The candidate demonstrates knowledge rather large, moderate depth, with few gaps; satisfactory mastery of the expressive capabilities and significant scientific language; critical

ability, good capacity for synthesis and ability to graphic expression more than acceptable.
d) Outstanding (27 to 29)
The candidate demonstrates a wealth of notions very extensive, well depth, with marginal gaps; remarkable powers of expression and high mastery of scientific language; remarkable dialogue capacity, good competence and relevant aptitude for logic synthesis, high capacity for synthesis and graphic expression.
e) Excellent (30)
The candidate demonstrates a wealth of very extensive and in-depth knowledge, gaps irrelevant, high capacity and high mastery of the expressive language of science; excellent ability dialogical aptitude to make connections between different subjects, excellent ability to synthesize and very familiar with the expression graphics.
The praise is attributed to the candidates clearly above average, and whose notional limits, if any, expressive, conceptual, logical, as a whole are completely irrelevant.

Texts

TextBook of Biochemistry with Clinical Correlations- Sixth Editions-Thomas M. Devlin
I Principi di Biochimica di Lehninger; Nelson-Cox, Zanichelli.

More Information

Students will be given slides of lectures, scientific publications (reviews) on specific topics covered in class (English),

EC/0052 - INTERNATIONAL STANDARDS AND TOURISM INDICATORS MONITORING

Academic Year 2021/2022

Free text for the University

Professor
PATRIZIA DANIELA MODICA (Tit.)
Period
Second Semester
Teaching style
Convenzionale
Lingua Insegnamento
INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[11/81] SUSTAINABLE TOURISM MANAGEMENT AND MONITORING	[81/00 - Ord. 2017] PERCORSO COMUNE	9	54

Objectives

The training program International Standards and Tourism Indicators Monitoring aims at providing students with fundamental knowledge on tourism monitoring through standards and indicators.

In the present techno-society, together with the increase in demand of “new forms of tourist experience” impacting directly on communities and environment, the need for a sustainable management of tourism destinations is strengthened together with the need for a systematic monitoring and comparison with international standards.

The teaching course International Standards and Tourism Indicators Monitoring is part of the first semester of the second year of the Master Degree Sustainable Tourism Management and Monitoring (STMM). Coherently with the training project and in line with the other lectures foreseen for the semester, it fulfils the third training objective of STMM which is to provide specialized knowledge pertaining to the professional output of the Master Degree. In particular, indicators for monitoring sustainable tourism, information systems to support decision making and IT management of data of the territory are central contents of the module curriculum.

Based on objective 3, the expected learning outcomes of the course have been identified and detailed as per Dublin Descriptors.

1) Knowledge and understanding
- Knowledge and understanding of sustainable tourism and new emerging trends;
- Knowledge and understanding of a EU language at level B2, besides Italian;
- Knowledge and understanding of sustainable tourism, international standards and indicators;
- Knowledge and understanding of monitoring principles.

2) Applying knowledge and understanding
-Know how to apply knowledge for analysing the local system in order to plan a sustainable development strategy in sustainable tourism;
-Know how to identify the relevant indicator systems for monitoring sustainability in a specific tourism ambit;
-Know how to apply multidisciplinary knowledge to analyse, describe and solve tourism development problems.

3) Making judgements
-Be capable to formulate an evaluation and/or opinion based on the interpretation of available data and identify, collect and elaborate the further data necessary to attain an increased awareness about themes specific and/or common to sustainable tourism development;
- Have the capability to know how to do it, i.e. know how to assume initiatives and decisions being aware that each activity is implemented in uncertainty and risk conditions, taking into account besides the technical aspects, also the economic, ethic, and social ones.

4) Communication
-Know how to communicate in an effective way information, projects and lines of action to internal and external stakeholders, organizations, economic and social operators, and to the community;
-Know how to choose the communication form and means suitable for the interlocutor, both specialist and non;
-Know how to communicate in a national and international context.

5) Learning skills
-Have the learning skills that are needed by a manager to operate in line with the needs of change and of turbulence of the economic systems;
-Have the capability of retrieving from different bibliographic sources, both in Italian and in English, in order to acquire new competences;
-Have the capability, curiosity and inclination towards learning to undertake further studies.

Prerequisites

Knowledge of first year notions are recommended.

Contents

International indicator systems connected with sustainability follow two main directions:

a) the international indicators framework;
b) techniques for the analysis and implementation of indicators.

1) GENERAL FRAMEWORK
1.1. Recalling sustainable tourism basic concepts;
1.1.1. The philosophy of sustainability;
1.1.2. Components of tourism sustainability;
1.1.2.1. Natural environment;
1.1.2.2. Economic environment;
1.1.2.3. Social, historical and cultural environment;
1.1.2.4. Managerial environment;
1.2. Defining a sustainable tourism destination;
1.3. Type of tourism;
1.4. Tourism area life cycle;
1.5. Sustainable tourism management;
1.5.1. Tourism management organization
1.5.2. Delivery on the ground
1.5.3. Management and Monitoring of sustainable tourism: introduction
1.6. Sustainable tourism stakeholders
1.7. Partnerships
1.7.1. Public/private
1.7.2. Different level of partnerships
1.8. Why manage sustainable tourism.

2) FRAMEWORK FOR SUSTAINABLE TOURISM DEVELOPMENT
2.1. The Visitor Industry Community Environment (VICE) model;
2.2. The role of sustainable tourism managers;
2.3. Tools for managing resources.

3) INTERNATIONAL FRAMEWORK
3.1. The human rights architecture;
3.2. The United Nations (UN) 2030 Agenda for Sustainable Development and sustainable tourism;
3.3. Global level: United Nations World Tourism Organization (UNWTO), Global Sustainable Tourism Council (GSTC), Global reporting Initiative (GRI), etc.;
3.4. Regional level: European Union (EU), European Commission (EC), Council of Europe (CoE), Association of South-East Asian Nations (ASEAN), African Union (AU), etc.;
3.5. Local level: governmental institutions in charge of the tourism sector (e.g. Region, Province, Municipality, etc.);
3.5.1. The case study of the Destination Management Organization (DMO) Visit South Sardinia;
3.6. Data acquisition bodies and tools:
3.6.1. Bodies: Organization for Economic Cooperation and Development (OECD), European EUROSTAT, Italian Istituto Nazionale di Statistica (ISTAT), etc.;
3.6.2. Tools: United Nations Development Program (UNDP) Indexes, UNWTO Indicators, GSTC Criteria and Indicators, European Tourism Indicator System (ETIS), GRI Indicators, etc.;

4) OPERATIONAL TOOLS

4.1. Indicators of sustainable development for tourism
4.2. Types of indicators
4.3. Tourism impacts
4.4. Tourism seasonality
4.4.1. Seasonality indicators
4.4.2. The case study of Villasimius, Sardinia
4.4.3. Strategies to reduce seasonality
4.5. Management and monitoring sustainability in tourism;
4.5.1. Tools for managing tourism resources;
4.5.1.1. Public sector plans and methods;
4.5.1.2. International Institutions programs;
4.5.1.3. Private sector involvement;
4.5.2. Managing and monitoring tourism impacts: sustainable practices;
4.5.2.1. Environmental impact analysis and management systems;
4.5.2.2. Codes of conduct for tourism;
4.5.2.3. Tourism certifications;
4.5.2.4. Indicator techniques;
4.5.3. Effectiveness of managerial and control tools in tourism sustainability;

5) TECHNIQUES FOR THE ANALYSIS AND IMPLEMENTATION OF INDICATORS

5.1. Indicator systems for sustainable tourism destinations: preamble;
5.2. The European Tourism Indicator System (ETIS);
5.2.1. ETIS toolkit;
5.2.2. ETIS indicators;
5.3. The World Tourism Organization (WTO) indicator system;
5.3.1. WTO indicators;
5.4. The Global Sustainable Tourism Council (GSTC) criteria and indicators program;
5.4.1. GSTC criteria and indicators;
5.5. The Global Reporting Initiative (GRI) for sustainable organizations;
5.5.1. The GRI indicators;
5.6. Comparisons among indicator systems;
5.7. Indicator systems: potential and value for tourism stakeholders;
5.8. Evidence on international case studies of sustainable tourism destinations.

Teaching Methods

The course is developed along 54 hours of frontal lectures, supported by 10 hours of laboratory work.
The traditional teaching methodology will focus on the topics foreseen in the program and will follow a communication approach based on interactive dialogue between lecturers and students.
The laboratory work will be based on deepening issues tightly linked to the contents of item 5 of the program and to the analysis of case studies. In addition, the approach adopted in the laboratory activities will focus on the acquisition of the concrete knowledge of identification and use of indicators in advanced research and retrieval, elaboration and analysis of tourism data within the indicator systems.

Topics for discussion and supporting materials, will be indicated in classroom a week before the date of the discussion.
At the end of these activities, students will produce a final elaboration to be evaluated that will contribute to determine the final evaluation.

However, also in case of no final laboratory elaboration, each student will receive a qualitative evaluation of the active participation in the activity of the lab that will be taken into account in the overall assessment of the learning objectives achieved by the student.
Teaching activities will be delivered mainly in the presence, integrated and “augmented” with online strategies, in order to guarantee its use in a
innovative and inclusive way.

Verification of learning

The exam consists of a written test structured through a series of questions divided according to the five topics of the program, in order to verify knowledge and understanding, knowing how to apply knowledge and understanding, formulating judgments and communication skills acquired through training.

Course requirements

Final course grades are awarded to students who have successfully completed the required activities and integration activities (as described in point 2) and obtained a final grade of at least 18/30.

1) Exam with a single final written test (attending and non-attending students)

The exam consists of a written test to be completed within 1.5 hours which includes 5 questions with open answers and an exercise to be developed, structured as follows:
- Question 1 concerning the topics contained in the general framework (points 5/30)
- Question 2 relating to the topics contained in the framework for the development of sustainable tourism (points 3/30)
- Question 3 relating to the topics contained in the operational tools (points 7/30)
- Question 4 concerning the topics contained in the international framework (points 5/30)
- Question 5 relating to the topics contained in the Techniques for the analysis and implementation of indicators, including exercise (grade 10/30).

A bonus of 2 points will be added to the above scores for the evaluation of the elaboration which will stand out for the high level of discussion of the topics and which can allow to reach a final qualitative evaluation of 30/30 cum laude. Only for attending students, the recognition of this bonus is linked to the qualitative assessment achieved through participation in supplementary activities, referred to in point 2 below.

2) Exam with supplementary activity (attending students)

For attending students there is the possibility of an additional activity, which will determine the final score. Students who undertake these activities will be exempted from the final written test. To meet this second method of conducting the exam, students must:

1. Read critically and be able to discuss all books and articles assigned to the class, as well as engage in constructive conversation with colleagues. (30% of the final grade) - the "exercises" are not evaluated, but participation in group discussions is part of the vote;
2. make 1 presentation in the classroom of the selected sustainable destination project (30%);
3. produce a final project document (30%) of about 20-25 pages (bibliography included);
4. participate in laboratory activities. This activity will consist in the design and analysis of surveys on sustainable tourism (10%), which will contribute to the drafting of the final project document.

Texts

• World Tourism Organization. (2007). A practical guide to tourism destination management. World Tourism Organization, Madrid, chap. 1 and 8.

• P. Modica. (2015) Sustainable Tourism Management and Monitoring. Destinations, Buisiness and Stakeholder Perspectives, FrancoAngeli, Milano.

• World Tourism Organization. (2004). Indicators of Sustainable Development for Tourism Destinations. A Guidebook, World Tourism Organization, Madrid.

• Global Sustainable Tourism Council (GSTC). 2013. GSTC Criteria version 1., 1 November 2013 and Suggested Performance indicators version 1, 10 December 2013 for Destinations, Washington.

• Global Sustainable Tourism Council (GSTC). 2019. GSTC Destination Criteria, version 2.0, 6 December 2019 with Performance indicators and SDGs, Washington

• European Commission. 2013. The European Tourism Indicator System—ETIS Toolkit for Sustainable Destination Management. Publications Office of the European Union, Luxembourg.

• European Commission. 2016. European Tourism Indicator System for Sustainable Destinations; European Union, Brussels, Belgium.

Materials regarding Part 3 (International Framework) of the program are available on the following web sites:
www.ohchr.org
www.europa.org
www.fra.europa.cu
www.coe.int
www.unwto.org
www.unwto.org/sustainable/publications.htm
www.tourmis.info
www.oecd.org/statisticdata

To facilitate retrieval of information, main relevant documentation will be selected and downloaded into this teaching course available in the Moodle platform.

More Information

Further information will be provided during lectures

EC/0053 - SPATIAL TOURISM DATA ANALYSIS

Academic Year 2021/2022

Free text for the University

Professor
MASSIMO CANNAS (Tit.)
Period
First Semester
Teaching style
Convenzionale
Lingua Insegnamento
INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[11/81] SUSTAINABLE TOURISM MANAGEMENT AND MONITORING	[81/00 - Ord. 2017] PERCORSO COMUNE	6	36

Objectives

The aim of the course is to offer students the main tools for flexible data analysis, data-driven decision making and efficient use of resources. All tools will be illustrated via realistic case studies of business relevance.

Prerequisites

Basic probability and statistics typically offered in a first undergraduate course for students in economic and business sciences e.g. Newbold Carlson Thorne, Statistics for Business and Economics, Pearson Education. See in particular the probability chapters. Familiarity with R language is advantageous.

Contents

Decision trees. Probability and random variables: MonteCarlo approximation. Linear programming and the simplex. Basic Stochastic Processes.

Teaching Methods

Lessons and practice sessions.

Verification of learning

Attending students: a final written exam (60%) and a final presentation (40%). The final presentation can be done in groups (1-3 students)

Non attending students: written and oral exam.

Texts

Probability and statistics recap:

Paul Newbold, William L. Carlson, Betty Thorne:
Statistics for Business and Economics, Pearson Education 8th edition. Please review all chapters on probability and the first chapter on regression.

Main Text:
Data, Models, and Decisions: The Fundamentals of Management Science by Dimitris Bertsimis and Robert Freund.

For the stochastic processes part:

Understanding Markov Chains (2nd Edition), N. Privault, Springer 2018 (part of ch1, ch4)

Other possible readings will be shared on the learning space.

More Information

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EC/0068 - STATISTICAL MODELS FOR PORTFOLIO ASSET ALLOCATION

Academic Year 2021/2022

Free text for the University

Professor
CLAUDIO CONVERSANO (Tit.)
Period
First Semester
Teaching style
Convenzionale
Lingua Insegnamento
INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[11/83] ECONOMICS, FINANCE AND PUBLIC POLICY	[83/20 - Ord. 2017] Economia e Mercati Finanziari	6	36

Objectives

The course aims to provide students with the basics of asset allocation methods to be applied in portfolio management in order to better understand the effectiveness of such methods in solving real life problems related to the asset management. At the end of the course, students will be able to better understand the basics of advanced statistical methods used for that purpose, and to assess their importance for the decision making process typical of asset allocation.

In line with the Dublin Descriptors, the learning skills acquired at the end of the course can be classified as follows:
1) Knowledge and understanding. The course permits to study the multivariate statistical models utilized for decision-making processes in modern (multinational) financial companies, and understand the effects they produce on asset management actions.
2) Applying knowledge and understanding. The methods being studied are applied during case-studies classes, where students can learn the basics of the R software for statistical computing and understand how it can be used to solve real problems related to portfolio asset management.
3) Making judgements. During classes, students are asked for problem solving and decision making as if they where a asset managers that need to take a decision in order to improve profitability of their investments.
4) Communication skills. Students are called during classes to discuss on the appropriateness

of suggested methods in different management scenarios.
5) Learning skills. Classes, lecture notes, and case-study analyses allow to maximize the students overall learning skills in the statistics and asset management field.

Prerequisites

Students attending the course are expected to have acquired the basic notions in univariate and bivariate descriptive statistics, probability distribution and statistical inference ("important") and some basic notions of Mathematics ("useful").

Contents

1. Introduction to the course; Intro to R, Intro to measurements, Descriptive Statistics (4 hours)
2. R functions and financial functions to manipulate assets (4 hours)
Manipulating financial time series
Price and index series
Return and cumulated return series
Drawdowns and Duration series
Estimates of covariance matrices
Quantile and related risk measures
3. Robust estimation of mean and covariance of financial assets (4 hours)
Robust covariance estimator
Nearest-Neighbour covariance estimator
Shrinkage and Bagging estimator
4. Exploratory data analysis of assets (4 hours)
Graphical representation of prices and returns
Testing asset returns of normality
Selecting similar or dissimilar assets
Comparing multivariate return and risk statistics
Pairwise dependencies of assets
5. Specifying portfolios and their constraints in R (4 hours)
6. Mean-Variance portfolios (4 hours)
Markowitz portfolio theory
Minimum-risk mean-variance portfolios
Efficient frontier
Robust portfolios
7. Mean-CVaR Portfolios (4 hours)
Long-only portfolio frontier
Unlimited short portfolio frontier
Box-Constrained portfolio frontier
Group-Constrained portfolio frontier
8. Portfolio Backtesting (2 hours)
9. Issues in asset management of financial portfolios (6 hours)
Adaptive asset allocation
Mean-Gini Portfolios
Portfolio shrinkage
Resampled efficient frontier
Omega portfolios
Rebalancing strategies

Performance attribution
130/30 management strategy

Teaching Methods

The course is scheduled in 6 Lecture hours per week.
Some classes (of 2 hours each) are given to analyse case studies and apply all acquired knowledge to understand how using the R software to solve real problems in portfolio management.

Verification of learning

Students preparation is verified through a two-hours written exam where students are asked to answer 7 questions related to the theoretical foundations of the statistical methods as well as to the interpretation of the results of a statistical analysis. Ability in mathematical formalization, graphical representation and appropriate statistical language are also evaluated. All classes and additional material, along with notes and reference books, are necessarily needed for the full completion of the exam.
In line with the Dublin Descriptors, the evaluation process aims also to verify:
1) the ability to identify the statistical method to be applied in order to analyse a specific dataset (evaluation of knowledge and understanding).
2) the ability in the interpretation of the results of a statistical analysis (evaluation of applying knowledge and understanding).
3) the capacity to use properly the R statistical software in order to apply the most appropriate method for a specific dataset (evaluation of making judgements).
4) the capacity of synthesizing the results of a statistical analysis and to represent them both with mathematical formulations and rigorous graphic representation (evaluation of communication skills).
5) the theoretical knowledge of multivariate statistical methods (evaluation of learning skills).

Final mark is expressed through a 30-point scale.
A passing mark ranges from:
- 18/30: if the student shows a sufficient level of knowledge, that is he is able to at least identify the scenario in the analysis of a real dataset, knows the basic elements to draw the appropriate graphics and tables, and expresses comments with an elementary technical language.
- to 30/30, eventually cum laude, if the student is able to schematize in a logic and coherent way the statistical knowledge acquired during the course, namely all the theoretical issues characterizing statistical methods, and is able to apply these methods in a proper way.

Texts

Lecturer will not follow any textbook.

Notes and reference papers are made available through the personal homepage.

More Information

Additional material, further readings, and past exams, along with every additional information on the course and its credits, will be provided at request.

EC/0069 - CORPORATE FINANCE

Academic Year 2021/2022

Free text for the University

Professor
FABIO CERINA (Tit.)
Period
First Semester
Teaching style
Convenzionale
Lingua Insegnamento
INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[11/83] ECONOMICS, FINANCE AND PUBLIC POLICY	[83/20 - Ord. 2017] Economia e Mercati Finanziari	6	36

Objectives

At the end of the course, student will have the following knowledge, understanding and skills:

1) Knowledge and understanding
- of the role of information in financial markets;
- of the role of financial intermediaries in lender-borrower relationship;

2) Applying knowledge and understanding
Student will be able:
- to understand and to assess incentives of financial contracts;
- Design an optimal financial contract
- to identify the proper financial technique to solve specific financial issues and to discuss results.

3) Making judgements
Students will be involved in homework group discussions as well paper discussions. These activities will require and stimulate student capacity to make judgements in financial real cases scenarios.

4) Communication skills
Students will be able to develop critical discussion and to properly communicate financial topics. Homework, paper discussion will enhance students communication skills within the

team group and outside it (public speaking).
English communication skill will be also developed given that the course will be taught in english.

5) Learning skills
Students will learn and understand reciprocal financial incentives of economics agents (households, firms and intermediaries) and they will be able to self-learning and to understand the logic of financial relationship in actual real life situations.

Prerequisites

Mathematics for economics and microeconomics at the undegraduate level. Having studied the exam of Economics of Information will help remarkably.

Contents

The course aims at a detailed analysis of how the right design of financial contracts and the presence of financial intermediaries can help mitigating the agency problems due to the presence of asymmetric information (moral hazard and adverse selection) in the relationship between firms (managers, insiders) and investors (creditors, outsiders).

Why financial markets exists? Why people save and invest? Welfare gains in perfect markets ;
Separation of ownership and control and irrelevence of the financial structure (Modigliani-Miller) when markets are perfect ;
Corporate governance and Corporate finance when markets are not perfect: stylized facts and real world applications ;
Corporate finance and moral hazard: credit rationing and relevance of the financial structure;
How to reduce agency costs? Collateral posting and risk diversification;
Corporate finance and adverse selection (2 hours);
Implications: pecking-order and negative stock price reaction;
Signalling costs: certification and collateral posting;
Formal and real authorities in corporations;
Why banks exist? The role of financial intermediaries;
Banks as liquidity insurance: fragility and bank runs;
Banks as devices to reduce the informational cost of capital;
Banks as active monitors;
Special topic: the macroeconomic effects of collateral crises;

Teaching Methods

- front classes (26 hours), to develop knowledge and understanding;
- group homeworks and class discussions (6 hours), to develop judgements and communication skills;
- papers discussions (4 hours), to develop communication skills and judgements capacity.

Verification of learning

Final exams marks are on a scale of 30. Exam is passed when mark is not lower of 18/30. "Cum Laude" is assigned where exam results are excellent.

For attending students who will give the final exam within the winter session (January-February) the final evaluation will be the weighted average of the evaluation of three different parts:
1. Final writtenexam (55% weight).
2. Team-homework to be corrected in class (25% weight)
3. Presentation in class of a scientific paper or a further topic of study (15% weight)
4. Class participation (5% weight)

Non-attending students
Oral exam 100% weight (until the end of covid restrictions)

Students will give exam in English.

In order to pass the exam with the minimum grade (18/30) the student will be demostrate to have acquired a sufficient knowledge of the topics presented during the course.
The grade 30/30 (potentially cum laude) will be given to students showing an excellent command on topics presented during classes both from the theoretical and the empirical point of view, and being able to answer questions using a rigorous and appropriate language

Texts

Students will receive slides in pdf which cover the whole material of the course.
The main reference text is
Jean Tirole, 2006, The Theory of Corporate Finance, PUP Press (chapters 1,2,3,4,6,10)
The last part of the course borrows from several scientific papers and from two books:
Matthews, K. and J. Thompson , 2008, The Economics of Banking, Wiley (second edition)
Freixas, X. and J-C. Rochet, 2008, Microeconomics of Banking, MIT Press (second edition)

EC/0070 - RISK MANAGEMENT AND VALUE IN BANKING

Academic Year 2021/2022

Free text for the University

Professor
RICCARDO DE LISA (Tit.)
Period
First Semester
Teaching style
Convenzionale
Lingua Insegnamento
INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[11/83] ECONOMICS, FINANCE AND PUBLIC POLICY	[83/20 - Ord. 2017] Economia e Mercati Finanziari	6	36

Objectives

The course regards risks measurement and management, capital management and value creation in banks.
The course is divided into three parts: i) banks individual risks; ii) risk regulation; iii) capital allocation and value creation.

At the end of the course, a student will have the following knowledge, understanding and skills:
1) Knowledge and understanding
A student will know and understand:
- types of banks risk and main methodologies to measure them;
- models to assess the probability of failure of banks;
- capital regulation of bank;
- capital management and capital allocation.

2) Applying knowledge and understanding
A student will be able:
- to apply metrics to measure bank individual risks;
- to apply methodologies to assess bank overall risk;
- to compute capital requirements regulation;
- to measure the allocation and to optimize capital

3) Making judgments
Students will be involved in homework group discussions and case study discussions as well as paper discussions. These activities will require and stimulate student capacity to make judgments in banks real cases scenarios.
4) Communication skills
Students will be able to develop critical discussion and to properly communicate on banks risk management and related topics.
Homework, case study an paper discussion will enhance students communication skills within the team group and outside it (public speaking).
5) Learning skills
Students will learn and understand bank risk management concepts and tool of bank capital regulation and they will be able to self-learning and to understand the real bank life evolution.

Prerequisites

Foundation of Banking, Statistics, Mathematics for economics and Bank Accounting.

Contents

1. Bank Individual risks: credit, market, operational risk (12 hours);
2. Probability of default of banks (10 hours);
3. Capital requirement regulations and Basel Accords (8 hours);
4. Capital Allocation (6 hours).

Teaching Methods

Classes will be mainly face-to-face, integrated and augmented with online strategies, to assure participation by innovative and inclusive means

Details:
- conventional classes to develop knowledge and understanding (50%)
- group homework and class discussions, to develop judgments and communication skills (30%);
- papers discussions, to develop communication skills and judgments capacity (20%).

Classes are provided frontally/on-line (blended way), due to current national and local policies on COVID-19 pandemic.

Monitor faculty news for any possible variation.

Verification of learning

Written examination

Texts

- A. Resti – A. Sironi, Risk Management and shareholders value in banking, Wiley Finance
- Notes and Slides

More Information

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EC/0073 - ECONOMICS AND GEOGRAPHY OF INNOVATION

Academic Year 2021/2022

Free text for the University

Professor
RAFFAELE PACI (Tit.)
FABIO CERINA
Period
First Semester
Teaching style
Convenzionale
Lingua Insegnamento
INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[11/83] ECONOMICS, FINANCE AND PUBLIC POLICY	[83/10 - Ord. 2017] Economia e Politiche Pubbliche	12	72

Objectives

At the end of the course, the students who passed the exam will reach the following learning objectives
• Knowledge and understanding:
o Of advanced models for the analysis of regional economic systems
o Of quantitative methodologies as tools to interpret economic phenomena at the regional level
o Of regional policies
• Applying knowledge and understanding:
o In evaluating regional policies
o In applying research methods to study economic local institutions and in formulating public regional policies and couterfactual analysis also through the help of computational software like MATLAB
o In analysing and interpreting local territories
• Making judgments: the course stimutates the ability to make judgments through a series of activities: the elaboration of homeworks in team and their discussion in class, the personal writing of economic reports and the presentation in class of scientific papers.
• Communication: During classes, students will be involved in discussions which will enable them to develop a critical judgment and improve their communication skills. Moreover they will be asked to present in front of the class audience some scientific papers and prepare

statistical reports. Finally, the resolution of homeworks in team will develop students' skills in communicate their ideas within a team.
• Lifelong learning skills: The course is meant to develop the students' ability to analitically apply the notions learned in class. In particular, the course aims at developing the ability to read historical actual phenomena through the lenses of the theoretical models studied during lectures and at stimulating a critical and analytical approach to economic reality. The objective is to enable students to understand the mechanisms and the dynamics behind the localization decisions of economic agents (households, firms, innovators). Finally, some exercises on computational softwares like MATLAB will be carried on in order to develop the students' ability in apply computational methods to evaluate regional policies

Prerequisites

Basic principles of microeconomics and Economics of Growth and of quantitative methods for Economics

Contents

This course deals with some theoretical and empirical aspects of firms' and workers' localization and the spatial distribution of innovation activities. It aims at
• understanding the reasons behind these choices and to help predicting the impacts of these investments,
• providing a thorough analytical knowledge on modern urban and regional economics and on the economics of innovation.
• Allow student to be able to use this knowledge in order to study how the phenomena of industrial and demographic agglomeration can determine the economic success or failure of a region.
The course is made of two parts. Module A has two main aims: 1) to provide a thorough overview of the current economic theories on the determinants (causes) and on the consequences (effects) of the spatial concentration of economic activities; 2) to introduce the recent literature on urban labor markets and the spatial sorting of heterogenously skilled workers
More precisely, module A will deal with the following topics
• Stylized facts on agglomeration (2 hours)
• Models of monopolistic competition: Dixit Stiglitz (1977) (4 hours)
• Monopolistic competition and increasing returns : Krugman (1980) (2 hours)
• Factor mobility: new economic geography and the core-periphery model of Krugman (1991) (4 hours)
• The role of housing in agglomeration processes: Helpman (1998) (2 hours)
• The empirics of the NEG (4 hours)
• Testing the predictive capacity of NEG models with MATLAB: Quantitative Spatial Economics (12 hours)
• Urban labor markets and spatial allocation of skills (6 hours)

Module B aims to analyse the empirical models that explain the process of agglomeration of production and innovation activities and their effects on regional performance. In addition, module B will also contain a laboratory of statistical-econometric analysis which will allow student to test the concepts learned during lectures. More precisely, this module will present the following topics

• Introduction on the agglomeration process of production activities (8 hours)
• The determinants of regional performance (10 hours)
• The process of creation and diffusion of technological progress and knowledge among regions (8 hours)
• Statistical and econometric techniques and software for the analysis of spatial data on the topics covered during the classes (14)

Teaching Methods

Lectures (20 hours in module A and 18 hours in module B) in order to develop Knowledge and Understanding
• Homework resolution in team and discussion in class (6 hours in module A) in order to develop Communication skills
• Presentation of scientific papers in class (6 hours in module A and 4 hours in module B) in order to develop Communication skills and Making judgments
• Sessions on computational software like MATLAB (4 hours in module A) in order to develop Lifelong learning and applying knowledge and understanding
• Laboratory of spatial statistical analysis (14 hours in module B) in order to develop Judgements and applying knowledge and understanding

Verification of learning

The final grade is in 30th and will be computed as the arithmetic average of the grades in module A and module B.
Module A: for attending students who will give the final exam within the winter session (February) the final evaluation will be the weighted average of the evaluation of three different parts:
1. Final written exam (1 small essay) or development of a work using MATLAB (50% weight)
2. Team-homework to be corrected in class (25% weight)
3. Presentation of a scientific paper in class (20% weight)
For non-attending students, evaluation is 100% through a written exam (1 quantitative exercise and 2 small essays)
4. Class Participation (5%)

Module B: to pass the exam the students should exhibit the ability to write a report, manage and analyse databases and work on statistical-econometric analysis in autonomy.
For attending students the final exam will consist of
1) A presentation and discussion in class of some scientific papers (50%)
2) The elaboration of a short thesis on topics presented in class and in the laboratory (50%).
The active participation in the classes work will be also evaluated.
For non-attending students, the final exam will consist of a written exam (3 small essays)

Attending classes is strongly suggested and active participation of students is required for both modules
Generally, questions will be formulated in order to be able to evaluate if students have acquired the knowledge of the theoretical models and methods of empirical analysis and if they are able to apply them with judgment.
In answering questions, in presenting papers and in writing reports students will be asked to
• Present and discuss theoretical concepts with rigorous thinking

• Demonstrate the ability to comment in a rigorous and logical way statistical indicators and tables

In order to pass the exam with the minimum grade (18/30) the student will be demonstrated to have acquired sufficient knowledge of the topics presented during the course.
The grade 30/30 (potentially cum laude) will be given to students showing an excellent command on topics presented during classes both from the theoretical and the empirical point of view, and being able to answer questions using a rigorous language

Texts

Module A
The main source are the slides provided by the instructor.
The first part will refer mostly to the book:
Combes P.P., Mayer T., Thisse J.J. (2008), Economic Geography: the Integration of Regions and Nations, Princeton University Press.
We will study several papers, among which:
Redding S. and Rossi-Hasberg E. (2017), Quantitative Spatial Economics, Annual Review of Economics, 9:2158

Redding S. (2017), Goods Trade, Factor Mobility and Welfare, Journal of International Economics, 101: 148-167.

Eeckhout, J, Pinheiro, R. and Schmidheiny, K. (2014), Spatial Sorting, Journal of Political Economy, 122, 554-620

Cerina F. Elisa Dienesch, Alessio Moro and Michelle Rendall. Spatial Polarization (2019), CRENoS Working Paper 19-09

Autor (2019), "Work of the Past, Work of the Future", AEA proceedings

Module B:
The agglomeration process of production and innovation activities
(L1) Introduction
(L2) European Commission (2017) 7th Report on Economic and Social and Territorial Cohesion. Brussels.
Part 1. Agglomeration and determinants of regional performance
(L3-5) Determinants of regional performance and agglomeration economies
Beaudry C., A. Schiffauerova (2009) Who’s right, Marshall or Jacobs? The localization versus urbanization debate, Research Policy, 38, 318–337.
Paci R., Usai S. (2008) Agglomeration economies, spatial dependence and local industry growth, Revue d’Economie Industrielle, 123, 3, 87-109.
Dettori B., Marrocu E., Paci R. (2012) TFP, intangible assets and spatial dependence in the European regions, Regional Studies, 46, 10, 1401-1416.
Marrocu E., R. Paci, S. Usai (2013) Productivity growth in the Old and New Europe: the role of agglomeration externalities, Journal of Regional Science 53(3) 418–442
(L6) Creativity
Boschma, R.A., M. Fritsch (2009), Creative class and regional growth. Empirical evidence from seven European countries, Economic Geography, 85, 4, 391-423. (Intrroduction to the topic)

Marrocu E., Paci R. (2012) Education or Creativity: what matters most for economic performance?, Economic Geography, 88, 4, 369-401.
Marrocu E., Paci R. (2013) Regional development and creativity, International Regional Science Review, 36, 354-391.
(L7) Smart specialisation strategy and relatedness
Marrocu E., Paci R., Rigby D., Usai S. (2020) Smart Specialization Strategy: any relatedness between theory and practice?
Part 2. Spatial distribution of innovation activity
(L8) Introduction
Audretsch D., Feldman M. (2004), Knowledge Spillovers and the Geography of Innovation, in Henderson J.V. and J.F. Thisse (eds.) Handbook of Urban and Regional Economics.
Boschma R. (2005) Proximity and innovation. A critical assessment, Regional Studies, 39, 61–74.
Colombelli A., Foddi M., Paci R. (2011) The knowledge regions in the enlarged Europe, Working Paper CRENoS 2011/10. Published in Scientific regions, in Capello R. and Lenzi C. (editors) Territorial Patterns of Innovation. 2013. London: Routledge. 43-69.
(L9) Knowledge Production Function
Moreno R., Paci R., Usai S. (2006) Innovation clusters in the European regions, European Planning Studies ,14, 9, 1235-1263.
Moreno R., R. Paci, S. Usai (2005) Spatial spillovers and innovation activity in European regions, Environment and Planning A, 37, 10, 1793–1812.
(L10) Knowledge Flows
Paci R., Usai S. (2009) Knowledge Flows across European Regions, Annals of Regional Science, 43; p. 669-690
(L11) Proximity dimensions and innovation
Marrocu E., Paci R., Usai S. (2013) Proximity, Networking and Knowledge Production in Europe: what lessons for innovation policy?, Technological Forecasting and Social Change. 80, 8, 1484-1498.
Paci R., Marrocu E., Usai S. (2014) The complementary effects of proximity dimensions on knowledge spillovers, Spatial Economic Analysis. 9, 1, 9-30.

EC/0083 - ADVANCED CORPORATE FINANCE

Academic Year 2021/2022

Free text for the University

Professor
LUCA PIRAS (Tit.)
Period
First Semester
Teaching style
Convenzionale
Lingua Insegnamento
INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[11/80] MANAGEMENT	[80/30 - Ord. 2018] International Management	6	36

Objectives

a) Knowledge and comprehension abilities
Students will develop and increase their corporate finance knowledge, theories of Markets and behavioral finance. They will become familiar with complex investments and corporate valuation problems and technics.

b) Ability to apply knowledge and comprehension abilities
Students will develop the ability to set and solve complex valuation problems, including planning a start-up and large investments programs of big companies. They will be able to calculate, use and properly interpret the size of the opportunity cost of capital. Students will be able to analyze market scenarios also considering real individual behavior in business activity.

c) The ability to judge
the course will help students to develop and increase their ability to autonomously evaluate problems and processes of the financial environment and to make proper decisions.

d) The ability to comunicate
Students will learn how to interpret and communicate all financial information. Will be able to build and present financial reports, business plans and the most common kind of pitch.

e) Learning Ability

Students will be guided through the study activity so that they can acquire the ability to develop autonomous learning enhancement.

Prerequisites

Though there are not specific pre-requirements, the following topics will be assumed to be known by the student at the beginning of the course and won't be treated during class: Corporate finance, basic capital budgeting, the law of single price, Accounting, and Financial mathematics, Balance sheets analysis, ratios, and cash flow analysis; Basic Algebra and financial mathematics; Microeconomics basic elements are also warmly suggested.

Contents

1. The Cost of Capital
a. Fisher' theory of Interest;
b. The Separation Theorem;
c. Modigliani e Miller theory
d. Frequent mistakes in measuring the cost of capital

2. The Capital Market:
a. Harry Markowitz: Modern portfolio theory;
b. Eugene Fama: Efficient Market Hypothesis

3. Behavioral Finance
a. The Prospect Theory
b. Biases and Heuristics
c. Narrative, Noise, Technology

4. Valuation
a. Determining valuation criteria
b. Determining the cost of capital
c. Start-up Valuation
d. Elements of M&A

Teaching Methods

Lectures will be mainly in presence, integrated, and augmented with online instruments in order to grant the possibility to attend classes inclusively and innovatively.

Lectures: The course is organized into 18 lectures of two hours each.

Verification of learning

The exam is based on a written test, consisting in the solution of problems, questions requiring open answers on theoretical topics, as well as multiple choice.
Problems solutions will be evaluated considering the correctness of numerical results and the applied methodology; theoretical questions will be evaluated considering the essential content of theories and basic literature; in open questions will also be kept into account the capacity

to express in a synthetic, but clear manner the answers, properly using the jargon of the discipline.
To achieve the minimum grade (18-23), the student must obtain correct numerical results and has to demonstrate to have knowledge of basic concepts and to be able to properly frame basic knowledge within the discipline.
In order to achieve a better grade (24-26), students will also have to demonstrate a fair capacity to draw proper conclusions out of solutions found and questions answered.
Higher grades (27-28) can be attributed to students who demonstrate a complete knowledge of the topics with eventually trivial exceptions.
Top grades will be awarded to students who not only demonstrate to have fully reached the learning objective, but also delivered in time all the hands-out requested in an accurate and complete manner.

Texts

Eugene F. Fama Two Pillars of Asset Pricing, Prize Lecture, December 8, 2013,
Download at http://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/2013/fama-lecture.pdf
J. Berk – P. De Marzo, Finanza Aziendale, Pearson, Seconda edizione (o successive), 2011 - Capitoli: 10-13, 17-19
M.M. Pompian, Behavioral Finance and Wealth Management, Wiley Finance, 2006, chapters 4-23
Download at http://www.untag-smd.ac.id/files/Perpustakaan_Digital_1/FINANCE%20Behavioral%20finance%20and%20wealth%20management%20%20building%20optimal%20portfolios%20that%20account%20for%20in.pdf)

More Information

Within the course, though not necessarily during normal schedule, experts and professional managers will hold seminars on topics related to corporate valuation an investment funding.
All students are required to pass in two 2500 words essays (in english): one on M&A and the other on block chain and crypto currencies

EC0085 - APPLIED ECONOMICS

Academic Year 2021/2022

Free text for the University

Professor
STEFANO USAI (Tit.)
Period
First Semester
Teaching style
Convenzionale
Lingua Insegnamento
INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[11/80] MANAGEMENT	[80/30 - Ord. 2018] International Management	9	54

Objectives

Contents
Coursework provides students with a solid understanding of theoretical and empirical models of development economics mixed with a few focus on some elements of the current environment of globalization.
Moreover, students are introduced to some basics of economic growth theory. In particular, after having investigated the many reasons that explain the differences in wealth and welfare in the world, and the corresponding differences in growth rates, we will focus on the themes linked to the causes that derive from the localization of productive and innovative activities. Firstly, we aim at answering the following main question: Why are some countries rich and others poor? How can we measure such a gap and how can we analyse and assess the relationship between different socioeconomic phenomena: some of which are causes and others are outcomes. Students are introduced to the latest theoretical and empirical tools, with a particular focus on data, indicators and basic statistical tools to get a rigorous insight on these pivotal questions. By showing how empirical data relate to new and old theoretical ideas, this course provides students with a complete introduction to the discipline and the latest research.
Secondly, the course offers a multi-dimensional analysis of the environment in which international business operates. We will try to see how multi-national corporations, nation states, regional trade blocs, markets, and global institutions interact to shape the international economic system. In particular, we try to identify winners and losers of the globalization process and to assess if internationalization is leading to a global world, or a regional one.

In line with the Dublin Descriptors, the learning skills acquired at the end of the course can

be classified as follows:
1) Knowledge and understanding. The course allows students to study different specialized topics in economics, as presented in the literature. The objective is to analyze with students the capacity of economic framework and models to explain patterns of data both along time and across space, and to understand the role of market regulations. In general, the objective is to evaluate the content of reforms and of good managerial practices as advocated at the international level.
2) Capacity of applying knowledge and understanding. The topics presented in class will be analysed using real data and appropriate statistical models for data analysis. The objective is to make students able to understand the workings, the dynamics and the decisions tools within firms and to make meaningful economic decisions and forecast their effects in their future professional career.
3) Making judgements. During classes, students will be asked to give their technical opinion on real decisions, policies and reforms. This will be done under different points of view, trying to operate as in the real world, and thinking of the real impact of such policies/practices. Basic and real information and data will be made available in order to have the necessary knowledge to make appropriate investigation and make adequate decision.
4) Communication skills. Students will be encouraged to actively participate in class by discussing their opinions and showing capacity of speech, motivation and reciprocal exchange of ideas with the other students. In this respect, additional material presented in the classes will allow students to improve their communication skills, as requested in the final exam.
5) Learning skills. The use of real cases, theoretical explanations and additional activities will allow students to increase their learning skills that will be used in their academic and professional career.

Prerequisites

Students should know the basic principles of Economic Analysis, Micro and Macroeconomics.
Standard statistical tools will be useful to familiarize with the topics discussed during the course.

Even though not formally required, students attending the course are expected to have acquired the basic notions in Economics (“useful”) and Statistics (“useful”).

Contents

The course aims to offer a solid base of knowledge on the main empirical and theoretical issues of development economics and the global economy. The issues of localization and delocalization of productive and innovative activities worldwide will also be dealt with.

Teaching Methods

The course consists of lectures and workshops in which there will be as much interaction as possible between students and teacher and among students themselves.
The program includes presentations by students divided in groups, discussion of written reports prepared by students

Verification of learning

The evaluation will take place through a written exam (50%) and two assessments during the course (25% each). Students will have to prepare a written report and to present a specific study to the class.Students that will write the report and present a study to the class can choose to answer just two out of four questions at the final exam. [30 minutes per question]. The final exam consists of four open questions (closed books) on the topics taught in the course. Students that will not present the report and study to the class will be required to write the entire exam (4 questions instead of 2).

The report refers to a short document of presentation of a country / region / sector for a potential customer, be it a public or a private company
Presentations: 15 minutes power point of one study assigned by the Professor or chosen by the student (and approved by the Professor) on European Policy issues

Ability in economic reasoning, managing formal tools and appropriate economic language are also evaluated.
All classes and additional material, along with notes and reference books, are necessarily needed for the full completion of the exam.

In line with the Dublin Descriptors, the evaluation process aims also to verify:
1) the ability to identify the firm, sectoral, regional and economic scenario from different perspectives.
2) the capacity to discuss the economic facts and to relate them to the tools presented in classes or individually studied.
3) the capacity to implement and motivate a particular intervention both at the firm and aggregate level and its adoption, and show the short- and long-run real effects arising due to the intervention.
4) the capacity of sinthesizing the economic facts and to provide economic intuitions and rationale.
5) the knowledge of empirical models presented in class.

Final mark is expressed through a 30-point scale. A Student presentation is scheduled at the beginning of January, the final mark will be the average between presentations and written exam. Students that have presented in the class must complete the exam within the summer section.
A passing mark ranges:
- from 18/30: if the student shows a sufficient level of knowledge, that is he/she is able to at least identify the economic situation, knows the basic elements to draw the appropriate conclusions, and expresses comments with an elementary technical language.
- to 30/30, possibly cum laude, if the student is able to schematize in a logic and coherent way the knowledge acquired during the course, namely all the series of effects produced by the adoption of a pratices and policies, and the associated real effects for firms and economies, and supports the analysis with an outstanding technical representation, and comments the facts with an excellent use of technical language.

Texts

Main readings are taken from
Economic Growth, 3/Edition (2013), Pearson by David N. Weil

The Global Environment of Business (2009), Oxford University Press by Frederick Guy

Other readings are taken from
Multinational and Economic Geography (2013) Edward Elgar , by Iammarino and McCann
Investing in Europe Future, European Commission
EUROPE 2020, A strategy for smart,sustainable and inclusive growth, European Commission

FA/0210/EN - PHARMACOTHERAPY

Academic Year 2021/2022

Free text for the University

Professor
MICAELA MORELLI (Tit.)
GIULIA COSTA
Period
First Semester
Teaching style
Convenzionale
Lingua Insegnamento
INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[50/21] PHARMACEUTICAL CHEMISTRY AND TECHNOLOGY	[21/00 - Ord. 2014] PERCORSO COMUNE	8	64

Objectives

The goal of the course of pharmacotherapy is to provide to students the academic tools needed to understand the mechanisms of actions, the distribution and metabolism, the side effects and the interaction of the pharmacological agents used for the treatment of the main and more diffuse human pathologies. During the course, the student will have to acquire a wide knowledge of the pathologies treated in terms of symptomatology, physiopathology and clinical manifestation. At the end of the course, the student will have to possess suitable communicative skills, and the ability to use the appropriate terminology in describing the features of the illness and the effect of drug used.

Prerequisites

Students must have adequate knowledge of notions acquired in the courses of Anatomy, Physiology, Biochemistry and Pharmacology, attended in the previous years of the Degree. Students must have taken the exams of Physiology, General Pharmacology and Pharmacognosy, before taking this exam.

Contents

The pharmacotherapy course will be held in accordance to the following program:
1. General aspects. Diagnostic Statistical Manual (DSM).

2. Neurodegenerative disease:
Parkinsons disease: symptoms and pathology. Therapy: from dopamine precursors to new generation agents, side effects and pharmacological interactions.
Alzheimer disease: symptoms and pathology. Therapy: AchE inhibitors and others, side effects and pharmacological interactions.
Hungtington disease: symptoms, phatology, therapy, side effects and pharmacological interactions.
3. Schizophrenia: symptoms and diagnostic criteria. Therapy: typical and atypical antipsychotics, side effects and pharmacological interactions.
4. Anxiety: diagnostic criteria. Therapy: hypnotic and sedative agents, benzodiazepine and others. Side effects and pharmacological interactions.
5. Depression and bipolar disorder: diagnostic criteria. Therapy: SSRI, TCA, MAO inhibitors, lithium and others, side effects and pharmacological interactions.
6. Epilepsy: Classification and characterization. Pharmacological therapy, side effects and pharmacological interactions.
7. Anaesthetics: Inhalation, e.v. and local anaesthetics. Side effects and pharmacological interactions.
8. Analgesics: genesis of pain and nociception, opioid analgesics, morphine, opioids antagonists, tolerance, drug addiction and withdrawal, side effects and pharmacological interactions.
9. Psychostimulants and drugs of abuse: diagnostical criteria. Amphetamine, cocaine, ecstasy, cannabinoids, hallucinogens, caffeine, nicotine and alcohol, side effects and pharmacological interactions.
10. Anti-inflammatory drugs: genesis and characteristics of inflammation. Therapy: prostanoids, FANS and paracetamol, glucocorticoids, immunosuppressor, gout and arthritis, side effects and pharmacological interactions.
11. Hemicrania and cephalgia
12. Anti-histaminic: general description of histaminergic transmission, mechanism of action, side effects and pharmacological interactions.
13. Pharmaceutical agents acting in the respiratory system: therapy for asthma; allergies; agents for the Chronic Obstructive Pulmonary Disease; therapy against the cough, side effects and pharmacological interactions.
14. Pharmaceutical agents against the erection disfunction
15. Pharmaceutical agents for the osteoporosis
16. Pharmaceutical agents acting in the gastrointestinal system: therapy for the peptic ulcer: anti-microbial agents, anti-H2, proton pump inhibitor, prostaglandins, anti-emetics, agents for the diarrhoea and constipation, side effects and pharmacological interactions.
17. Pharmaceutical agents against obesity
18. Antihyperlipidemic agents: HMG-CoA reductase inhibitors; fibrates; niacin; acid bile sequestrants, side effects and pharmacological interactions.
19. Antihypertension agents: genesis and consequences of hypertension. Therapy: diuretic, alpha and beta-blockers, calcium antagonist, ACE inhibitors, angiotensin II inhibitors and others, side effects and pharmacological interactions.
20. Pharmaceutical agents for heart failure: genesis and consequences of heart failures. Therapy: renin-angiotensin system blockers, beta-blockers, diuretics, ionotropic agents, cardioactive glycosides, side effects and pharmacological interactions.
21. Antiarrhythmic agents: Genesis and consequences of cardiac arrhythmia. Therapy: Na+-channels blockers, beta-blockers, k+-channel blockers, Ca2+-channel blockers and others, side effects and pharmacological interactions.

22. Pharmacological agents for angina: Genesis and consequences of angina. Therapy: nitrates, beta-blockers, Ca2+-channel blockers, side effects and pharmacological interactions.

Teaching Methods

The pharmacotherapy course involves three lectures a week, of approximately 2 hours each of duration. The total amount of time allocated for the lectures is 64 hours. Topics described in the course content section will be exposed through power point presentation. Students will have access to the power point files immediately after the lesson. In accordance with participating students, there will be the possibility to test the own level of knowledge by the mean of mid-term examinations.

Verification of learning

Learning will be tested by and oral test. The final grade will be established on the bases of: a) general knowledge of contents on disorders, therapy and pharmacological agents, but also ability to explain the rationale of the drug use. b) Exposition ability, use of a proper and synthetic language.
The final evaluation can be:
a) Insufficient (exam is not passed): the candidate does not show an adequate level of knowledge that allows him to express coherent and logic conclusions.
b) Satisfactory/Acceptable standard (18 to 23/30) when the candidate shows to possess a sufficient grade of knowledge that allows him to express coherent conclusions, although the student has been struggling to reach the conclusions.
c) Good/Exceeds acceptable standard (from 24 to 27/30)
The candidate shows to possess an almost complete grade of knowledge in a way that allows him to express coherent conclusions in an ordered and clear exposition, although the student can be uncertain about details.
d) Excellent/standard of excellence (from 28 to 30/30)
The candidate shows to possess a complete grade of knowledge that allows him to express coherent conclusions synthetically in a very clear exposition, reach of detail and logic conclusions.
Laude will be given to candidates above standard levels, who shows a full grade of knowledge of the material of the course but also possesses a level of knowledge acquired through updated scientific journals.

Texts

Annunziato, Di Renzo. FARMACOLOGIA.

H.P. Rang, M.M. Dale, J.M. Ritter, P.K. Moore. FARMACOLOGIA.

Goodman & Gilmans. LE BASI FARMACOLOGICHE DELLA TERAPIA. (capitoli consigliati)

Lesson notes

More Information

A digital copy of the power point slides will be available at the end of the lecture. Students will be able to download it by reaching the didactic section located in the professor webpage. Moreover, seminars related to the topics of the course will be held to improve the didactic offer.

FA/0215/EN - PHARMACOTHERAPY 1

Academic Year 2021/2022

Free text for the University

Professor
MICAELA MORELLI (Tit.)
GIULIA COSTA
Period
First Semester
Teaching style
Convenzionale
Lingua Insegnamento
INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[50/22] PHARMACY	[22/00 - Ord. 2014] PERCORSO COMUNE	8	64

Objectives

The goal of the course of pharmacotherapy is to provide to students the academic tools needed to understand the mechanisms of actions, the distribution and metabolism, the side effects and the interaction of the pharmacological agents used for the treatment of the main and more diffuse human pathologies. During the course, the student will have to acquire a wide knowledge of the pathologies treated in terms of symptomatology, physiopathology and clinical manifestation. At the end of the course, the student will have to possess suitable communicative skills, and the ability to use the appropriate terminology in describing the features of the illness and the effect of drug used.

Prerequisites

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Contents

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Hungtington disease and SLA: symptoms, phatology, therapy, side effects and pharmacological interactions.
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Teaching Methods

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Verification of learning

Learning will be tested by and oral test. The final grade will be established on the bases of:
a) general knowledge of contents on disorders, therapy and pharmacological agents, but also ability to explain the rationale of the drug use. b) Exposition ability, use of a proper and synthetic language.
The final evaluation can be:
a) Insufficient (exam is not passed): the candidate does not show an adequate level of knowledge that allows him to express coherent and logic conclusions.
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Lesson notes

More Information

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IA/0020/EN - INTERNET OF THINGS

Academic Year 2021/2022

Free text for the University

Professor
MICHELE NITTI (Tit.)
Period
First Semester
Teaching style
Convenzionale
Lingua Insegnamento
INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[70/83] ELECTRONIC ENGINEERING	[83/15 - Ord. 2018] EMBEDDED ELECTRONICS	6	60
[70/91] INTERNET ENGINEERING	[91/00 - Ord. 2018] INGEGNERIA DELLE TECNOLOGIE PER INTERNET	6	60
[70/90] COMPUTER ENGINEERING, CYBERSECURITY AND ARTIFICIAL INTELLIGENCE	[90/00 - Ord. 2018] PERCORSO COMUNE	6	60

Objectives

The Internet of Things (IoT) is a world-wide network of interconnected objects uniquely addressable, based on standard communication protocols. The course aims to present to the students the technologies and the main application scenarios of the IoT world.
The theoretical lessons will be complemented by demonstrations and practical exercises in the lab. Students will learn how to create sensor networks using Raspberry and Arduino and implement various application-level communication protocols, such as MQTT or CoAP.

In detail, the training objectives, according to the Dublin Descriptors, and in accordance with the training objectives of the Master Degree Course in Telecommunications Engineering, are the following.

Knowledge and comprehension skills
At the end of the course, the student must know and understand
- features and functionalities of the various levels of IoT network architecture and its possible variants;
- main protocol specifications that characterize application-level communications among

objects;
- the mechanisms of operation of sensor networks for the acquisition of data of interest and their communication to the Internet through appropriate gateways.

Ability to apply knowledge and comprehension
At the end of the course, the student must:
- know how to describe, analyse and design an IoT application, identifying its requirements and specifications;
- be able to understand the differences, in terms of strengths and possible weakness, among the possible enabling technologies in reference to the specific use case;
- know how to properly configure various devices so that they can implement the communication protocols required by the various applications;
- know how to set up the most appropriate interfaces to present the services offered to users.

Making judgments
At the end of the course, the student must be able to distinguish the main advantages and disadvantages of possible IoT solutions at all levels of the network architecture; it will also have to be able to autonomously choose the fittest enabling technology and the application-level communication protocol based on the reference scenario.

Communication skills
The teaching approach and the methods for the assessment of knowledge acquired will make the students used to communicate the concepts and the methods learned, as well as to formalize the problems in terms of protocols and their configurations and to discuss related topics with both specialist and non-specialist colleagues.

Ability to learn
Through the course, students will integrate knowledge gained in other courses with reference to the protocols used in the Internet and to the main standards for Access Technologies to it. Moreover, conducting studies and class presentation of projects developed throughout the course will give students the ability to independently integrate the knowledge learned through the course with additional knowledge and summarize these arguments in order to set out a clear presentation to the audience of colleagues.

Prerequisites

Communication: know how to present concepts and information in oral, written, and graphic form.
Organizational: know how to organize activities around the clock and plan a mid-term work / study plan.
Knowledge: The student must have an appropriate knowledge of the architectures for telecommunication networks and Internet protocols. Additionally, it is necessary to have a technical knowledge of English and of the TCP/IP protocol suite. Not necessary, but recommended knowledge: basic of Access Networks and programming skills.
Skills: The skills acquired from previous teaching courses relate to the ability to analyse the basic architecture of the telecommunication networks.
Competence: The skills acquired in previous teaching courses are essential to the understanding, interpret, and critically analyse network architecture and protocol configurations.

Contents

The Internet of Things course aims to present students with the basic concepts of the IoT landscape and help them develop the capabilities of developing, managing and presenting simple IoT projects.
The course is structured, even temporarily, in the following teaching units.
Generalities on the Internet of Things (11 hours of theory, 5 hours of laboratory):
- Introduction to IoT;
- Organize and manage an IoT project;
- General IoT architecture and survey of enabling technologies, protocols and applications.

Sensor networks, physical and virtual objects (12 hours of theory, 10 hours of laboratory):
- Typologies of sensor networks;
- Physical-level communication protocols;
- virtual objects;
- Virtual objects management.

Applications, protocols, user interfaces (10 hours of theory, 12 hours of laboratory):
- Application-level protocols;
- Presentation of the IoT platform developed at DIEE;
- Analysis of IoT application requirements;
- Possible variants of the IoT paradigm.

Teaching Methods

The teaching is organized in a traditional way with the use of slide lectures and exercises through the use of emulators and sensors and gateway of different types. Presentation activities are also organized by the students of additional topics assigned to them during the course.
To meet specific educational needs related to the epidemiological situation, the possibility of live streaming lessons or recordings of the same available online is provided. Furthermore, the exercises may include shifts and / or be carried out through forms of remote interaction with the available IT supports.

Verification of learning

In order to verify the knowledge and comprehension skills, the exam is carried out at the end of the course through a written test which multiple choice questions, in which it is requested to justify the chosen answer.
Each question is assigned a maximum score. Each question is evaluated with a score between 0 and the maximum score assigned. The maximum score is assigned in case of correct answer while a lower score will be assigned in presence of errors. Lack of attention or misunderstandings mistakes, as well as text errors attributed to possible ambiguity will have a lower weight than conceptual errors, clearly caused by a partial knowledge of the subject.
To test the applying knowledge and understanding and the judgment autonomy, projects will be assigned to groups of students to design and develop IoT applications. These applications will be based on high level requests from the teacher, which the students have to match using the knowledge acquired during the course. Once the project is completed, the design choices and the ability to present the project results will be evaluated.
In order to verify the ability to learn and communication skills, each student will be assigned

a theoretical topic on some specific aspect of the course that the student will have to deepen through articles of specialized magazines and expose to the audience of colleagues.
The final vote is obtained as the sum of the scores obtained for the three parts. The maximum score of the tests is 32. Those who get an overall score of 32 will have a vote equal to 30 cum laude.
Since the actual situation is constantly evolving, intermediate and final verification methods can be replaced by different verification methods, for example: individual or group work, oral interviews, remote written tests using computer aids (moodle, Teams, etc.), or completely eliminated in the case of intermediate checks.

Texts

Guinard, Dominique, and Vlad Trifa. Building the web of things: with examples in node. js and raspberry pi. Manning Publications Co., 2016.
Dieter Uckelmann, Mark Harrison, Florian Michahelles, “Architecting the Internet of Things” (ISBN: 9783642191565, ISBN-online: 978-3642191572)

Cirani, S., Ferrari, G., Picone, M., & Veltri, L. (2018). Internet of Things: Architectures, Protocols and Standards. John Wiley & Sons.

In addition, given the newness of the topic discussed, the teacher will provide the reference scientific papers necessary for further study of the subject matter.

Texts

Guinard, Dominique, and Vlad Trifa. Building the web of things: with examples in node. js and raspberry pi. Manning Publications Co., 2016.
Dieter Uckelmann, Mark Harrison, Florian Michahelles, “Architecting the Internet of Things” (ISBN: 9783642191565, ISBN-online: 978-3642191572)

Cirani, S., Ferrari, G., Picone, M., & Veltri, L. (2018). Internet of Things: Architectures, Protocols and Standards. John Wiley & Sons.

In addition, given the newness of the topic discussed, the teacher will provide the reference scientific papers necessary for further study of the subject matter.

More Information

The students will be provided with slides and solutions of the exercises.

IA/0122/EN - PHYSICAL-LAYER TECHNIQUES FOR WIRELESS COMMUNICATION SECURITY

Academic Year 2021/2022

Free text for the University

Professor
GIUSEPPE MAZZARELLA (Tit.)
Period
First Semester
Teaching style
Convenzionale
Lingua Insegnamento
INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[70/90] COMPUTER ENGINEERING, CYBERSECURITY AND ARTIFICIAL INTELLIGENCE	[90/00 - Ord. 2018] PERCORSO COMUNE	6	60

Objectives

The radio channel, in particular for wireless systems, is intrinsically a shared channel, and as such it cannot guarantee security "at its border" like wired channels. It is therefore necessary to shift the emphasis of the channel security issues to the radio part, using the characteristics of the Physical-Layer to guarantee the security of the connection.

The course has two general objectives. The first is to make the students aware of the physical part of wireless systems at the level of black-blocks and signals, and in particular of their radio link. The second is, starting from this knowledge, to provide the students with the knowledge and skills necessary to analyze the main radio techniques used to obtain secure connections, up to the basic skills needed for their dimensioning.

The detailed objectives are:

Knowledge and understanding: students will have to know the basic properties of wireless systems, and in particular those relating to the Physical-Layer that can be used to guarantee the security of the connection; they will also have to know the main techniques proposed to implement secure radio links.

Ability to apply knowledge and understanding: at the end of the course, students must be able to make simple numerical evaluations of wireless links and to simulate at least one of the radio techniques used for security, in order to be able, in professional practice, to integrate their skills about secure computer connections, acquired in other courses, with the skills of the designers of the radio part.

Prerequisites

The course requires a good knowledge of the topics of Electricity and Magnetism, in particular those related to variable currents and fields (normally available in the Physics courses), and of some subjects of Mathematics, in particular derivatives and integrals, matrices, complex numbers.
A knowledge of some basic Electromagnetic Engineering topics (in particular plane waves and antennas) can simplify the acquisition of the required skills.

Contents

The planned syllabus (and an estimate of the time needed for each topic) is as follows.

1-Introduction to Wireless Systems: Black-Box description of Wireless systems, signals and protocols, radio-link budget, radio-sources and free-space propagation (lectures: 12h; exercises: 4h).

2-Radio-Fingerprints: Time domain fingeprints, spectral fingerprints, identification and check of wirelss fingerprints, performance indices (lectures: 6h; exercises: 2h).

3-UltraWideBand Communications (lectures: 6h; exercises: 2h).

4-Radio-Link reciprocity: Propagation and scattering in real environments, use of Radio-Link reciprocity for security purposes, generation and security of symmetric keys (lectures: 8h; exercises: 4h).

5-RFID and NFC: fundamentals and performances of UHF RFID and NFC systems, securty in UHF RFID, security in NFC (lectures: 8h; exercises: 2h).

6-Jamming: Fundamentals of jamming techniques (lectures: 4h; exercises: 2h).

Teaching Methods

The set of lectures will be balanced between theoretical lessons and numerical exrcises. The objective of the former is to describe the different topics, focusing on the variables involved and on the relations between them. Numerical execises, done also using softwares like MATLAB, will be used to experiment on how the different choices will affect final results and to gain knowledge on the order-of-magnitude of the quantities involved.

Teaching will be done essentially in the classroom, but online resources will be employed to integrate it, aiming at guarantee an inclusive use.

Verification of learning

The exam is made by two parts, which can be passed in whatever order, a written part and an individual part.

The written part consists of some numerical exercises on the Wireless part of the program, and some multiple--answer questions on the whole program. Textbooks can be used during this test. This part has a maximum of 14 points, and is passed when the mark is 4 or higher. If necessary due to the CoViD 19 pandemic, this part can be held at a distance using computer aids.

The alternative for the individual part are a standard oral examination on the whole program or some practical activities. This part has a maximum of 20 points, and is passed when the mark is 12 or higher.

The final score is the sum of the scores of the two parts.

Practical activities can be either the implementation of one of the algorithms developed during the lectures, described in a report including problem analysis, implementation and test, or the preparation of two reports describing topics connected to the program, but not directly described during the lectures, starting from a journal paper.

Texts

D. M. Dobkin: RF Engineering for Wireless Networks - Ed. Elsevier-Newnes 2005;

Course notes;

Scientific journal papers.

Further readings:

D.M. Dobkin: The RF in RFId - Ed. Newnes;

K. Fujimoto: Mobile Antenna System Handbook- Ed. Artech House, Boston, 2008

T. Zwick et al (Eds): Ultra-wideband RF System Engineering - Ed. Cambridge Univ. Press.

Ahmed Khattab, Zahra Jeddi, Esmaeil Amini, Magdy Bayoumi:- RFID Security: A Lightweight Paradigm - Ed. Springer

Ruanaidh, J.K., and Fitzgerald, W.J.: Numerical Bayesian methods applied to signal processing - Ed. Springer-Verlag, New York, 1996

Tongtong Li, Tianlong Song, Yuan Liang - Wireless Communications under Hostile Jamming_ Security and Efficiency-Springer Singapore (2018)

More Information

The Matlab software was purchased by the University and is available free to students. Guidelines for obtaining your licensed copy will be provided at the beginning of the course.

Scientific articles will be made available inside the University internet domain.

IA/0123/EN - OPERATING SYSTEMS

Academic Year 2021/2022

Free text for the University

Professor
GIORGIO GIACINTO (Tit.)
Period
First Semester
Teaching style
Convenzionale
Lingua Insegnamento
INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[70/83] ELECTRONIC ENGINEERING	[83/15 - Ord. 2018] EMBEDDED ELECTRONICS	7	70
[70/91] INTERNET ENGINEERING	[91/00 - Ord. 2018] INGEGNERIA DELLE TECNOLOGIE PER INTERNET	7	70
[70/90] COMPUTER ENGINEERING, CYBERSECURITY AND ARTIFICIAL INTELLIGENCE	[90/00 - Ord. 2018] PERCORSO COMUNE	7	70

Objectives

The subject of Operating Systems aims at providing the knowledge of the organization of modern operating systems in different application scenarios, such as: desktop and notebook computers, servers, mobile and IoT devices, embedded systems, and real-time systems. The course will comprise both standard lectures, and labs, the latter devoted to learn how to use some UNIX/Linux primitives for creating concurrent processes using the C language.
The learning outcomes of this subject, expressed in terms of the Dublin Descriptors, are the following:

Knowledge and understanding.
After the completion of this teaching activity, the student should know and understand:
- the architecture of the different types of operating systems in terms of their components, and the related functionalities, related to the different devices where they are deployed;.
- the main characteristics of the UNIX/Linux operating system families;
- the main characteristics of mobile, embedded and IoT operating system, and, in particular, of the Android operating system;
- the basic concepts behind virtualization technologies and cloud computing.

- the main issues that need to be analyzed for designing and managing an operating system.
Applying knowledge and understanding
After the completion of this teaching activity, the student should be able to:
- use the basic operating system library functions used in application programming for managing processes and threads;
- use the techniques to correctly configure an operating system, not only from the point of view of the performances, but also from the point of view of security and privacy, according to the device and the application scenario at hand.

Making judgements
The student will be able to choose the most apt operating system given the set of requirements related to the application scenario at hand.

Communication skills
After the completion of this teaching activity, the student should be able to explain in an organic way the dependences among the different modules of an operating systems, and the dependences of these modules on the device where they have been deployed.

Lifelong learning skills
The evolution of operating systems, that is driven on one hand by the development of ubiquitous devices (mobile devices, wearables, internet of things, etc.), requires a good capability for lifelong learning. This teaching activity will empower students to understand the technical documentation that is published by developers and producers of operating systems, especially the one related to open source projects.

Prerequisites

The student should have a deep knowledge of the organization of modern computer architectures, as well as good programming capabilities using the C language.

Contents

Main components of modern operating systems with examples of Linux/Unix operating systems (4hrs theory - 2hrs exercises)
Processes and threads (8hrs theory - 6hrs exercises)
Process Scheduling (2hrs theory - 2hr exercises)
Mutual exclusion, process synchronization and deadlock (6hrs theory - 4hrs exercises).
Memory management (6hrs theory - 2hrs exercises)
File system (3hrs theory - 1hr exercises)
Input/Output systems, and disk management (2hrs theory - 1hr exercises)
Operating System security (3hrs theory - 1 hour exercises)
Virtualization and cloud computing (4 hrs theory - 2 hrs exercises)
Embedded and Real Time Operating Systems (3hrs theory)
Main concepts of mobile and IoT operating systems (4 hrs theory)
Case Study: the Android Operating System (4 hrs exercises)

Teaching Methods

This teaching unit is organized with
- lectures with electronic presentations (PowerPoint or similar);

- lab exercises using Linux operating systems;
- lab exercises on virtualization system;
- lab exercises on the Android operating system;
- a seminar or a site visit;

The teaching material is available at the following web address:
http://people.unica.it/giorgiogiacinto/didattica/insegnamenti/materiale-didattico/sistemi-operativi/

The teacher is available to answer questions either by email, or during the contact hours, or directly in class, during the lecture or during the break between consecutive teaching hours.

Verification of learning

The exam consists in two parts: one part that will be carried out as a test in writing, while the other part will be made up of a number of practical exercises distributed during the semester.

The test will contain:
- open questions
- numerical exercises
- programming exercises (pseudocode)
that cover all the topics of this teaching activity. In particular the exam aims to test the student's:
- knowledge and understanding of processes and threads;
- knowledge of the techniques and classic problems for processes and threads mutual exclusion and synchronization;
- knowledge of the organization and management of main memory, and ability to solve some numerical problems on memory management;
- knowledge of the organization and management of storage devices (hard disks), and ability to solve some numerical problems on disk management;
- knowledge of file system organization and structure;
- knowledge of input/output organization and structure;
- knowledge of virtualization techniques;
- knowledge of the architecture of the Android Operating System;
- capability do describe the main differences among operating system deployed in different application scenarios;
- knowledge of the security and privacy issues in operating systems.

A number of practical lab exercises will be proposed throughout the period of lectures. One set of exercises will require to write small fragments of C code using the primitives for creating processes and enabling communication between processes in UNIX/Linux. Another set of exercises will be focused on the configuration of operating systems and virtualization platforms from the point of view of security and performances.

For each exercise/question in the test, a maximum score is assigned. The answer provided for each exercise/question is evaluated with a score from 0 to the max assigned score. The maximum score is assigned in the case of a correct answer, while a smaller score is assigned according to the severity of the errors. In particular, conceptual errors, and errors caused by lack of knowledge have a larger weight than errors due to misunderstandings or inaccuracies.

The lab sessions will be evaluated with a maximum of 12 points, that will be distributed among the different exercises.

The final mark is given by the sum of the points assigned to each exercise/question of the test and to the points related to the participation to the lab sessions. The total number of points will be equal to 32, so that students attaining 32 points will be assigned the '30 cum laude' mark.

It is possible to increase the final mark of the written test with a short oral test.

Texts

William Stallings
Operating Systems: Internals and Design Principles, 9/E
Pearson - ©2018
ISBN 9781292214290

More Information

Copies of the slides as well as all the material used for the labs will be available at the following linkh
https://elearning.unica.it/

More Information

Copies of the slides as well as all the material used for the labs will be available at the following link https://elearning.unica.it/

More Information

Copies of the slides as well as all the material used for the labs will be available at the following link
https://elearning.unica.it

IA/0125/EN - ADVANCED EMBEDDED SYSTEMS

Academic Year 2021/2022

Free text for the University

Professor
PAOLO MELONI (Tit.)
Period
First Semester
Teaching style
Convenzionale
Lingua Insegnamento
INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[70/83] ELECTRONIC ENGINEERING	[83/15 - Ord. 2018] EMBEDDED ELECTRONICS	8	80
[70/91] INTERNET ENGINEERING	[91/00 - Ord. 2018] INGEGNERIA DELLE TECNOLOGIE PER INTERNET	8	80
[70/90] COMPUTER ENGINEERING, CYBERSECURITY AND ARTIFICIAL INTELLIGENCE	[90/00 - Ord. 2018] PERCORSO COMUNE	8	80

Objectives

Acquiring knowledge and understanding: understanding the basics of microprocessor-based systems, special -purpose systems and the related research topics.
Applying knowledge and understanding: developing the capability of analyzing, designing and optimizing a microprocessor-based system, understanding the concepts and techniques for design space exploration.
Making informed judgements and choices: develop the ability to properly use CAD/EDA tools for analyzing, designing and prototyping embedded systems.
Communicating knowledge and understanding: technical language of embedded system design, embedded system performance metrics.
Capacities to continue learning: integrating information provided by different parties, reading and understanding research articles, using commercial datasheets of industrial products.

Objectives

Acquiring knowledge and understanding: understanding the basics of microprocessor-based systems, special -purpose systems and the related research topics.
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Communicating knowledge and understanding: technical language of embedded system design, embedded system performance metrics.
Capacities to continue learning: integrating information provided by different parties, reading and understanding research articles, using commercial datasheets of industrial products.

Prerequisites

Digital system design

Contents

In the first part of the course, the basics of hardware/software design for embedded systems will be presented. In the second, novel advanced topics will be presented with references to parallel computing and multi-processor systems. The course will include hands-on sessions aimed at the acquisition of technical skills involving EDA/CAD usage.

Teaching Methods

Lectures (50h) and lab sessions with simulators and FPGAs (30h)
The course will be taken mainly in person. To face the current epidemiological situation, the possibility of offering streaming lessons and of making them available on-line is envisioned. Moreover, the lab sessions could be attended using remote interaction methods with adequate tools and IT support.

Verification of learning

Oral exam. The knowledge of the course topics will be verified and the skills acquired during lab sessions will be evaluated. The student will have to master the techniques learned during lab experiments. Related skills will be verified through an adequately commented presentation of the lab results.

Texts

David A. Patterson and John L. Hennessy - "Computer Organization and Design: The Hardware/Software Interface"

More Information

Lecture slides will be made available when needed, to integrate the book content.

News and other utilities will be available at:
https://teams.microsoft.com/l/team/19%3aPNtEInYthIcWrsKbI8CoS8Er91E7UhQbiMcogqj2

tuU1%40thread.tacv2/conversations?groupId=8b81588b-3781-459c-9bde-ef0454bb5629&tenantId=6bfa74cc-fe34-4d57-97d3-97fd6e0edee1

IA/0149/EN - OPTOELECTRONICS, DIAGNOSTICS AND AEROSPACE APPLICATIONS

Academic Year 2021/2022

Free text for the University

Professor
GIOVANNA MURA (Tit.)
GIOVANNI MARTINES
Period
First Semester
Teaching style
Convenzionale
Lingua Insegnamento
INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[70/83] ELECTRONIC ENGINEERING	[83/25 - Ord. 2018] ELECTRONIC TECHNOLOGIES FOR EMERGING APPLICATIONS	7	70

Objectives

OPTOELECTRONICS
INTEGRATED PHOTONIC DEVICES
Understanding of the fundamental physical phenomena related to emission, absorption, confinement and guidance of photons and wave packets in semiconductors.
Production techniques for photonics integrated circuits (PICs) main building blocks including LEDs, lasers, waveguides and passive and active components for wave manipulation and control.
Main applications: telecommunications and sensing.
Physical and technological issues in integrated photonic.

Understanding in
design and optimization of PICs
implementation of electro-optical measurements on PIC components

Ability in
identifying and managing data dealing with concrete or abstract analysis aim to interpret

experimental data related to physical and technological parameters
designing of PICs starting from the device datasheets

Communication skills
interaction with other people in addressing and solving theoretical and practical problems assigned by the professor to groups of students

DIAGNOSTICS AND AEROSPACE APPLICATIONS
Knowledge and understanding of
Semiconductor Technology
Reverse Engineering
Failure mechanisms
Principles and fundamental methods in Electron Microscopy
Methodology for the Failure Analysis
The Space environment
Failure modes in Space applications
CubeSats: Philosophy and Reliability

Application of knowledge and understanding in
Performing electrical measurements on electron devices
Performing selective deprocessing
Analyzing the surface of a device by using optical and electronic microscopes

Ability to identify and use data to formulate responses to
Reading the experimental data in terms of degradation of electrical behaviour
Evaluation of a failure analysis report

Communication skills
Ability to cooperate with peers in solving given problems and to report to the teacher
Ability to illustrate and discuss the results of own studies

Learning skills
Ability to access complementary sources for studying the theory
Practice with the bibliographic search.

MEASUREMENTS LABORATORY FOR ELECTRONIC COMPONENTS ACCEPTANCE
By the end of this workshop, the students should be able:

[Knowledge and understanding]
- to know the performance characteristics of the most common electronic components;
- to understand which measurement procedures allow the correct evaluation in compliance with internationally accepted standards;

[Applied knowledge and understanding]
- to apply the knowledge of electronic measurement instrumentation and the understanding of the methodologies of measurements to verify the performances declared in the data sheets of simple electronic components;

[Making judgments]
-to choose the instrumentation for checking acceptance of the performance of electronic components in compliance with the limitations imposed by the reference standards and by the measurement conditions suggested by the manufacturer;

[Communication skills]
-to present and discuss in public the procedures adopted and the results obtained in verifying the performance of electronic components;

[Learning abilities]
- to consult and understand the data sheets of electronic components made by different manufacturers with similar and / or different technologies;
- to verify the performances declared by the manufacturer.

Prerequisites

OPTOELECTRONICS
INTEGRATED PHOTONIC DEVICES
The skills acquired in the lecture courses Physics 2 and Solid State Physics, as well as the pn junction theory and microelectronics technology contained in the Semiconductor Physics courses are compulsory.
In particular, it is required the comprehension of:
Maxwell's equations, d'Alembert's equation, vector potential, wave packets
Band structure in solids
Electrons and holes
pn junctions: technology and electrical characteristics
Are also important:
the mathematical skills for the resolution of differential equations
familiarity with electromagnetic field features worthwhile for the wave propagation
Are then useful:
good skills with calculation, graphing and plotting programs

DIAGNOSTICS AND AEROSPACE APPLICATIONS
The fundamental requirements belong to the contents of the courses of Reliability of electron devices, Semiconductor Physics and Electron Devices given at the University of Cagliari, Bachelor degree in Electrical, Electronics (and Information) Eng .
In detail, the knowledge is absolutely required of
Design for Reliability
Electron devices

MEASUREMENTS LABORATORY FOR ELECTRONIC COMPONENTS ACCEPTANCE
Knowledge of the simple electronic components physics and of the operation of basic electronic instruments such as the multimeter and the power supply voltage and current generators are essential. It is necessary to know the operation principle of an oscilloscope, a spectrum analyzer or a signal generator. Practice with virtual integrated instrumentation such as that available in the multifunctional LIDIA laboratory of the Faculty of Engineering is helpful.

Contents

OPTOELECTRONICS
INTEGRATED PHOTONIC DEVICES
This module is composed of 3 parts (20 hours):

PART 1 – Photonic Integrated Circuit (PIC) Building Blocks: [6h]
Sources: diodes and lasers {1}
Active and Passive circuital components {2}
Detectors {3}
PART 2 – PIC Development, Optimization, Design and Fabrication {4}: [10h]
PIC Components Development, Design and Optimization
Computational methods for free space optics, integrated micro- and nano-photonics and thermal analysis and management
PIC design
Grown techniques: e-beam lithography, UV lithography, MPW
PART 3 – Devices {4}: [4h]
Telecommunication
Sensing

DIAGNOSTICS AND AEROSPACE APPLICATIONS
the course (30 hours) will propose the following:
frontal lectures:
Semiconductor Technology (1h)
Failure Analysis Techniques and Reverse Engineering (5h)
Electron Microscopy (SEM, TEM, EDS, FIB) (6h)
Failure modes and Failure mechanisms, case studies (4h)
Diagnostics in Optoelectronics and in Space applications (5h)
Cubesats, philosophy, failures and reliability (4h)
laboratory activities:
Practical activity (5h)

MEASUREMENTS LABORATORY FOR ELECTRONIC COMPONENTS ACCEPTANCE
Presentation and analysis of technical data sheets and operating manuals of the electronic instruments available in the laboratory (lesson 3h).
Presentation and analysis of technical data sheets of transistors and operational amplifiers focused to the performance limits and the recommended measurement conditions (lesson 2h).
Laboratory for testing the transistor performances. The measurement system design and implementation. The measurements carrying out and the experimental results analysis (8h in the laboratory).
Laboratory for the operational amplifiers testing. The measurement system design and implementation. The measurements carrying out and the experimental results analysis (7h in the laboratory).

Teaching Methods

OPTOELECTRONICS:
INTEGRATED PHOTONIC DEVICES

20 hours lessons where the use of journal publications is proposed as an alternative to textbooks for the more advanced parts of the program.
The use of supplementary texts and publications is also welcome, particularly in view of the final exam. In this regards, the use of any text, even not suggested by the professor, is strongly encouraged.

DIAGNOSTICS AND AEROSPACE APPLICATIONS:
The course will be organized in:
25 frontal lectures and seminars
5 laboratory activities

MEASUREMENTS LABORATORY FOR ELECTRONIC COMPONENTS ACCEPTANCE
The workshop is organized on:
✔ lectures (5 hours) based on slides prepared by the teacher to organize, present and comment on the technical documentation, available online;
✔ practices (15 hours) in a multifunctional didactic laboratory in which the student, alone or in groups of 2/3 people, first designs and implements the measurement system necessary to verify the performance of the device under examination, then performs the measurements and analyzes the results to accept the device in an industrial production process, finally prepares a written presentation on the methods and procedures adopted and the results obtained.

Verification of learning

OPTOELECTRONICS
INTEGRATED PHOTONIC DEVICES
The final evaluation consists of a written test. It is divided into three questions, ranging among the five topics of the sub-modules of the main module.
In particular, the proposed questions aim to verify
1) The knowledge and understanding of the physical and technological foundation of Optoelectronics
2) The ability to use the distributed educational material and any other extra document for solving the proposed problems
3) The ability to operate choices, in problems with open or multiple answer
4) The ability to communicate. This is obtained by granting of higher score even a wrong exercise, provided the student demonstrates to be aware of the presence of some error, and illustrates in detail how he/she reached such conclusion

Each question has an evaluation score ranging from 0 to 10. The sum of the three scores makes the final evaluation, in 30th, of the whole module.

DIAGNOSTICS AND SPACE APPLICATIONS
The final evaluation consists of an oral exam/ quiz/ a presentation of a report able to evaluate the knowledge and understanding of terminology, communication skills and the acquired learning- by- doing capability.
The score of the integrated course is the aritmetical average between the two scores of the modules.

MEASUREMENTS LABORATORY FOR ELECTRONIC COMPONENTS
ACCEPTANCE
Each student presents and discusses with the commission the choice of the procedures adopted and the analysis of the results obtained also on the basis of the presentation prepared during the practices. In the end, the commission expresses only a judgment of suitability or non-suitability to pass the exam.

Texts

OPTOELECTRONICS
INTEGRATED PHOTONIC DEVICES
Lecture notes
{ref1} Orazio Svelto, "Principles of Lasers" – Springer;
{ref2} B.E.A. Saleh, M.C. Teich, "Fundamentals of Photonics" – Wiley;
{ref3} G. Lutz, R. Klanner, "Solid State Detectors" – Springer
(available for free at https://doi.org/10.1007/978-3-030-35318-6_5);
{ref4} Slides provided by the professor.
DIAGNOSTICS AND AEROSPACE APPLICATIONS
SM Sze Dispositivi a semiconduttore ch. 8 - 12
Failure Analysis of Integrated circuits - tool and techniques L.C.Wagner - Kluwer Academic Publishers
Vanzi, M., Béchou, L., Fukuda, M., Mura, G. (eds) (2020). Advanced Laser Diode Reliability. ISTE Press, London, and Elsevier, Oxford.
slides provided by the professor.

MEASUREMENTS LABORATORY FOR ELECTRONIC COMPONENTS
ACCEPTANCE
- Operating manuals of the instrumentation used in the laboratory.
- MIL-STD-883E methods 4001-4007 standards.

More Information

Slides of seminars and conferences held at international symposia on the main topics of the Course.
Some of such slides, dealing with topics covered by international NDAs, will only be made available in the classroom, without the permission of any kind of further distribution.

IA/0155/EN - WASTEWATER TREATMENT PLANTS

Anno Accademico 2021/2022

Docente
ALESSANDRA CARUCCI (Tit.)
GIOVANNA SALVATORICA CAPPAI
Periodo
Primo Semestre
Modalità d'Erogazione
Convenzionale
Lingua Insegnamento
INGLESE

Informazioni aggiuntive

Corso	Percorso	CFU	Durata(h)
[70/86] INGEGNERIA PER L'AMBIENTE E IL TERRITORIO	[86/10 - Ord. 2016] TECNICHE E TECNOLOGIE DI RISANAMENTO AMBIENTALE	9	90

Obiettivi

Conoscenze specifiche sulla legislazione in materia di acque. Conoscenza delle caratteristiche dei più avanzati processi di trattamento delle acque reflue e comprensione dei principali aspetti gestionali degli impianti di depurazione.
Capacità di dimensionare un impianto di depurazione di acque reflue urbane.
Capacità di individuare le cause di disfunzioni impiantistiche e di utilizzare modelli e software di simulazione e di dimensionamento del processo. Capacità di caratterizzare reflui e biomasse.
Al termine del corso lo studente avrà acquisito maggiore sensibilità rispetto alle problematiche di salvaguardia della risorsa idrica ed ai rischi delle tecnologie.

Prerequisiti

Per seguire con profitto questo insegnamento è necessario aver sostenuto l'esame di Ingegneria Sanitaria-Ambientale.

Contenuti

Normativa: Richiami alla normativa vigente in materia di tutela delle acque e di Servizio Idrico Integrato (Direttiva Quadro Acque 60/2000/CE, D.Lgs. 152/06, parte terza) (8).
Introduzione alla progettazione di un impianto di depurazione. Caratteristiche qualitative e

portate di un liquame urbano (5+2 es.).
Trattamenti preliminari: grigliatura, triturazione e stacciatura. Dissabbiatura e disoleatura. Equalizzazione delle portate (3+4 es.).
Sedimentazione primaria: Tempi di permanenza e carichi idraulici superficiali in condizioni di tempo secco e in tempo di pioggia. Rendimento di sedimentazione. Produzione di fanghi primari (2+1 es.).
Trattamenti biologici per l'ossidazione della sostanza organica: Impianti a fanghi attivi. Concentrazione di biomassa nella vasca a fanghi attivi. Rendimento di rimozione del BOD e carico del fango. Produzione di fango di supero. Dimensionamento di una vasca a fanghi attivi. Consumo di ossigeno. Sistemi di aerazione e loro dimensionamento. (10+2 es.).
Sedimentazione secondaria: Tempi di permanenza e carichi idraulici superficiali in tempo secco e in tempo di pioggia. Rising. Criterio di dimensionamento basato sul flusso solido limite. Concentrazione di biomassa nella sospensione addensata. Sedimentabilità del fango. Portata del fango di ricircolo (2+1 es.).
Rimozione biologica dell'azoto: I processi di nitrificazione e denitrificazione. Frazione di biomassa autotrofa nella vasca a fanghi attivi. Consumo di ossigeno nella nitrificazione. Cinetica di nitrificazione. Dimensionamento della nitrificazione. Tipi di substrato organico usato in denitrificazione e consumo specifico per la riduzione ad azoto gassoso dell'azoto nitrico. Cinetica di denitrificazione. Schemi di processo. Processi biologici alternativi. Reattori SBR (5+2 es.).
Rimozione biologica del fosforo: Fondamenti del processo, schemi di processo; rimozione combinata di azoto e fosforo, cenni ai criteri di dimensionamento (2).
Stabilizzazione biologica dei fanghi: Caratteristiche dei fanghi. Digestione biologica dei fanghi. Produzione di biogas in digestione anaerobica. Ispessimento. Digestione convenzionale monostadio. Digestione monostadio a medio carico. Digestione a due stadi (4+2 es).
Disidratazione del fango: Condizionamento chimico del fango digerito. Letti di essiccamento, filtropresse, nastropresse, centrifughe (2).
Il fenomeno del bulking: Descrizione del problema, identificazione dei microrganismi filamentosi, possibili cause e strategie di intervento; il foaming (3+2 es.).
Modelli di simulazione del processo a fanghi attivi: Concetti generali sulla modellizzazione di un sistema biologico; modello ASCAM (IRSA-CNR); Activated Sludge Model N. 1 (IWA): analisi dettagliata delle componenti previste nel modello, dei processi, delle rispettive cinetiche e dei coefficienti stechiometrici (4).
Metodi di misura delle frazioni di COD del liquame e delle costanti cinetiche: Metodi fisici, chimico-fisici e biologici (4+4 es.).
Sistemi di controllo del processo a fanghi attivi: Concetti generali sul controllo automatico, controllo basato sulla respirometria, sulla misura di pH, potenziale redox e ossigeno disciolto (4).
Processi di trattamento a biomassa adesa: Il biofilm e la sua modellizzazione; vantaggi dei sistemi a biomassa adesa; letti percolatori, biodischi, filtri sommersi, MBBR; criteri di dimensionamento (6).
Bioreattori a membrana (MBR): Parametri, applicazioni, vantaggi e svantaggi (2).
Fitodepurazione, caratteristiche e principali tipologie.
Visita tecnica presso impianto depurazione Tecnocasic (4).

Metodi Didattici

66 ore di lezione frontali, 20 ore di esercitazioni in aula e laboratorio, e 4 ore di visita tecnica. Le lezioni si svolgono con presentazione di slide e richiami di concetti e approfondimenti alla

lavagna; le esercitazioni prevedono il coinvolgimento degli studenti nello svolgimento di esercizi e attività pratiche in laboratorio o al computer; è prevista attività di lavoro in gruppo per lo sviluppo di un progetto preliminare di un impianto di depurazione.
Alla fine del corso è prevista una visita tecnica presso un impianto di depurazione di reflui urbani e industriali.
La didattica verrà erogata prevalentemente in presenza, integrata e “aumentata” con strategie online, allo scopo di garantirne la fruizione in modo innovativo e inclusivo.

Verifica dell'apprendimento

L'esame consiste in una prova orale sugli argomenti oggetto del corso e sulla esercitazione relativa al dimensionamento di un impianto di depurazione di acque reflue urbane che lo studente dovrà presentare all'atto dell'esame.
Si potrà in tal modo accertare se lo studente abbia compreso gli aspetti caratteristici dei processi analizzati durante il corso, se conosca la legislazione in materia di acque nei suoi vari aspetti e se abbia acquisito la capacità di dimensionare un impianto di depurazione di acque reflue urbane, con le sue diverse sezioni di trattamento.
Un terzo del voto sarà attribuito sulla base del progetto presentato e della sua discussione e due terzi sulla base delle due domande relative alla parte teorica.

Testi

Materiale didattico: dispense distribuite dal docente
Metcalf & Eddy: Wastewater Engineering: Treatment and reuse, Mc Graw-Hill, 2014.
Innovative Wastewater Treatment & Resource Recovery Technologies: Impacts on Energy, Economy and Environment (2017). Editor(s): Juan M. Lema, Sonia Suarez Martinez. IWA Publishing.
Luca Bonomo: Trattamenti delle acque reflue, Mc Graw-Hill, 2008.
Per approfondimenti degli argomenti trattati nel corso, sono inoltre disponibili presso la Biblioteca del Distretto Tecnologico i seguenti testi:
Instrumentation, Control and Automation in Wastewater Systems (2005), G. Olsson, M. Nielsen, Z Yuan, A Lynggaard-Jensen. IWA Publishing, Scientific and Technical Report No. 15.
Activated Sludge Models: ASM1, ASM2, ASM2d and ASM3 (2000), IWA Publishing.
Manual on the Causes and Control of Activated Sludge Bulking, Foaming and other Solids Separation Problems (2003), D Jenkins, MG Richard, GT Daigger. 3rd Edition, IWA Publishing.
Il processo depurativo a letto mobile. Falletti, Andreottola, Canziani, Foladori (2012). Ed. Tecniche nuove.

Altre Informazioni

Per le esercitazioni ci si avvale del supporto di altri docenti, ricercatori o dottorandi. Alcuni argomenti potranno essere approfonditi con la lettura di articoli scientifici.
Come supporto allo studio saranno messe a disposizione degli studenti le slide delle lezioni.

IA/0187/EN - CHEMICAL AND BIOLOGICAL REACTORS

Academic Year 2021/2022

Free text for the University

Professor
ALBERTO CINCOTTI (Tit.)
Period
First Semester
Teaching style
Convenzionale
Lingua Insegnamento
INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[70/88] CHEMICAL AND BIOTECHNOLOGICAL PROCESS ENGINEERING	[88/00 - Ord. 2020] PERCORSO COMUNE	9	90

Objectives

Knowledge and understanding of lab- and industrial-scale reactors, influence of operating conditions and contacting systems between phases for chemical and biological reactors, and how to take them into account during design or testing.

Knowledge and understanding of technical specifications for reactors, and the effects and relevance of main variables involved.

Applying knowledge and understanding to design/testing of pseudo- and homogenous reacting systems, to searching of optimal conditions for running the reacting process.

Making judgements on the effect of different design options, on the opportunity to apply process intensification techniques.

Communication and learning skills of the results and design options, writing technical or scientific reports according to international standards.

Prerequisites

Chemical reaction engineering; Transport phenomena; Thermodynamics

Contents

Analysis of industrial reactors, ideal and not-ideal, homogenous and pseudo-homogeneous systems, with varying temperature and pressure. Analysis of the techniques to determine and taking into account of the non-ideal fluid-dynamics in industrial reactors.

Teaching Methods

The program divided in 2 sections (Lessons and Exercises) will be developed in 90 hours (45 hours devoted to Lessons and 45 hours to Exercises) with numerical solutions obtained also with commercial software (COMSOL Multiphysics).
Lectures will be prevalently held in classrooms, also integrated with online teaching resources, by using specific online platforms
managed by the University of Cagliari

Verification of learning

Student attendance to course activities is mandatory.
The final examination consists of an oral exam where specific design/test problems will be assigned. The student will be asked to demonstrate his capability to write down the mathematical equations describing the system (without providing a numerical solution), with the required modeling details (i.e. balancing the level description of the different phenomena involved in a proper way), but also to extend to more complex description when a more detailed simulation is needed; the student will be asked to know and apply the simplifying assumptions typically adopted in a deterministic modeling of reactors, to communicate also the design options and test results of industrial reactors.
During the course, the student will be asked to report in written form and respecting the temporal deadlines the results of the analysis of several reacting systems (including a stable and robust numerical solution of the equation systems involved) assigned in class, even working in group.
The student’s final grade will take into account his real, active participation to lessons, the reports with numerical solutions provided, and the final oral exam.

Texts

H. Scott Fogler, “Elements of Chemical Reaction Engineering”, Prentice Hall, 1999; S. Carrà and M. Morbidelli, “Chimica Fisica Applicata”, Hoepli, 1983; O. Levenspiel, “Chemical Reaction Engineering”, 3rd Ed., John Wiley, 1999.

More Information

Lecture slides used during the course will be provided.

IA/0205/EN - ARTIFICIAL INTELLIGENCE

Academic Year 2021/2022

Free text for the University

Professor
GIORGIO FUMERA (Tit.)
Period
First Semester
Teaching style
Convenzionale
Lingua Insegnamento
INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[70/83] ELECTRONIC ENGINEERING	[83/15 - Ord. 2018] EMBEDDED ELECTRONICS	6	60
[70/90] COMPUTER ENGINEERING, CYBERSECURITY AND ARTIFICIAL INTELLIGENCE	[90/00 - Ord. 2018] PERCORSO COMUNE	6	60

Objectives

This course is taught in English, and provides basic knowledge of some of the main approaches, methods, and application fields of Artificial Intelligence, under the computer engineering perspective.

The learning outcomes expressed in terms of the Dublin descriptors are the following:

Knowledge and understanding
Students will know and understand some of the main approaches, models and algorithms of Artificial Intelligence in the following fields: graph search and constraint satisfaction problems; knowledge representation and reasoning using logical languages, and using probabilistic methods; machine learning.

Applying knowledge and understanding
Students will be capable of solving simple problems in the fields mentioned above, and of implementing and testing computer programs to solve them.

Making judgements
Students will be able to analyze and design systems for solving simple problems in the fields mentioned above, taking into account the trade-off between computational complexity and solution quality, in terms of criteria such as accuracy and optimality.

Communication
Student will be capable of expressing and discussing issues related to Artificial Intelligence, to highlight problems and to propose solutions.

Prerequisites

Good knowledge of elements of discrete mathematics (combinatorics), computer architecture, and at least one high-level programming language.

Contents

- Introduction and historical notes (1h).
- Graph search problems (lectures: 10h, exercises: 2h)
Formulation of search problems: state space, operators, goal, path cost, search tree. Uninformed search strategies: breadth-first, depth-first, uniform cost; other search strategies (basics): depth-limited, iterative-deepening depth-first, bidirectional. Informed, best-first search strategies: greedy search, A*; heuristic functions. Computational complexity of search algorithms.
- Constraint satisfaction problems (lectures: 2h, exercises: 1h)
- Knowledge representation and reasoning using logical languages and inference algorithms (lectures: 10h, exercises: 2h)
Introduction: logical languages, inference.
Propositional logic and first-order logic: syntax and semantics. Main inference algorithms: model checking, inference rules, forward and backward chaining; the resolution algorithm (basics).
- Knowledge representation and reasoning under uncertainty (lectures: 10h, exercises: 2h)
Notes on probability theory. Bayesian networks: network structure definition, inference algorithms.
- Machine learning (lectures: 14h, exercises: 6h)
Basic concepts. Supervised classification problems, classification algorithms. Decision trees, learning algorithms. Neural networks: the perceptron, feed-forward multilayer networks, back-propagation algorithm; deep neural networks (basics).

Teaching Methods

Lectures: 47 hours.
In-class exercises: 13 hours.

Verification of learning

The examination consists in a written or oral test and in a computer project.
The written/oral test consists of open questions and exercises about all course topics.
The project can be developed individually or in groups of two, and aims at deepening knowledge of one of the course topics; this is achieved by implementing suitable computer

programs to solve specific problem instances.
To pass the examination a pass mark in both the written/oral test and the project is required; the final grade (expressed in the numeric range 18-30) will be the sum of the two grades: up to 20 for the written/oral test, up to 10 for the project.
To get a pass mark on the written/oral test students have to: be capable of framing simple problems in the fields considered in this course using suitable models; know the basic elements of the main approaches and algorithms to solve them; be able to apply such methods and algorithms to solve simple problem instances.
The grade of the written/oral test, expressed in a numeric scale from 12 to 20, depends on the degree of knowledge of the approaches and algorithms presented during the course, and on the degree of complexity of the problems that the student will be able to address and to solve.
To get a pass mark on the project, students must possess: a sufficient mastery of related models, methods and algorithms; the capability of developing computer programs to implement simple versions of such algorithms; the capability of applying their programs to solve specific problem instances.
The grade of the project, expressed in a numeric scale from 6 to 10, depends on the degree of complexity of the algorithms that the student will be capable of implementing, and the capability of analyzing and discussing the results of their application to solve specific problem instances.

Texts

S. Russell and P. Norvig, "Artificial Intelligence - A Modern Approach", 3rd Ed., Prentice Hall, 2009.

More Information

Teaching material is available on the course web site:
https://www.unica.it/unica/page/it/giorgio_fumera_mat_artificial_intelligence
The web site includes an extended version of the lecture slides, in-class exercises (including solutions), and additional resources on Artificial Intelligence (textbooks, links to relevant Web sites, etc.).

IN/0240/EN - PROCESS MODELING AND SIMULATION

Academic Year 2021/2022

Free text for the University

Professor
ROBERTO BARATTI (Tit.)
MASSIMILIANO GROSSO
Period
First Semester
Teaching style
Convenzionale
Lingua Insegnamento
INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[70/88] CHEMICAL AND BIOTECHNOLOGICAL PROCESS ENGINEERING	[88/00 - Ord. 2020] PERCORSO COMUNE	9	90

Objectives

Attending classes, the student will learn:
- Knowledge and understanding
Knowledge and understanding of the needed steps to develop a mathematical model for a system. Knowledge and understanding of numerical method to solve a mathematical model.
- Applying knowledge and understanding
Understanding the problems related to the modeling and simulation of the main units present in process industry.
- Making judgments
Skills in judge the need to model and simulate a real process.
- Communication skills
Communication skills acquired in-group work.
- Learning skills
Ability to independent study and analysis of technical books on the course arguments.

Prerequisites

Knowledge: An adequate knowledge of the fundamental methodological aspects of the basic sciences (calculus, geometry, physics), applied science (thermodynamics, reaction system)

and operation units (distillation column and reactors).
Skills: Be able to solve systems of algebraic equations, how to derive and integrate functions. Knowing how to formulate a process model.

Contents

Course overview. Model definition. Error types (3 hours).
Programming (6 hours of practice).
Steady state mono-dimensional nonlinear models. Numerical solution methods: bisection, Newton and secant (9 hours + 6 hours of practice).
Steady state multi-dimensional nonlinear models, Numerical solution of nonlinear systems (9 hours + 6 hours of practice).
Integral system models. Numerical solution methods: trapeze, Simpson and Gauss (9 hours + 6 hours of practice).
Nonlinear dynamic systems: mono- and multi-dimensional. Numerical solution methods: Eulero (explicit and implicit), Heun and Runge-Kutta (12 hours + 3 hours of practice).
System described by second order differential equations, Numerical solution methods: finite difference, orthogonal polynomials (9 hours + 6 hours of practice).
System described by partial differential equations. Numerical solution methods: finite difference, orthogonal polynomials (9 hours + 6 hours of practice).

Teaching Methods

Lectures will be prevalently held in classrooms, also integrated with online teaching resources, by using specific online platforms managed by the University of Cagliari.

Theoretical lessons on numerical calculus will be held by prof. Grosso (30 hours) while the model development lessons and practice will be held by prof. Baratti (60 hours).

60 hours of class and 30 hours of practice, the student is invited to work with the colleagues for finding the solutions of the assigned problems. The teachers is in the class to give support.

Verification of learning

The final exam consists in delivering written reports for the assigned homeworks, analogous to the one carried out in class, and a final discussion (in-presence or remotely using computer aids).
The student, to pass the exam, should be able to:
- derive a mathematical model of chemical processes and able to numerically solve it;
- analyze the process and choose the appropriate model to simulate it;
- able to understand the scientific literature in order to acquire the needed knowledge to derive a mathematical model;
- write a brief report on the obtained results.
The student is evaluated according to the following criteria:
- demonstrated knowledge and understanding: 18/30-21/30;
-demonstrated knowledge and understanding and ability of applying knowledge: 23/30-26/30;
- demonstrated knowledge and understanding, ability of applying knowledge and ability to deliver exhaustive reports: 27/30-30/30.

Texts

Smith – Chemical Process Design and Integration – J. Wiley
Coulson-Richardson - Chemical Engineering - vol. 2, vol. 6
H. Scott Fogler, “Elements of Chemical Reaction Engineering”, Prentice Hall, 1999
S. Carrà e M. Morbidelli, “Chimica Fisica Applicata”, Hoepli, 1983
“Fenomeni di Trasporto”, R. Byron Bird, Warren E. Stewart and Edwin N. Lightfoot, Casa Editrice Ambrosiana, Milano
V. Comincioli, Analisi Numerica, McGraw-Hill Italia.
"Numerical recipes: The Art of Scientific Computing ", W.H. Press, B.P. Flannery, S.A. Teukolsky, W.T. Vetterling, University Press, Cambridge

More Information

Course notes are available on Moodle..

IN/0243/EN - GEOCHEMICAL CHARACTERIZATION

Academic Year 2021/2022

Free text for the University

Professor
PAOLO VALERA (Tit.)
Period
First Semester
Teaching style
Convenzionale
Lingua Insegnamento
INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[70/86] ENVIRONMENTAL AND LAND ENGINEERING	[86/00 - Ord. 2016] PERCORSO COMUNE	6	60

Objectives

Knowledge on the dynamics of geochemical factors, on their mobility and natural distribution. Ability to read and interpret the interaction between the different natural factors that govern the elemental dispersion in order to locate the source of release, whether it be of natural or anthropogenic origin.

Identification of the most effective sampling methods and analysis to be applied depending on the area of investigation. Interpretation ability of the environmental factors present in the investigated areas and possibly involved in the concentration / diffusion of elements.

Ability to interpret data, in laboratory and on the land, depending on the spatial position and according to the environmental characteristics of the survey area, with tipical methods of geochemical characterization in order to discern between both natural or anthropogenic contributions

Acquisition of the technical terminology; processing capacity of technical documents also to publication of results in scientific journals and in the disclosure magazines. Ability to synthesize

Being able to learn and develop new research techniques, including through the consultation

of scientific articles. Adapt quickly to problems linked to the geographical area in which it operates.

Prerequisites

Deep knowledge of the most common lithologies and their mineral-petrographic characteristics. Knowledge of ore deposits and geological contexts associated with them.

Contents

Introduction (8 hours)
· Overview of main lithologies.
· General Principles of Geochemistry - Definitions.
· Absolute and Relative Abundance of the elements in the cosmos and on the earth's crust.
Part 1 (10 hours)
· Geochemical classification of elements.
· Geochemical Environment: deep and shallow, the geochemical cycle, mobility in deep and shallow environment, control parameters.
· Availability of the elements.
· Sources of natural and man-made.
· Association of the elements.
· Primary and secondary geochemical dispersions.
Part 2 (15 hours)
· Background, anomalies, anomaly threshold.
· Trace elements analysis: principles and methods. Choice of methods of analysis, units of measurement, detection limit (d.l.), precision, accuracy and control.
· Levels of research: recognitional, strategic, tactical and detail.
· Methods of sampling and analysis: types of sampling, collection, finalization, analysis. Criticality. Tools.
Part 3 (15 hours)
· Epigenetic abnormalities: halos of diffusion and loss. Zoning anomalies.
· Surface alteration: physical, chemical, biological. Factors affecting surface alteration. Products of surface alteration.
· Notes on soil formation.
· Regulatory and legislative aspects. Examples and case studies.
· Risk Analysis.
Part 4 (12 hours)
training and tutorials

Teaching Methods

48 hours of lectures, 12 hours of training in the classroom and field trip,
The teaching will be delivered mainly face to face, integrated and "augmented" with online strategies, in order to guarantee its use in an innovative and inclusive way.
About field trip work, on the basis of the contextual conditions linked to the Covid-19 pandemic, shifts and / or online replacement activities will be may scheduled

Verification of learning

The vote, in thirtieths, shall be determined at the end of the oral exam. During the examination are required arguments where the level of detail, by the candidate, together with him capacity for analysis and synthesis, are the evaluation criterion.

Texts

Teacher's notes and the books:
1. DE VIVO B., LIMA A. e SIEGEL F. R., 2004. Geochimica Ambientale. Metalli potenzialmente tossici. Liguori Editore, ISBN 88-207-3549-0, Napoli. 464 pp.
2. DE VIVO B. e LIMA A., 2009. Caratterizzazione geochimica dei siti, rifiuti e analisi di rischio. Aracne Editrice Roma. ISBN 978-88-548-2746-2, 338 p.
3. PIERO ZUFFARDI – GIACIMENTOLOGIA E PROSPEZIONE MINERARIA, Pitagora Editrice, Bologna
4. PIERRE GY, 1971 – L'echantillonnage des minerais en vrac. Mémoires du B.R.G.M., n. 67, Tome 2.
5. William M. White, 2015. Geochemistry. Wiley-Blackwell publisher. ISBN : 978-1-118-64682-3
672 pages.
6. Manuale Critico di Sanità Pubblica, 2015. A cura di Francesco Calamo-Specchia. Maggioli Editore, pp. 900. ISBN/EAN: 8891613080/9788891613080

More Information

The course is carried out, for the part in the classroom, with slides and the aid of the most common software for exercises. During the field trip exercises, the teacher makes his personal equipment available to illustrate the geo-petrographic characteristics of the areas examined. Furthermore, teacher's lecture notes of the course were made available to students.

IN/0244/EN - SOLID WASTE MANAGEMENT

Academic Year 2021/2022

Free text for the University

Professor
ALDO MUNTONI (Tit.)
Period
First Semester
Teaching style
Convenzionale
Lingua Insegnamento
INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[70/86] ENVIRONMENTAL AND LAND ENGINEERING	[86/10 - Ord. 2016] TECNICHE E TECNOLOGIE DI RISANAMENTO AMBIENTALE	9	90

Objectives

- Knowledge and understanding. Knowledge and understanding aimed at defining the chemical-physical characteristics of solid waste, technically addressing the sustainable management, including minimization of production, valorization and treatment. Understanding and minimizing the impacts associated with solid waste management. Knowledge and skills may be deepened also in a research context.
- Applying knowledge and understanding. Ability to analyze a problem of solid waste management, to understand the related technical, economic and social issues, to choose, design and manage the related technical solutions.
- Making judgements. Ability to collect, integrate and process data relating to solid waste production/management and to develop technical solutions independently. Developing awareness of the effects of the chosen technical solution.
- Communication skills. Ability to describe to specialist and non-specialist interlocutors the solid waste scenario and the rationale behind the technical solutions deemed necessary for the sustainable management.
- Learning skills. Developing learning skills to be used to further deepening the knowledge of aspects related to the sustainable management of solid wastes with a high degree of autonomy.

Prerequisites

Knowledge of Basic Organic and Inorganic Chemistry (important), Thermomechanics (useful) and Environmental-Sanitary Engineering (important).

Contents

The course focuses on solid waste management, including all the phases from production to final disposal, with emphasis on waste valorization in terms of materials and energy recovery according to the principles of the circular economy. The course deals with topics such as chemical-physical characterization of solid waste, actions aimed at minimizing the production of solid waste, technological aspects related to separate collection and selection of waste fractions, processes and technologies for the recovery of materials and energy, technical and design aspects related to the most common systems for collection, transport, valorization, treatment and final disposal. References to the national and European legislation are made during the course, and technical visits to plants are organized.
In general, the course is organized as follows:
- Characteristics of solid waste, qualitative and quantitative aspects, integrated management systems, waste and circular economy (20 hours)
- Collection and transport (15 hours)
- Treatment and valorization of biodegradable solid waste, including the recovery of bioproducts and renewable bioenergy (15 hours)
- Conventional and non-conventional waste to energy processes (15 hours)
- Inertization (stabilization/solidification) of special waste (10 hours)
- Sanitary landfills (10 hours)
- Management of specific types of waste (e.g. WEEE, etc.) (5 hours)

Teaching Methods

78-80 hours for frontal lessons
10-12 hours for exercises
Teaching will be delivered mainly face to face, integrated and "augmented" with online strategies in order to guarantee its fruition in an innovative and inclusive way.

Verification of learning

The student's examination consists of an oral test in which all the topics covered in the course are proposed. 5 questions of equal weight are proposed to assign the final mark.
The student must demonstrate to be able to use and integrate the acquired knowledge/skills to deal with a problem of solid waste management, to define and design activities and processes deemed necessary, both in a descriptive and computational way.
The logic followed in answering the question, the methodological correctness, the adequacy of the answer in relation to the skills acquired, the property of technical language, all represent elements of evaluation.
The evaluation is given out of thirty, starting from 18/30 awarded when the knowledge/skills are at least sufficient, up to 30/30 with possible cum laude awarded when the knowledge/skills are excellent.

Texts

Handouts and the PowerPoint files used during lessons are made available, as well as technical and scientific documents if deemed useful by the teacher or requested by the students for further insights.
Handbook of Solid Waste Management by George Tchobanoglous and Frank Kreith. McGraw-Hill Professional.

More Information

Visit to relevant plants are organized during the course.
The course contributes to the achievement of the following Sustainable Development Goals:
Goal 6: Clean water and sanitation
Goal 7: Affordable and clean energy
Goal 10: Reducing inequalities
Goal 11: Sustainable cities and communities
Goal 12: Responsible consumption and production
Goal 13: Climate action
Goal 15: Life on land

SM/0048/EN - BIOPHYSICS

Academic Year 2021/2022

Free text for the University

Professor
MATTEO CECCARELLI (Tit.)
Period
First Semester
Teaching style
Convenzionale
Lingua Insegnamento
INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[60/68] PHYSICS	[68/40 - Ord. 2020] FISICA MEDICA E APPLICATA	6	48
[60/68] PHYSICS	[68/70 - Ord. 2020] TEORIA, SIMULAZIONE E PROGETTAZIONE DI NUOVI MATERIALI	6	48

Objectives

1. Knowledge and understanding: the student will extend knowledge of physics to the field of biological systems with a molecular approach. In particular he will focus on main biological structures, namely protein, membrane and nucleic acids and their mutual interactions; he will focus on experimental methodologies for solving molecular structures and spectroscopy; transport models through channels and pores and techniques of electrophysiology. He will understand how to apply physics to the biological processes.
2 Applying knowledge and understanding: The student will develop the ability to analyze simple problems related to biophysics and assess qualitatively the change in mass/energy accompanying the related processes. Further, he will be able to apply simple statistical models to the study of biological phenomena, such as the molecular transport and recognition.
3 Making judgments: The student will develop the ability to analyze critically a given phenomenon by applying a theory and/or a model.
4. Learning skills: The student will acquire the learning skills necessary to further continue the career in biophysics. In particular, the student will become familiar with concepts, methodologies, theories and models commonly used in biophysics. He might use these developed skills for advanced studies, such as a master thesis and the PhD.
5. Communication skills: The student will acquire basic knowledge necessary to discuss with an appropriate language topics in biophysics.

Prerequisites

Knowledge of the fundamental laws of physics, chemistry, and statistical mechanics.

Contents

Introduction to Molecular Biophysics
What is biophysics
The Avogadron number and the unit of mass
Principles of Fluidodynamics
Reaction chemistry: kinetics and termodynamics

Biological macromolecules and the biological complexes
Membranes, proteins, nucleic acids and their complexes
Water as mediator and the solvation theories

Compartmentalization in biology
The cellular membranes
Transport phenomena: diffusion, osmosis and filtration

Methods on structural determination with atomic resolution:
NMR, Xray, Free Xray Laser, CRYO-EM

Electricity in cells
The Hodgkin/Huxley theory of nerve impulse
The action of Anesthetics
Electrophysiology and Sensing: Nerst-Planck equation and non-equilibrium for fast response
GHK model

Biomimetics: the electron transfer and the photosynthesis
The Spin-Boson model and the Marcus theory of ET
The time scale of proton transport

The Energy landscape Theory: from folding to transport
The protein folding as complex reaction
Diffusive Transport phenomena: from Einstein to Kramer

Phase transitions and crowding:
Axial accumulation of blood cells
Crowding in cells

Teaching Methods

The course will be based on front lectures (24 lectures for a total of 48 hours). Some arguments will be presented in a phenomenological way, others more in depth with the explicit derivation of the main results. Several applications will also be discussed through exercises that will be solved together with the students.
Some activities might be delivered online.

Verification of learning

Written test based on simple exercises.
Oral examination at the end of the Course, and consisting in the discussion of a report on a study topic approved by the teacher.
The following points will constitute the basis for the evaluation:
-Ability to use a appropriate language and acquisition of the terminology.
-Acquisition of relevant notions and understanding of the concepts introduced in the Course.
-Ability to critically use the notions and the concepts presented in the Course.
-Ability to process data in an independent and thorough manner.
-Ability to expose the study topic in a professional, clear and focused manner.

The score will be based on the assessment of the objectives outlined above. In particular, a sufficient score will be given only to the students who have acquired the ability to re-use critical knowledge and data processing in an organized, independent and professional manner.

Texts

- Rob Phillips et al., Physical Biology of the Cell, second edition (2013), Editor: Garland Science
- Philip Nelson, Biological Physics: Energy, Information, Life, Updated first edition (2008), Editor: WH Freeman and Company
- A. Kuznetsov: Charge Transfer in Chemical Reaction Kinetics

More Information

Slides of the lectures will be made available by e-mail

SM/0121/EN - NETWORK FLOWS OPTIMIZATION

Academic Year 2021/2022

Free text for the University

Professor
MASSIMO DI FRANCESCO (Tit.)
Period
First Semester
Teaching style
Convenzionale
Lingua Insegnamento
INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[60/73] INFORMATICS	[73/00 - Ord. 2017] PERCORSO COMUNE	6	48

Objectives

1. Knowledge and understanding skills.
The course is designed for the students of the 2nd year of the Master Degree in Computer Science.
This course aims to provide students with a deep knowledge on the theory and practice of network optimization and its extensions. Network optimization problems form a subclass of mathematical programming problems with applications to Computer Science, Engineering, Economics, as well as in interdisciplinary domains such as in the transportation, logistics, manufacturing, project management. This course will survey some of the applications of network optimization and focus on key special cases of network flow problems such as the shortest path problem, the maximum flow problem, etc. The goals of the course are the following:
• To present the knowledge of the state-of-the-art in the theory and practice for solving network optimization problems.
• To provide students with a rigorous analysis of network optimization algorithms.
• To help students develop their intuition about algorithm development and analysis.
2. Ability to apply knowledge and understanding.
Students must apply these optimization methods to face a realistic problem. The problem is defined by the cooperation of the professor and is typically investigated with another student.
3. Autonomy of judgment.
Facing a realistic problem will put students in the position of critically thinking at the problem setting, evaluating which data are requested in their formulation, developing,

implementing their algorithms and assessing the outcomes.
4. Communicative Skills.
The work on the problem will be illustrated in a write-up. It will enable students to develop the skills requested to present their work in an ordered and coherent way. Speaking skills will be evaluated in an oral interview, in which students must show the ability in explaining the underlying theory.
5. Learning Skills.
The course provides students with an adequate preparation to understand more advanced mathematical texts and makes them able to expand their knowledge autonomously in the future.

Prerequisites

1. Knowledge. The course would benefit from a good understanding of the basic concepts of Linear Programming, which are learned both in the Bachelor's Degree Program and in the Master Degree Program.
2. Skill. Students must be able to read and understand Linear Programming models and pseudocodes.
3. Competences. The ability to use a Mixed Integer Programming solver is requested.
4. Prerequisite courses. None.

Contents

• Introduction: Paths, Trees and Cycles
• Algorithm Design and Analysis
• Algorithms for Shortest-Path problems
• Algorithms for Maximum-Flow problems
• The Minimum-Cost-Flow-Problem
• Assignments and Spanning Trees
• Multy-commodity flow problems

Teaching Methods

The course consists of 48 hours of lectures held in English. They cover theoretical concepts, as well as several exercises to review and reinforce the theoretical concepts. Finally, the professor provides regular support to students throughout the course by ad-hoc meetings and e-mails.

Verification of learning

Students must demonstrate their knowledge of the specific terminology, the ability to solve a realistic problem and the theoretical concepts presented in the lectures. Students are evaluated in two stages: a project on a problem and an oral exam. The project must be approved by the Professor and is typically made in cooperation with another student. The conclusion of the project is a necessary condition to give the oral exam. It is evaluated 16 points. Two questions are typically made in the oral exam. The answers are evaluated up to 15 points.
• The final mark ranges between 18/30 and 22/30 in the case of sufficient knowledge of the specific terminology, correct application of the methodological concepts and sufficient presentation of the concepts and results.

• The final mark ranges between 22/30 and 26/30 in the case of good knowledge of the terminology, good application of the methodological concepts and a good presentation of concepts and results.
• The final mark ranges between 27/30 and 30 cum laude in the case of an excellent mastery of specific terminology, a critical application of the methodological concepts and a clear display of concepts and results.
Students are advised to check their preparation during the lectures. They will test their skills by practicing with exercises and comparing their results to those presented by the Professor.

Texts

Ravindra k. Ahuja, Thomas L. Magnanti, James B. Orlin. Network Flows. Upper Saddle River, NJ: Prentice Hall, 1993. ISBN: 9780136175490.

Matteo Fischetti. Introduction to Mathematical Optimization. Kindle Edition, 2019.

More Information

The main teaching-supporting tool is the platform elearning platform (https://elearning.unica.it/), where additional information is available (e.g. a course diary reporting the topics of each lesson and further teaching files). Additional online support will be provided according to the evolution of the COVID-19 pandemic.

SM/0122/EN - FORMAL METHODS

Academic Year 2021/2022

Free text for the University

Professor
GIOVANNI MICHELE PINNA (Tit.)
Period
First Semester
Teaching style
Convenzionale
Lingua Insegnamento
INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[60/73] INFORMATICS	[73/00 - Ord. 2017] PERCORSO COMUNE	6	48

Objectives

1. Acquiring knowledge and understanding
The course, devoted to second year students of the Laurea Magistrale in Computer Science, has as main target the achievement of all the knowledges, both theoretical and practical, that will allow the complete comprehension and their effective applicability of the design and verification, using model checking techniques, of a complex system.

2. Applying knowledge and understanding
The course will illustrate methodologies concerning system modeling, and how to formulate and effectively verify
properties the system should enjoy.

3. Making informed judgements and choices
The course provides all the tools and notions to face critically every problem connected to the modeling and
verification of complex systems.

4. Communicating knowledge and understanding
The written proof, with open questions, allows the student to show his capability of exposing in a clear and
coherent manner the treated arguments.

5. Learning capabilities

The course gives an adequate background to be able to face all the problems concerning the design,
development and implementation of programming languages, and gives the key notions to comprehend the
theory and applications of programming languages.

Prerequisites

1. Knowledge
The course does not require any specific knowledge beside the ones acquired in a laurea triennale in Computer Science.

2. Skills
None specific.

3. Competence
None specific.

Preparatory courses:
None.

Contents

The course is organized in 24 lessons concerning both the theory but also the application (each lesson presents an argument in the first part, and in the second part some examples, applications and exercises are provided).

Lessons are divided into three groups:

- in the first group is devoted to the modeling of complex system (transition system), on how to represent the
  computations of a transition system, focussing on concurrency and parallelism, and on how to formalize properties one wish to verify for the system

- the lessons the second group focus on the Linear Time Logic (LTL) and on how to do model checking for properties formalized using LTL

- in the third group the Computational Time Logic (CTL) is formalized and investigated, in particular on how to do model checking for properties written in CTL, and which are the relations with LTL

Teaching Methods

Lectures are given mainly using blackboard. Other online material could be possibly used. No slides are used, as the book used contains the material illustrated during the lessons, and using the blackboard allows to explain better using the proper pace.

Compatibly with the mixed teaching method foreseen in the Academic Manifesto for the A.Y. 2020-21 following the COVID-19 emergency, the tools used for the lectures will be both the blackboard and tablet with projection system via classroom screen and via internet streaming.

Verification of learning

For each lessons a number of exercise will be proposed, and together with a written exam, will be used in the oral exam.

Accordingly to the Manifesto of Studies for the A.Y. 2021-22 following the COVID-19 emergency, lessons will be mainly given in class, integrated and augmented with online strategies, to assure the correct and fruitful attendance. Exams will follow the same guidelines.

Texts

Christel Baier & Joost-Pieter Katoen: Principles of Model Checking, MIT Press

More Information

None

SP/0043 - LAW OF INTERNATIONAL ORGANIZATION

Academic Year 2021/2022

Free text for the University

Professor
GIACOMO BIAGIONI (Tit.)
Period
First Semester
Teaching style
Convenzionale
Lingua Insegnamento
INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[2/66] INTERNATIONAL RELATIONS	[66/10 - Ord. 2018] Diplomatic and Area Studies	6	36

Objectives

The course will focus on legal issues of international organisations in order to allow students to acquire awareness of their functioning. It will examine structure, nature and powers of the United Nations, as the most important example of international organisations. At the same time, the role of other international organisations, especially the World Health Organisation, will be taken into account.
Students will be enabled to acquire:
1) knowledge and understanding:
- of the role of governmental organisations in international relations;
- of the nature, the structure and the functioning of the United Nations.;
- of the powers and duties of the UN in the general context of international relations;
2) capacity to apply their knowledge and understanding to the evaluation of international relations;
3) ability to formulate
judgements as to the functioning of international organisations and to their contribution to the development of international relations;
4) ability to communicate their knowledge making proper use of the language of international law and international relations;
5) the learning skills to allow them to continue to study in the field of international law.

Prerequisites

Familiarity with the concepts, principles and rules of international law is necessary.

Contents

The course will focus on legal issues of international organisations and will deal especially with the United Nations system. In this context it will examine the following topics:
- the concept of international organisations;
- the features of international governmental organisations and their functioning;
- the legal personality of international organisations;
- universal organisations and regional organisations;
- the United Nations Organisation: history and main principles;
- the membership of the United Nations;
- the UN Charter;
- the system of specialised agencies, with a special focus on the role of World Health Organization;
- the functions of the United Nations, with special regard to the 2030 Sustainable Development Goals.

Teaching Methods

36 hours: 15 two-hours lectures and 3 two-hours seminars, subject to measures imposed by State or regional authorities or by the University, in order to cope with the emergency situation connected to the existing Coronavirus outbreak. In conformity with the Student Information Booklet, teaching activities will mainly take place as "in-presence" activities, while they can be complemented by online activities, in order to ensure the use of innovative and inclusive methods. Lectures and seminars will be in English.

Verification of learning

Oral exams. Each student will be asked at least three questions in order to assess the familiarity and the awareness of the nature and of the functioning of international organisations and of the United Nations, especially as concerns the main features, the bodies and the powers of the organisation; the capacity to analyze the interactions with the global framework of international law; the capacity to apply their knowledge and understanding to the actual facts of international relations, exercising their ability to formulate judgements and making proper use of the language of international law. Exam scores are expressed in thirtieths. In the evaluation of the exams account will be taken of the active participation of the students to the classes and to the seminars. In the assessment of the exam the following elements will be simultaneously evaluated:
1) knowledge and understanding of the topics of the course;
2) capacity to understand the functioning of international organisations and of the United Nations as a system;
3) the logic in providing the answer to the questions;
4) the proper use of the language of international law;
5) the capacity to link the knowledge acquired during the classes with the basic elements of international law.
In order to pass the exam with the score of 18/30, students will have to show to have a sufficient knowledge of all the topics examined during the course and of the overall functioning of international organisations and of the UN (see points 1 and 2 above), to be able to provide an answer based on an adequate logical process (see point 3 above) and to be

able to use the legal language without serious mistakes (see point 4 above), to show a sufficient comprehension of existing connections to the basic and general notions of international law (see point 5 above).
In order to obtain the maximum score (30/30 with honors), students will have to show an excellent knowledge of all the topics examined during the course, and of the overall functioning of international organisations and of the UN (see points 1 and 2 above), to be able to provide an answer based on an excellent logical process (see point 3 above) and to be able to use the legal language without mistakes (see point 4 above), to show an excellent comprehension of existing connections to the basic and general notions of international law (see point 5 above).

Texts

CONFORTI B., FOCARELLI C., The Law and Practice of the United Nations, Brill, 2010.

SP/0044 - CONTEMPORARY AFRICA

Academic Year 2021/2022

Free text for the University

Professor
ISABELLA SOI (Tit.)
Period
First Semester
Teaching style
Convenzionale
Lingua Insegnamento
INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[2/66] INTERNATIONAL RELATIONS	[66/10 - Ord. 2018] Diplomatic and Area Studies	6	36

Objectives

The course focuses on the analysis of political power and the State in Africa. It aims to provide the students with the necessary tools to analyse different types of political power in sub-Saharan Africa. In particular, it will investigate the development of the African state and the steps that have characterized its history, paying particular attention to the colonial, post-colonial and independent state. Particular emphasis will be given to the relationship between State and borders, and the analysis of conflicts. The course then will analyse inter-State relations in Africa, its main regional economic communities, and the dynamics of the international politics governing the African continent. In particular, it will lead students in the study of major African regional and continental organisations. Particular emphasis will be given to key concepts such as transitional justice, conflict management and RECs (Regional Economic Communities). At the end of the course the students:

1. they will acquire specialised knowledge on contemporary international issues;
2. they will be able to examine and question the evolution of African regional and continental institutions;
3. they will be able to evaluate African organizations and their relations with international actors;
4. they will be able to professionally communicate their knowledge;
5. they will be able to independently enhance their professional skills.

Prerequisites

Good knowledge of African History: those unfamiliar with African History should acquire its basic knowledge using the readings in the section Additional Readings. Knowledge of English.

Contents

The course examines different types of political power and organisations in sub-Saharan Africa since the 1800s. It will provide an overview of the evolution of the States and their regional relations, particularly within major political entities of the African continent, focusing on the policies of regional and continental organisations. The first part of the course will examine the political trajectories of political entities and some main issues since the 1960s, such as the evolution and role of international borders. The second part of the course will focus on those movements associated with Panafricanism and their influence on the historical process and current continental policies. Organisations as the African Union will be analysed, but particular attention will be dedicated to the Regional Economic Communities (RECs), on the analysis of their policies, especially regarding the management of conflicts and the relations with non-African actors. Main topics of the course will be:

1. The State in Africa: history and contemporary developments
Kingdoms, Empires, Colonial States, Independent States
2. African Regional Integration: from Panafricanism to Regionalism
African nationalisms, the Organisation of African Unity, the African Union, Regional Economic Communities, African borders
3. Conflicts: characteristics and resolutions
Type of conflicts, racist regimes, transitional justice (Truth and Reconciliation Commissions and International Courts)
4. External relations: from the bipolar and the global systems
The Cold war system, Asian partners (China, India, Japan)
5. African political theories and thinkers
African politicians, political and civil movements (environment, health, sustainable development, human rights, art)

Teaching Methods

Six weeks' course divided into 30 hours of lectures and 6 hours of seminars and presentations on key concepts of the course, such as borders, conflicts and international relations. Use of PPTs, maps, tables, documentaries and distribution of copies of documents and other useful texts.

The course will be delivered in presence and in streaming (i.e. lectures will be given simultaneously in a classroom and remotely). At the beginning of the semester, each student will choose (binding choice) face-to-face or distance teaching. Depending on classrooms availability and number of students, there may be shifts for physical classroom attendance.

Verification of learning

The verification of the preparation of the students will be done during the entire course through talks with the students at the end of each lecture. The final exam will be oral and will examine the knowledge acquired using the readings and bibliographic material and other documents made available.

The final mark is based on the students' performance on the course and exam and marks up to 30/30 cum laude. In the evaluation the determination of the final mark will take into consideration the following elements:

1. The capacity of the student of using the knowledge and arguments with respect to the proposed question;
2. The capacity to link different topics and historical periods;
3. Adequate historical and political language;
4. The ability of the student to critically analyse the topics of the course.

In order to pass the exam, the student has to get a mark not less than 18/30, and the student should demonstrate of having acquired sufficient knowledge of the different topics of the course (point 1) and be able to link different historic periods (point 2) with a proper language (point 3). In order to get 30/30 cum laude the student should demonstrate to have acquired an excellent knowledge of all the topics of the course (point 1), excellent ability to link different periods (point 2) using the proper language (point 3), with an excellent ability to critically analyse the various topics of the course.

Texts

Essential readings (choose at least one of them)

- Tim Murithi. Handbook of Africa's International Relations. Routledge 2014, Chapters: 1, 2, 3, 6, 8, 12, 14, 15, 16, 17, 18, 19, 22, 23, 27, 28, 29, 33, 34, 35, 36.
OR
- Crawford Young, The Post-Colonial State in Africa Fifty Years of Independence 1960-2010, University of Wisconsin Press, Madison 2012.
OR
- G. Carbone, L'Africa. Gli stati, la politica, i confini. Il Mulino, Bologna 2012.
OR
- A. Thomson (4th ed), An introduction to African politics. Routledge, 2016.

Other essential readings (for specific topics)

- Christopher S. Clapham (ed.), African Guerrillas, James Currey Publishers, 1998, Chapter 1
- Introduction: Analysing African Insurgencies.
- Anders, G., Zenker, O., Transition and Justice: An Introduction, Development and Change, May 2014, Vol.45(3), pp.395-414.
- Joram Mukama Biswaro. The Quest for Regional Integration in Africa, Latin America and Beyond in the Twenty First Century: Experience, Progress and Prospects - Rethoric versus Reality - A Comparative Study. Fundacao Alexandre de Gusmao, FUNAG, Brasilia 2011. Chapters 1, 7, 8, 9, 10
- G. Martin, African Political Thought, Palgrave and MacMillan, 2010.

Additional readings

- Cornelissen, S., Cheru, F., Shaw, T. (Eds.), Africa and International Relations in the 21st Century, Palgrave Macmillan UK, 2012.
- Catherine Coquery Vidrovitch, Breve storia dell'Africa, Bologna, Il Mulino, 2012.
- John Parker, Richard Rathbone, African History: A Very Short Introduction, Oxford, OUP,

2007.
- K. Shillington, History of Africa, 3rd edition, Palgrave Macmillan, Basingstoke 2012.
- C. Coquery Vidrovitch, Africa nera: mutamenti e continuità, SEI, Torino 1990, pp.133-194.
- A.M. Gentili, Il leone e il cacciatore. Storia dell'Africa Subsahariana, Carocci, Roma 2008, pp. 333-435.

More Information

Course contents and rules could change depending on the evolution of the COVID 19 situation

EC/0007 - COMPARATIVE CORPORATE LAW

Academic Year 2021/2022

Professor DIONIGI SCANO (Tit.)
Period First Semester
Teaching style Convenzionale
Lingua Insegnamento INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[11/80] MANAGEMENT	[80/30 - Ord. 2018] International Management	6	36

OBJECTIVES

The course aims to deepen and consolidate the knowledge of some areas of corporate law comparing six different jurisdictions as well as the ability to frame and solve the main issues underlying them.

A. knowledge and understanding: at the end of the course the student will gain knowledge of the rules of comparative corporate law and will understand the methodological aspects of the discipline.

.B. Ability to Apply Knowledge and Understanding: Presentation and review of regulatory data, controversial issues, cases and materials that will be held during the course, including seminars and exercises, will allow the student to acqu.ire the ability to identify solution to the main controversial issues and to apply the acquired skills to concrete cases.

C. Autonomy of judgment: the student will develop his / her ability to analyze and judge critically about positive law institutes, with regard to private rules on economic activities and interest-based considerations.

D Communication skills: the course will address the proper meaning and scope of the lexicon of business/corporate law, so that the student will acquire the ability to use it correctly and effectively in oral and written expression.

E. Learning Abilities: The course will help to increase the student's learning ability by developing individual study and self-assessment skills through exercises conducted in a classroom manner supply a comparative approach to modern corporate law. At end of the course the students will possess the skill to detect autonomously the various legal systems with regards to corporate law.

PREREQUISITES

As the textbook and the lessons are exclusively in English, fluent English language and basic knowledge of corporate law are required.

CONTENTS

introduction to corporate law, agency problems, governance structure, shareholders interests, protection of minority shareholders, protection of company creditors,related-party transactions, control transactions, investor protection.

The course and the lessons follow the structure of the textbook in order to facilitate Students in their learning process. Lessons will be 18 of two hours each.

Any single chapter of the textbook will contribuite to shape the course content and it will have same relevance and studying dignity.

TEACHING METHODS

The course takes place entirely through frontal Lessons where any arising issue can be discussed.
Students are required to take an active part during the lessons. A silent or passive behavior of the students is not considered positively.

VERIFICATION OF LEARNING

Oral exams. Students must give evidence of their maturity in discussing the subjects of the course. Attendance of classes and of possible seminars are essential for those students who desire to obtain a outstanding evaluation.
Exams are carried out just in an oral form and will seek to ascertain the knowledge of the institutes that are part of the program, the ability of the students to establish links between them and to address systematically and knowingly the discipline. The evaluation will be expressed in thirty: the marks will be graduated according to the knowledge of the institutes and the skills demonstrated by the student to understand the system and the method of commercial law, to know the reference rules in the Civil code and use the lexicon of the discipline.

Exam test changes following the COVID-19 outbreak
I would like to communicate that starting from the appeals of the month of June 2020 and until the time the exams will be carried out electronically, the final tests will be carried out through an online interview using the Teams software.
The exam calendar remains the one published in the exam calendar.
Students who must take the exam must have a remote connection that allows for the online interview through the Teams software.

TEXTS

R. Kraakman and others, THE ANATOMY OF CORPORATE LAW, Oxford University Press, III edition, Oxford, 2017, ISBN 978-0-19-872431-5

MORE INFORMATION

Class attendance is strongly suggested for students who aim to gain excellent results.
During the course the students attending classes will be involved in seminars and helpful lectures.
Non attending students can simply refer to the suggested textbook.

EC/0008 - PUBLIC MANAGEMENT

Academic Year 2021/2022

Professor ALESSANDRO SPANO (Tit.)

Period First Semester

Teaching style Convenzionale

Lingua Insegnamento INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[11/80] MANAGEMENT	[80/30 - Ord. 2018] International Management	6	36

OBJECTIVES

Public sector organizations aim at satisfying needs by delivering services to individuals and organizations, together with a wide range or regulatory functions. This course in Public Management provides the competencies to better understand how to manage public organizations efficiently and effectively, leading to quality public services and improve performance.

The course provides in-depth knowledge of public sector organizations and the way they function; a better understanding of how to select the needs of both individuals and organizations; the way public sector organizations deliver services to satisfy public needs; and how to achieve higher levels of efficiency, effectiveness and economy. The course in Public Management provides an analysis of the current state of the art in public management and governance at the international level. Students are introduced to the basic principles of public management, by considering international comparisons, particularly through the analysis of reforms that have taken place in many countries.

The course presents both empirical analysis and the new theories of public management, to help students gain the fundamental competencies to understand work in the public sector.

Consistent with the training objectives of the Degree in Management Economics, which is addressed in International Management, the expected learning outcomes can also be defined according to the following Dublin Descriptors:

1) Knowledge and understanding. The course improves the ability to understand economic and business phenomena with particular reference to public sector organizations and fundamental methods and tools for analyzing decision-making processes in the public sector and allows the acquisition of a specific language of the economic-business disciplines and public management.

2) Applying knowledge and understanding. The course allows students to apply the fundamental concepts of public management to concrete business cases and provides guidelines for the analysis of decision-making processes, through the connection between political and economic dimensions

3) Making judgment. The course helps improving the analytical skills with regards the capability of public sector organizations to deliver services to satisfy citizens' needs end to develop autonomous judgments with regards socio-economic sustainability, also with the help of real-life examples

4) Communication skills. Students will be encouraged to play an active role during the lectures, by discussing their personal interpretation of the concepts dealt with during classes; in addition, the course will help improve students' communication skills through the preparation and discussion of group work.

5) Learning skills. The course develops the skills needed to successfully attend other subjects, in particular in the business and management field.

PREREQUISITES

Basic knowledge of business economics and management.

CONTENTS

1) Differences between private and public organizations;
2) From public management to public governance;
3) New Public Management and recent Public Management reforms;
4) Planning and control in public sector organisations;
5) Performance measurement and management in the public sector;
6) Towards creating public value.

TEACHING METHODS

The course consists of 36 hours of frontal teaching and seminars, during which the contents of the program will be presented also with reference to specific case studies. Group work is also planned, in which the students will be required to develop a theme related to the topics dealt with in class and pertaining to public management. The course combines interactive lessons, case studies, seminars with experts from private and public companies. Classroom discussions are an integral part of the learning process and will be stimulated throughout the course.

The teaching will be delivered simultaneously both in presence and online, thus outlining mixed teaching that can be enjoyed in university classrooms but also at a distance. At the beginning of the semester, the student will opt for face-to-face or distance teaching, and the choice will be binding for the entire semester. If the number of students exceeds the capacity of the classrooms, determined based on government provisions on health matters to combat the pandemic by Covid-19, access to teaching facilities will be regulated through a shift system that will be communicated in due time to the students.

VERIFICATION OF LEARNING

Learning is verified through:

- A written test articulated in open-ended questions on the topics of the program, in which students must demonstrate adequate knowledge and properly apply public management principles and methods. This part weights for 75% in the overall evaluation, with individual evaluation assigned to each student.

- Presentation of a group work developed by the students. This part weights for 25% of the overall assessment, with collective evaluation assigned to all the components of each working group. In the case of students who do not participate in the group work, it will be possible to make up the part related to 25% of the overall assessment by carrying out a supplementary report of 5,000 words on a topic related to the course program, to be handed in before the written test in which the student enrolls. The score of the exam is expressed in thirtieths. A pass mark is achieved when the minimum grade (18/30) is reached, both in the written test and in the group work. A pass mark ranges:

- from 18/30: for a level of elementary knowledge of the subject, ie when the student only manages to frame the issue of economic-business phenomena in a public sector context and demonstrates just enough knowledge of the topics of the program in the written test and sufficiently contributing to the group work, with just enough mastery of language.

- to 30/30, with possible praise, if the student is able to systematize in a logical and coherent manner the knowledge that is supposed to have acquired during the course, both in the business economic phenomena and as regards the tools and methods typical of public management, and is able to support the analysis with an excellent elaboration of the concepts expressed and an adequate mastery of technical and economic language.

The program and the final exam are the same for those who attend and those who do not attend classes.

Consistent with the descriptors identified in the training objectives, the following will be evaluated:

1) clarity in expressing the theoretical contents (assessment of knowledge and understanding);
2) the ability to re-elaborate the concepts and to explain them, also through the comparison with the real cases dealt with in the classroom or deepened by the student in an individual way (evaluation ability to apply knowledge and understanding);
3) The ability to adequately interpret the knowledge and skills acquired in reference to the context of public administration (assessment of independence of judgment);
4) The clarity of the exposition, the ability to synthesize and the mastery in the application of the acquired knowledge in relation to the information systems integrated in the business environment (evaluation of communication skills);
5) The ability to apply the basic characteristics of integrated information systems and to deepen the related implications with reference to the specific characteristics of the business context (assessment of learning capacity)."Exam test changes following the COVID-19 emergency".

Following the provisions issued as a result of the COVID-19 emergency, the written part of Prof. Spano's Public Management exam will be replaced by an oral exam performed electronically on the Teams platform. The interview will have a weight equal to 75% of the overall evaluation.

"Examination test variations as a result of the COVID-19 emergency".
As a result of provisions issued as a result of the COVID-19 emergency, the written test of Prof. Spano's Public Management exams will be held online with a quiz featuring multiple-choice questions on topics relevant to the syllabus.
Complete instructions for taking the quizzes are available at this link: https://www.unica.it/unica/protected/253410/0/def/
If health conditions allow it, the pre-emergency modalities will be restored.

TEXTS

Public Management and Governance, Tony Bovaird, Elke Löffler, Cengage, 2016;
Public Management and Administration, Hughes O.E., Palgrave Macmillan, 2012.

MORE INFORMATION

The course will offer presentations by practitioners and scholars of public administration both Italians and foreigners. Students will be encouraged to carry out periods of work experience and internship in both Italian and foreign public organizations.

EC/0073 - ECONOMICS AND GEOGRAPHY OF INNOVATION

Academic Year 2021/2022

Free text for the University

Professor
RAFFAELE PACI (Tit.)
FABIO CERINA
Period
First Semester
Teaching style
Convenzionale
Lingua Insegnamento
INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[11/83] ECONOMICS, FINANCE AND PUBLIC POLICY	[83/10 - Ord. 2017] Economia e Politiche Pubbliche	12	72

Objectives

At the end of the course, the students who passed the exam will reach the following learning objectives
• Knowledge and understanding:
o Of advanced models for the analysis of regional economic systems
o Of quantitative methodologies as tools to interpret economic phenomena at the regional level
o Of regional policies
• Applying knowledge and understanding:
o In evaluating regional policies
o In applying research methods to study economic local institutions and in formulating public regional policies and couterfactual analysis also through the help of computational software like MATLAB
o In analysing and interpreting local territories
• Making judgments: the course stimutates the ability to make judgments through a series of activities: the elaboration of homeworks in team and their discussion in class, the personal writing of economic reports and the presentation in class of scientific papers.
• Communication: During classes, students will be involved in discussions which will enable them to develop a critical judgment and improve their communication skills. Moreover they will be asked to present in front of the class audience some scientific papers and prepare

statistical reports. Finally, the resolution of homeworks in team will develop students' skills in communicate their ideas within a team.
• Lifelong learning skills: The course is meant to develop the students' ability to analitically apply the notions learned in class. In particular, the course aims at developing the ability to read historical actual phenomena through the lenses of the theoretical models studied during lectures and at stimulating a critical and analytical approach to economic reality. The objective is to enable students to understand the mechanisms and the dynamics behind the localization decisions of economic agents (households, firms, innovators). Finally, some exercises on computational softwares like MATLAB will be carried on in order to develop the students' ability in apply computational methods to evaluate regional policies

Prerequisites

Basic principles of microeconomics and Economics of Growth and of quantitative methods for Economics

Contents

This course deals with some theoretical and empirical aspects of firms' and workers' localization and the spatial distribution of innovation activities. It aims at
• understanding the reasons behind these choices and to help predicting the impacts of these investments,
• providing a thorough analytical knowledge on modern urban and regional economics and on the economics of innovation.
• Allow student to be able to use this knowledge in order to study how the phenomena of industrial and demographic agglomeration can determine the economic success or failure of a region.
The course is made of two parts. Module A has two main aims: 1) to provide a thorough overview of the current economic theories on the determinants (causes) and on the consequences (effects) of the spatial concentration of economic activities; 2) to introduce the recent literature on urban labor markets and the spatial sorting of heterogenously skilled workers
More precisely, module A will deal with the following topics
• Stylized facts on agglomeration (2 hours)
• Models of monopolistic competition: Dixit Stiglitz (1977) (4 hours)
• Monopolistic competition and increasing returns : Krugman (1980) (2 hours)
• Factor mobility: new economic geography and the core-periphery model of Krugman (1991) (4 hours)
• The role of housing in agglomeration processes: Helpman (1998) (2 hours)
• The empirics of the NEG (4 hours)
• Testing the predictive capacity of NEG models with MATLAB: Quantitative Spatial Economics (12 hours)
• Urban labor markets and spatial allocation of skills (6 hours)

Module B aims to analyse the empirical models that explain the process of agglomeration of production and innovation activities and their effects on regional performance. In addition, module B will also contain a laboratory of statistical-econometric analysis which will allow student to test the concepts learned during lectures. More precisely, this module will present the following topics

• Introduction on the agglomeration process of production activities (8 hours)
• The determinants of regional performance (10 hours)
• The process of creation and diffusion of technological progress and knowledge among regions (8 hours)
• Statistical and econometric techniques and software for the analysis of spatial data on the topics covered during the classes (14)

Teaching Methods

Lectures (20 hours in module A and 18 hours in module B) in order to develop Knowledge and Understanding
• Homework resolution in team and discussion in class (6 hours in module A) in order to develop Communication skills
• Presentation of scientific papers in class (6 hours in module A and 4 hours in module B) in order to develop Communication skills and Making judgments
• Sessions on computational software like MATLAB (4 hours in module A) in order to develop Lifelong learning and applying knowledge and understanding
• Laboratory of spatial statistical analysis (14 hours in module B) in order to develop Judgements and applying knowledge and understanding

Verification of learning

The final grade is in 30th and will be computed as the arithmetic average of the grades in module A and module B.
Module A: for attending students who will give the final exam within the winter session (February) the final evaluation will be the weighted average of the evaluation of three different parts:
1. Final written exam (1 small essay) or development of a work using MATLAB (50% weight)
2. Team-homework to be corrected in class (25% weight)
3. Presentation of a scientific paper in class (20% weight)
For non-attending students, evaluation is 100% through a written exam (1 quantitative exercise and 2 small essays)
4. Class Participation (5%)

Module B: to pass the exam the students should exhibit the ability to write a report, manage and analyse databases and work on statistical-econometric analysis in autonomy.
For attending students the final exam will consist of
1) A presentation and discussion in class of some scientific papers (50%)
2) The elaboration of a short thesis on topics presented in class and in the laboratory (50%).
The active participation in the classes work will be also evaluated.
For non-attending students, the final exam will consist of a written exam (3 small essays)

Attending classes is strongly suggested and active participation of students is required for both modules
Generally, questions will be formulated in order to be able to evaluate if students have acquired the knowledge of the theoretical models and methods of empirical analysis and if they are able to apply them with judgment.
In answering questions, in presenting papers and in writing reports students will be asked to
• Present and discuss theoretical concepts with rigorous thinking

• Demonstrate the ability to comment in a rigorous and logical way statistical indicators and tables

In order to pass the exam with the minimum grade (18/30) the student will be demonstrated to have acquired sufficient knowledge of the topics presented during the course.
The grade 30/30 (potentially cum laude) will be given to students showing an excellent command on topics presented during classes both from the theoretical and the empirical point of view, and being able to answer questions using a rigorous language

Texts

Module A
The main source are the slides provided by the instructor.
The first part will refer mostly to the book:
Combes P.P., Mayer T., Thisse J.J. (2008), Economic Geography: the Integration of Regions and Nations, Princeton University Press.
We will study several papers, among which:
Redding S. and Rossi-Hasberg E. (2017), Quantitative Spatial Economics, Annual Review of Economics, 9:2158

Redding S. (2017), Goods Trade, Factor Mobility and Welfare, Journal of International Economics, 101: 148-167.

Eeckhout, J, Pinheiro, R. and Schmidheiny, K. (2014), Spatial Sorting, Journal of Political Economy, 122, 554-620

Cerina F. Elisa Dienesch, Alessio Moro and Michelle Rendall. Spatial Polarization (2019), CRENoS Working Paper 19-09

Autor (2019), "Work of the Past, Work of the Future", AEA proceedings

Module B:
The agglomeration process of production and innovation activities
(L1) Introduction
(L2) European Commission (2017) 7th Report on Economic and Social and Territorial Cohesion. Brussels.
Part 1. Agglomeration and determinants of regional performance
(L3-5) Determinants of regional performance and agglomeration economies
Beaudry C., A. Schiffauerova (2009) Who’s right, Marshall or Jacobs? The localization versus urbanization debate, Research Policy, 38, 318–337.
Paci R., Usai S. (2008) Agglomeration economies, spatial dependence and local industry growth, Revue d’Economie Industrielle, 123, 3, 87-109.
Dettori B., Marrocu E., Paci R. (2012) TFP, intangible assets and spatial dependence in the European regions, Regional Studies, 46, 10, 1401-1416.
Marrocu E., R. Paci, S. Usai (2013) Productivity growth in the Old and New Europe: the role of agglomeration externalities, Journal of Regional Science 53(3) 418–442
(L6) Creativity
Boschma, R.A., M. Fritsch (2009), Creative class and regional growth. Empirical evidence from seven European countries, Economic Geography, 85, 4, 391-423. (Intrroduction to the topic)

Marrocu E., Paci R. (2012) Education or Creativity: what matters most for economic performance?, Economic Geography, 88, 4, 369-401.
Marrocu E., Paci R. (2013) Regional development and creativity, International Regional Science Review, 36, 354-391.
(L7) Smart specialisation strategy and relatedness
Marrocu E., Paci R., Rigby D., Usai S. (2020) Smart Specialization Strategy: any relatedness between theory and practice?
Part 2. Spatial distribution of innovation activity
(L8) Introduction
Audretsch D., Feldman M. (2004), Knowledge Spillovers and the Geography of Innovation, in Henderson J.V. and J.F. Thisse (eds.) Handbook of Urban and Regional Economics.
Boschma R. (2005) Proximity and innovation. A critical assessment, Regional Studies, 39, 61–74.
Colombelli A., Foddi M., Paci R. (2011) The knowledge regions in the enlarged Europe, Working Paper CRENoS 2011/10. Published in Scientific regions, in Capello R. and Lenzi C. (editors) Territorial Patterns of Innovation. 2013. London: Routledge. 43-69.
(L9) Knowledge Production Function
Moreno R., Paci R., Usai S. (2006) Innovation clusters in the European regions, European Planning Studies ,14, 9, 1235-1263.
Moreno R., R. Paci, S. Usai (2005) Spatial spillovers and innovation activity in European regions, Environment and Planning A, 37, 10, 1793–1812.
(L10) Knowledge Flows
Paci R., Usai S. (2009) Knowledge Flows across European Regions, Annals of Regional Science, 43; p. 669-690
(L11) Proximity dimensions and innovation
Marrocu E., Paci R., Usai S. (2013) Proximity, Networking and Knowledge Production in Europe: what lessons for innovation policy?, Technological Forecasting and Social Change. 80, 8, 1484-1498.
Paci R., Marrocu E., Usai S. (2014) The complementary effects of proximity dimensions on knowledge spillovers, Spatial Economic Analysis. 9, 1, 9-30.

EC/0083 - ADVANCED CORPORATE FINANCE

Academic Year 2021/2022

Free text for the University

Professor
LUCA PIRAS (Tit.)
Period
First Semester
Teaching style
Convenzionale
Lingua Insegnamento
INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[11/80] MANAGEMENT	[80/30 - Ord. 2018] International Management	6	36

Objectives

a) Knowledge and comprehension abilities
Students will develop and increase their corporate finance knowledge, theories of Markets and behavioral finance. They will become familiar with complex investments and corporate valuation problems and technics.

b) Ability to apply knowledge and comprehension abilities
Students will develop the ability to set and solve complex valuation problems, including planning a start-up and large investments programs of big companies. They will be able to calculate, use and properly interpret the size of the opportunity cost of capital. Students will be able to analyze market scenarios also considering real individual behavior in business activity.

c) The ability to judge
the course will help students to develop and increase their ability to autonomously evaluate problems and processes of the financial environment and to make proper decisions.

d) The ability to comunicate
Students will learn how to interpret and communicate all financial information. Will be able to build and present financial reports, business plans and the most common kind of pitch.

e) Learning Ability

Students will be guided through the study activity so that they can acquire the ability to develop autonomous learning enhancement.

Prerequisites

Though there are not specific pre-requirements, the following topics will be assumed to be known by the student at the beginning of the course and won't be treated during class: Corporate finance, basic capital budgeting, the law of single price, Accounting, and Financial mathematics, Balance sheets analysis, ratios, and cash flow analysis; Basic Algebra and financial mathematics; Microeconomics basic elements are also warmly suggested.

Contents

1. The Cost of Capital
a. Fisher' theory of Interest;
b. The Separation Theorem;
c. Modigliani e Miller theory
d. Frequent mistakes in measuring the cost of capital

2. The Capital Market:
a. Harry Markowitz: Modern portfolio theory;
b. Eugene Fama: Efficient Market Hypothesis

3. Behavioral Finance
a. The Prospect Theory
b. Biases and Heuristics
c. Narrative, Noise, Technology

4. Valuation
a. Determining valuation criteria
b. Determining the cost of capital
c. Start-up Valuation
d. Elements of M&A

Teaching Methods

Lectures will be mainly in presence, integrated, and augmented with online instruments in order to grant the possibility to attend classes inclusively and innovatively.

Lectures: The course is organized into 18 lectures of two hours each.

Verification of learning

The exam is based on a written test, consisting in the solution of problems, questions requiring open answers on theoretical topics, as well as multiple choice.
Problems solutions will be evaluated considering the correctness of numerical results and the applied methodology; theoretical questions will be evaluated considering the essential content of theories and basic literature; in open questions will also be kept into account the capacity

to express in a synthetic, but clear manner the answers, properly using the jargon of the discipline.
To achieve the minimum grade (18-23), the student must obtain correct numerical results and has to demonstrate to have knowledge of basic concepts and to be able to properly frame basic knowledge within the discipline.
In order to achieve a better grade (24-26), students will also have to demonstrate a fair capacity to draw proper conclusions out of solutions found and questions answered.
Higher grades (27-28) can be attributed to students who demonstrate a complete knowledge of the topics with eventually trivial exceptions.
Top grades will be awarded to students who not only demonstrate to have fully reached the learning objective, but also delivered in time all the hands-out requested in an accurate and complete manner.

Texts

Eugene F. Fama Two Pillars of Asset Pricing, Prize Lecture, December 8, 2013,
Download at http://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/2013/fama-lecture.pdf
J. Berk – P. De Marzo, Finanza Aziendale, Pearson, Seconda edizione (o successive), 2011 - Capitoli: 10-13, 17-19
M.M. Pompian, Behavioral Finance and Wealth Management, Wiley Finance, 2006, chapters 4-23
Download at http://www.untag-smd.ac.id/files/Perpustakaan_Digital_1/FINANCE%20Behavioral%20finance%20and%20wealth%20management%20%20building%20optimal%20portfolios%20that%20account%20for%20in.pdf)

More Information

Within the course, though not necessarily during normal schedule, experts and professional managers will hold seminars on topics related to corporate valuation an investment funding.
All students are required to pass in two 2500 words essays (in english): one on M&A and the other on block chain and crypto currencies

EC/0087 - MACROECONOMICS

Academic Year 2021/2022

Professor STEFANO MATTA (Tit.)

Period First Semester

Teaching style Convenzionale

Lingua Insegnamento INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[11/75] BUSINESS AND ECONOMICS	[75/66 - Ord. 2017] INTERNAZIONALE UNICA-BIELEFELD	9	54
[11/75] BUSINESS AND ECONOMICS	[75/67 - Ord. 2017] INTERNAZIONALE UNICA-PRAGA	9	54

OBJECTIVES

- Knowledge and understanding: understand the role played by the principal macroeconomic variables through the use of models; appraise the meaning and the effects of the economic policies pursued by the Government, Central Bank, and other economic institutions.

- Applying knowledge and understanding: Understand the role of assumptions in arguments, solve economic problems using models, graphs and algebra.

- Making judgements: know how to collect and interpret data in order to understand and evaluate current economic events and new economic ideas; compare two or more arguments that have different conclusions to a specific issue or problem.

- Communication skills: Communicate in written, spoken, and graphical form about specific economic issues, even by using graphs and equations, to experts and non-experts.

- Learning skills: the methodological approach, based on quantitative methods and models, enables the students to successfully embark on further study.

PREREQUISITES

Mathematics: basic linear algebra and differential calculus.

Microeconomics: Consumer and producer theory; supply, demand and market equilibrium.

Statistics: graphical and numerical description of data; independence and relationship indices; regression.

CONTENTS

- Introduction: the science and the data of macroeconomics;

- The economy in the long run: national income, monetary system, inflation, the open economy, unemployment.

- Growth theory

- the short run: economic fluctuations, IS-LM model, Mundell-Fleming model, aggregate supply and Phillips curve

- Macroeconomic policy debate: stabilization policy, government debt, common currency areas, European Economic and Monetary Union;

- More on microeconomics behind macroeconomics: consumption, investment, the financial system.

TEACHING METHODS

6 Lecture hours per week.

Exercises.

The teaching will be mainly classroom-based, integrated and "augmented" with online strategies, in order to ensure that it is used in an innovative and inclusive way.

VERIFICATION OF LEARNING

Written exam with theoretical questions (assessment of knowledge and understanding), exercises (assessment of the ability to apply knowledge and understanding) and case study (evaluation of making judgment). The use of appropriate language is an important element of the exam (assessment of communication skills).

The final grade is out of thirty. The intermediate exam will weight depending on the number of hours of lectures devoted to the teaching of the part being examined.

To determine the final grade the following elements will be considered :
1. The proper use of the model .
2. The ability to explain through an intuitive language the solution.
3. The use of algebra .
4. The use of graphs.

To achieve a maximum score , the student must show to have acquired an excellent knowledge of all the topics covered during the course. To pass the exam , the student must demonstrate that they have acquired sufficient knowledge of the subjects.

TEXTS

N. G. Mankiw- M.P.Taylor, Macroeconomics European Edition, Worth Publishers 2014, Second European Edition.

EC/0088 - INTERNATIONAL ACCOUNTING

Academic Year 2021/2022
Free text for the University

Professor ALESSANDRO MURA (Tit.)
Period First Semester
Teaching style Convenzionale
Lingua Insegnamento INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[11/75] BUSINESS AND ECONOMICS	[75/66 - Ord. 2017] INTERNAZIONALE UNICA-BIELEFELD	9	54
[11/75] BUSINESS AND ECONOMICS	[75/67 - Ord. 2017] INTERNAZIONALE UNICA-PRAGA	9	54

OBJECTIVES

The objective of this course is to make students understand the international dimensions of accounting and financial reporting. Through readings, research, problem solving, case analysis, and teamwork presentations, students should be able to develop analytical and practical skills to effectively deal with international financial reporting issues. More specifically the educational goals of this course consist of the following knowledge and skills relating to:

- International differences on accounting standards and the process of harmonisation;
- Financial Statements discipline for public companies under International Financial Reporting Standards (IAS/IFRS);
- comparison of Local European GAAP in relation to specific topics.

This course presents a higly operating content and aims at transferring ability of applying knowledge and skills as:
- preparation, presentation and interpretation of Financial Statements for commercial, manufacturing and service enterprises in accordance with IAS/IFRS.

Students acquire the ability to choose amongst alternative options of recording, evaluating and representing firm's performance, including the accounting choice's consequences on the informativeness of financial reporting.

As regards communication skills, students acquire the technical language of financial reporting in order to illustrate and communicate to stakeholders the financial performance of the firm.

Students develop their own reading by following up bibliographies and by browsing relevant accounting journals in the library. They thus also develope skills to undertake a research dissertation in the area of international financial reporting.

PREREQUISITES

Students are expected to be familiar with basic accounting and financial reporting in order to effectively learn the topics of this course. In particular it is essential to have a good knowledge of:
- the double-entry system of book-keeping;
- the concepts of income and net assets.

CONTENTS

Users of financial statements and their different expectations
International accounting differences and the process of harmonisation
Accounting principles under IASB
Structure of published financial statements (IAS1):
-Statement of financial position/Balance sheet
-Statement of financial profit or loss and other comprehensive income/Income statements
-Statement of changes in equity
- Cash flow statements
- Notes to the financial statements
Accounting Standards under IAS/IFRS
- Fixed (non-current) tangible assets (IAS 16)
- Intangible assets (IAS 38)
- Impairment (IAS 36)
- Leases (IFRS 16)
- Inventories (IAS 2)
- Provisions, contingent liabilities (IAS 37)
- Income taxes (IAS 12)

The armonisation of accounting within Europe.

Analysis and interpretation of Financial Statements
- Summary of commonly used ratios
- Interpretation of accounting ratios

TEACHING METHODS

Class sessions will consist of lecture, problem solving, and discussion. Discussion will focus on readings, essays and presentations by students.

VERIFICATION OF LEARNING

The final assesment will be based on:
- writing an essay and making the relating presentation on a specific accounting topic (within the area of accounting harmonisation) based on teamwork (20% of total marks)

- a written examination comprising both open-ended questions and a case study, relating to the various topics covered during the course (80% of total marks).

*An optional intermediate written examination is planned during the term break (40% of total marks)

TEXTS

Elliott B., Elliot J., Financial Accounting and Reporting., Pearson, 2019

Nobes C., Parker N., Comparative International Accounting, Pearson, 2020

IA/0020/EN - INTERNET OF THINGS

Academic Year 2021/2022

Professor MICHELE NITTI (Tit.)
Period First Semester
Teaching style Convenzionale
Lingua Insegnamento INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[70/83] ELECTRONIC ENGINEERING	[83/15 - Ord. 2018] EMBEDDED ELECTRONICS	6	60
[70/91] INTERNET ENGINEERING	[91/00 - Ord. 2018] INGEGNERIA DELLE TECNOLOGIE PER INTERNET	6	60
[70/90] COMPUTER ENGINEERING, CYBERSECURITY AND ARTIFICIAL INTELLIGENCE	[90/00 - Ord. 2018] PERCORSO COMUNE	6	60

OBJECTIVES

The Internet of Things (IoT) is a world-wide network of interconnected objects uniquely addressable, based on standard communication protocols. The course aims to present to the students the technologies and the main application scenarios of the IoT world.
The theoretical lessons will be complemented by demonstrations and practical exercises in the lab. Students will learn how to create sensor networks using Raspberry and Arduino and implement various application-level communication protocols, such as MQTT or CoAP.

In detail, the training objectives, according to the Dublin Descriptors, and in accordance with the training objectives of the Master Degree Course in Telecommunications Engineering, are the following. Knowledge and comprehension skills.
At the end of the course, the student must know and understand
- features and functionalities of the various levels of IoT network architecture and its possible variants;

- main protocol specifications that characterize application-level communications among objects

- the mechanisms of operation of sensor networks for the acquisition of data of

interest and their communication to the Internet through appropriate gateways. Ability to apply knowledge and comprehension

At the end of the course, the student must:

- know how to describe, analyse and design an IoT application, identifying its requirements and specifications;

- be able to understand the differences, in terms of strengths and possible weakness, among the possible enabling technologies in reference to the specific use case;

- know how to properly configure various devices so that they can implement the communication protocols required by the various applications;

- know how to set up the most appropriate interfaces to present the services offered to users.

Making judgments at the end of the course, the student must be able to distinguish the main advantages and disadvantages of possible IoT solutions at all levels of the network architecture; it will also have to be able to autonomously choose the fittest enabling technology and the application-level communication protocol based on the reference scenario.

Communication skills the teaching approach and the methods for the assessment of knowledge acquired will make the students used to communicate the concepts and the methods learned, as well as to formalize the problems in terms of protocols and their configurations and to discuss related topics with both specialist and non-specialist colleagues.

Ability to learn through the course, students will integrate knowledge gained in other courses with reference to the protocols used in the Internet and to the main standards for Access Technologies to it. Moreover, conducting studies and class presentation of projects developed throughout the course will give students the ability to independently integrate the knowledge learned through the course with additional knowledge and summarize these arguments in order to set out a clear presentation to the audience of colleagues.

PREREQUISITES

Communication: know how to present concepts and information in oral, written, and graphic form. Organizational: know how to organize activities around the clock and plan a mid-term work / study plan.

Knowledge: The student must have an appropriate knowledge of the architectures for telecommunication networks and Internet protocols. Additionally, it is necessary to have a technical knowledge of English and of the TCP/IP protocol suite. Not necessary, but recommended knowledge: basic of Access Networks and programming skills.

Skills: The skills acquired from previous teaching courses relate to the ability to analyse the basic architecture of the telecommunication networks.

Competence: The skills acquired in previous teaching courses are essential to the understanding, interpret, and critically analyse network architecture and protocol configurations.

CONTENTS

The Internet of Things course aims to present students with the basic concepts of the IoT landscape and help them develop the capabilities of developing, managing and presenting simple IoT projects.

The course is structured, even temporarily, in the following teaching units.
Generalities on the Internet of Things (11 hours of theory, 5 hours of laboratory):
- Introduction to IoT;
- Organize and manage an IoT project;
- General IoT architecture and survey of enabling technologies, protocols and applications.

Sensor networks, physical and virtual objects (12 hours of theory, 10 hours of laboratory):

- Typologies of sensor networks;
- Physical-level communication protocols;
- virtual objects;
- Virtual objects management.

Applications, protocols, user interfaces (10 hours of theory, 12 hours of laboratory):
- Application-level protocols;
- Presentation of the IoT platform developed at DIEE;
- Analysis of IoT application requirements;
- Possible variants of the IoT paradigm.

TEACHING METHODS

The teaching is organized in a traditional way with the use of slide lectures and exercises through the use of emulators and sensors and gateway of different types. Presentation activities are also organized by the students of additional topics assigned to them during the course.

To meet specific educational needs related to the epidemiological situation, the possibility of live streaming lessons or recordings of the same available online is provided. Furthermore, the exercises may include shifts and / or be carried out through forms of remote interaction with the available IT supports.

VERIFICATION OF LEARNING

In order to verify the knowledge and comprehension skills, the exam is carried out at the end of the course through a written test which multiple choice questions, in which it is requested to justify the chosen answer.

Each question is assigned a maximum score. Each question is evaluated with a score between 0 and the maximum score assigned. The maximum score is assigned in case of correct answer while a lower score will be assigned in presence of errors. Lack of attention or misunderstandings mistakes, as well as text errors attributed to possible ambiguity will have a lower weight than conceptual errors, clearly caused by a partial knowledge of the subject.

To test the applying knowledge and understanding and the judgment autonomy, projects will be assigned to groups of students to design and develop IoT applications. These applications will be based on high level requests from the teacher, which the students have to match using the knowledge acquired during the course. Once the project is completed, the design choices and the ability to present the project results will be evaluated.

In order to verify the ability to learn and communication skills, each student will be assigned a theoretical topic on some specific aspect of the course that the student will have to deepen through articles of specialized magazines and expose to the audience of colleagues.

The final vote is obtained as the sum of the scores obtained for the three parts. The maximum score of the tests is 32. Those who get an overall score of 32 will have a vote equal to 30 cum laude.

Since the actual situation is constantly evolving, intermediate and final verification methods can be replaced by different verification methods, for example: individual or group work, oral interviews, remote written tests using computer aids (moodle, Teams, etc.), or completely eliminated in the case of intermediate checks.

TEXTS

Guinard, Dominique, and Vlad Trifa. Building the web of things: with examples in node. js and raspberry pi. Manning Publications Co., 2016.
Dieter Uckelmann, Mark Harrison, Florian Michahelles, “Architecting the Internet of Things” (ISBN: 9783642191565, ISBN-online: 978-3642191572)

Cirani, S., Ferrari, G., Picone, M., & Veltri, L. (2018). Internet of Things: Architectures, Protocols and Standards. John Wiley & Sons.

In addition, given the newness of the topic discussed, the teacher will provide the reference scientific papers necessary for further study of the subject matter.

MORE INFORMATION

The students will be provided with slides and solutions of the exercises.

IA/0125/EN - ADVANCED EMBEDDED SYSTEMS

Academic Year 2021/2022

Professor PAOLO MELONI (Tit.)
Period First Semester
Teaching style Convenzionale
Lingua Insegnamento INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[70/83] ELECTRONIC ENGINEERING	[83/15 - Ord. 2018] EMBEDDED ELECTRONICS	8	80
[70/91] INTERNET ENGINEERING	[91/00 - Ord. 2018] INGEGNERIA DELLE TECNOLOGIE PER INTERNET	8	80
[70/90] COMPUTER ENGINEERING, CYBERSECURITY AND ARTIFICIAL INTELLIGENCE	[90/00 - Ord. 2018] PERCORSO COMUNE	8	80

Objectives

Acquiring knowledge and understanding: understanding the basics of microprocessor-based systems, special -purpose systems and the related research topics.
Applying knowledge and understanding: developing the capability of analyzing, designing and optimizing a microprocessor-based system, understanding the concepts and techniques for design space exploration.
Making informed judgements and choices: develop the ability to properly use CAD/EDA tools for analyzing, designing and prototyping embedded systems.
Communicating knowledge and understanding: technical language of embedded system design, embedded system performance metrics.
Capacities to continue learning: integrating information provided by different parties, reading and understanding research articles, using commercial datasheets of industrial products.

PREREQUISITES
Digital system design

CONTENTS
In the first part of the course, the basics of hardware/software design for embedded systems will be presented. In the second, novel advanced topics will be presented with references to parallel computing and multi-processor systems. The course will include hands-on sessions aimed at the acquisition of technical skills involving EDA/CAD usage.

TEACHING METHODS
Lectures (50h) and lab sessions with simulators and FPGAs (30h)
The course will be taken mainly in person. To face the current epidemiological situation, the possibility of offering streaming lessons and of making them available on-line is envisioned. Moreover, the lab sessions could be attended using remote interaction methods with adequate tools and IT support.

VERIFICATION OF LEARNING
Oral exam. The knowledge of the course topics will be verified and the skills acquired during lab sessions will be evaluated. The student will have to master the techniques learned during lab experiments. Related skills will be verified through an adequately commented presentation of the lab results.

TEXTS
David A. Patterson and John L. Hennessy - "Computer Organization and Design: The Hardware/Software Interface"

MORE INFORMATION
Lecture slides will be made available when needed, to integrate the book content.

News and other utilities will be available at:
https://teams.microsoft.com/l/team/19%3aPNtEInYthIcWrsKbI8CoS8Er91E7UhQbiMcogqj2tuU1%40thread.tacv2/conversations?groupId=8b81588b-3781-459c-9bde-ef0454bb5629&tenantId=6bfa74cc-fe34-4d57-97d3-97fd6e0edee1

IA/0151/EN - WEARABLE AND FLEXIBLE ELECTRONICS

Academic Year 2021/2022

Professor PIERO COSSEDDU (Tit.)
Period First Semester
Teaching style Convenzionale
Lingua Insegnamento INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[70/83] ELECTRONIC ENGINEERING	[83/25 - Ord. 2018] ELECTRONIC TECHNOLOGIES FOR EMERGING APPLICATIONS	7	70

OBJECTIVES

Development of basic knowledge of innovative technologies in the field of microelectronics, and in particlar of organic electronics
Development of the ability of fabrication and electrical charactierization of organic semiconductor based electronic devices
Development of the ability of clearly exaplain the different concepts learned during the course

PREREQUISITES

Physics, Physics of Solid State and Electronic Devices are mandatory in order to succesfully attend the course

CONTENTS

Introduction on Organic Electronics: organic chemistry, Carbon atom, molecular orbitals
Physics of Organic Semiconductors: Charge transport in organic aterials; inorganic semiconductors vs organic semiconductors
Charge Transport in Organic Semiconductors: Models for charge transport; Correlation between morphology and electrical properties in organic materials; small moleculs and polymers
Organic Field effect Transistor (OFET): working principle and main differences with MOSFETs; Structures and materials
Non idealities in OFETs: the role of interfaces
- metal/semiconductor
- insulator/semiconductor
Contact Resistance, Hysteresis and bias Stress in OFETs
Alternative configurations:

- Organic Electrochemical Transistors, OECT
- Electrolite Gated Organic Field Effect Transistors, EGOFET
- Self aligned OFET

Effect of mechanical deformation in policrystalline films based devices
Solutions for aobtaining mechanically stable devices
Applications :
Wearable Applications e Artificial Skin:

- Strain sensors
- temperature sensors
- Force/Pressure sensors

Textiles Electronics
Electrical charaterization: Instrumentation for electrical characterization; Measuring methods and electrical parameters extraction;
Oranic Solar Cells (OSCs): Working Principle; Aarchitectures and Materials
Organic Light Emitting Diodes (OLEDs): Working Principle; Architectures and Materials
Light Emitting Transistors (OLETs): Working Principle; Architectures and Materials
Organic Semiconductor-based Memory Elements: OFET-based Memories; Resistive Memories etc.
Laboratories:
1) Fabrication Technologies: Deposition from vapor phase; Deposition from liquid phase
2) Patterning Techniques: Inkjet Printing, Soft lithography, Photolithograpy
3) Electrical characterization of transistors made on flexible substrates (plastic, paper, fabric etc.)
4) Fabrication and characterization of flexible sensors for wearable application

TEACHING METHODS

The course will be organized as follows:
30 hours of lectures on the previously reported arguments
40 hours of lab experiences, organized as follows:

- 10 hours of Fabrication Technologies for organic semiconductor-

based electronic devices
- 10 hours Fabrication of OFETs by means of inkjet printing
- 10 hours of Electrical Characterization of Organic Electronic Devices and results analysis
- 10 hours of electrical characterization of organic semiconductor-based flexible sensors

VERIFICATION OF LEARNING

At the end of the course, the students will be asked to make a small thesis. The thesis arguments will be decided during the lectures.
The final exam will consist in an oral interview and a presentation of their thesis.
The final marks will depend on:
- Oral Interview marks
- Active involvement in the laboratory experiencies
- Thesis Quality
- Ability of the student to report about the achieved results during the final presentation

TEXTS

Molecular Electronics From Principles to Practice
Michael C. Petty
John Wiley and Sons LTD
ISBN: 978-0-470-01307-6

Organic Field Effect Transistors
Theory, Fabrication and Characterization
Ioannis Kymissis
Springer
ISBN 978-1-4419-4711-6

Slides of the lectures

MORE INFORMATION

During the semester the student will be provided with some of the most recent works publishe in international journals on the research activities related with the course topics
Moreover, the students will be provided with all the slides shown during the lectures

IA/0153/EN - DATA ACQUISITION TECHNOLOGIES

Academic Year 2021/2022

Professor PAOLO ATTILIO PEGORARO (Tit.)
PAOLO CASTELLO
Period First Semester
Teaching style Convenzionale
Lingua Insegnamento INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[70/83] ELECTRONIC ENGINEERING	[83/25 - Ord. 2018] ELECTRONIC TECHNOLOGIES FOR EMERGING APPLICATIONS	6	60

OBJECTIVES

The course Data Acquisition Technologies is designed to provide second year students of the Laurea Magistrale Degree in Electronic Engineering with a deeper understanding of technologies for measurement, with particular attention to acquisition, synchronization and remote instrument control technologies, and to complex measurement system design.
The Course aims at providing a high-level knowledge of hardware and protocols for designing and running acquisition and measurement systems of industrial level.
In details, the aims can be presented by the following five descriptors:
- Knowledge and understanding
Deep knowledge and understanding of theoretical and applicative topics in the field of technology for measurements. Knowledge of devices, hardware and protocols to design and implement an up-to-date and maintainable measurement system.
- Applying knowledge and understanding
Ability to design, implement and manage measurement systems, by choosing devices that are the most appropriate both from a technical and economical point of view. Ability to integrate instruments and devices of industrial level.

- Making informed judgements and choices:
Ability to evaluate results, select relevant information and suitable approximations to realize measurement systems. The student must test their capability to perform design choices and justify them.
-Communication skills
Capability to communicate technical information both orally and in writing. Ability to present and justify design choices. Ability to discuss problems and solutions with specialists and non-specialists. Ability to be either concise or accurate depending on the specific context.
-Continuous learning skills
Capability of continuous learning, through the proper interpretation of scientific and technical literature, manuals of manufacturers and technical standards.

PREREQUISITES

The prerequisites are those indicated in the regulations of the "Laurea Magistrale in Ingegenria Elettronica" for admission to the first year.
Basic knowledge of electronics and conventional instrumentation for electrical quantities.
Knowledge of the advanced measuring methods and uncertainty evaluation and propagation.

CONTENTS

-Introduction(2 hours -lessons)
Course presentation (expected skills, examination guidelines, reference materials).
Data acquisition systems: concepts.

-Measurements in industrial environment (8 hours - lessons)
Sensor characteristics and specifications
Working principles of most important industrial sensors and transducers.
Hall effect sensors
Wheatstone bridge for resistance measurement.
Temperature sensors (thermocouples, RTDs, thermistors, IC sensors) and corresponding conditioning systems.

-Synchronization problems and methods (10 hours - lessons)
Timescale principles.

Synchronization signals.
Short distance synchronization protocols.
Synchronization based on satellite systems.
Packet network based synchronization systems.
Latency measurements.

-Remote control of measurement devices (6 hours – lessons)
Distributed measurement systems and large-scale architectures.
Communication systems, serial and parallel buses.
Main standards for interfacing measurement instrumentation.

-Data acquisition systems: architectures (14 ore - lessons)
Review of data acquisition systems with analog and digital I/O.
Modular instrumentation.
Rack-based instrumentation.
Systems for real-time measurement.
Data acquisition on single-board computers.
Automated test systems.

-Measurement Technologies - Laboratory (20 hours - laboratory)
Review of LabVIEW environment.
Laboratory experience on data acquisition and elaboration with modular and general purpose devices.
Development of Virtual Instruments (VIs) and SubVIs for data acquisition.
Data acquisition in real-time systems.
Data acquisition in FPGA-base systems.
Acquisition from temperature and magnetic field sensors.
Laboratory experiences for serial and parallel communication among instruments.
Programs and prototypes for synchronized measurements.
Ph.D students' and/or industry people's lectures.

TEACHING METHODS

The course is composed of 40 hours of theory lessons and 20 hours of practice, for a total of 60 hours. During the theory lessons, the teacher sets out the topics in the program; whereas during the practice sessions, students, working in small groups under the supervision of

the teacher, learn how to use different technologies, to design and implement acquisition and measurement systems for specific applications.

VERIFICATION OF LEARNING

The examinations are carried out by oral exam aimed at discussing course topics. Linked laboratory experiences are discussed and at verifying the preparation of the student in other topics included in the course.
The final mark to pass the exam ranges from 18/30 to 30/30. The evaluation rewards students autonomy and capability to rethink the theoretical lessons in applications, communicate clearly relevant characteristics and highlight possible issues.
In this regard, the questions of the oral are organized to highlight the following aspects:
- Acquired knowledge of theoretical topics
- The applied knowledge and understanding, with particular attention to practical cases
- The capacity to choose among different technologies depending on needs and requirements of a real acquisition and measurement system.

TEXTS

Teaching material provided during the course (slides, lesson notes, manuals, etc.).
This is the reference material covering all the topics and aspects.

Other textbooks for support:
Keithley Instruments: Data acquisition and control handbook, 2001. (Measurements in industrial environment and Data acquisition systems)

MORE INFORMATION

The teacher provides the slides used for the presentation of lessons in electronic format.
Datasheets of measurement devices and international standards are also presented and discussed.

SM/0096/EN - GEOMETRIC ALGORITHMS AND SPATIAL DATA STRUCTURES

Academic Year 2021/2022

Professor RICCARDO SCATENI (Tit.)
Period First Semester
Teaching style Convenzionale
Lingua Insegnamento INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[60/73] INFORMATICS	[73/00 - Ord. 2017] PERCORSO COMUNE	9	72

OBJECTIVES

Knowledge and understanding:

• Know the main algorithms used to solve problems modeled using simple tools of Euclidean geometry in the plane and space
• Know what they are and how to use the data structures for the description of geometric entities in the plane and space
• Understand the classification of the paradigms that guide the design of algorithms (geometric and not) by distinguishing the various types of algorithms used

Applying knowledge and understanding:

• Being able to make an accurate empirical evaluation of computational complexity (both in time and in space) of the algorithms studied
• Design and implement an interactive application based on one of the algorithms seen during the course
• Use, in an advanced way, software development tools based on the C++ language

Making judgments

• Develop independently, concerning the design and implementation choices, the final project from the specifications provided

Communication skills

• Understand, summarize and expose a scientific text, written in English, treating in-depth one of the topics covered during the course

Learning skills

• Use multiple sources to solve the exercises assigned as homework

PREREQUISITES

It is essential to have basic knowledge of:

Geometry (plane and space)
Calculus
Linear algebra (vectors and matrices man)

Courses of the first tier program in Informatics partially treating the basic knowledge required are:
Matematica discreta (Discrete Mathematics)
Algoritmi e strutture dati (Algorithms and Data Structures)

CONTENTS

Numbers in brackets refer to chapters and sections of the textbook:

• Convex hull [1]
• Line intersection [2]
• Polygons triangulation [3]
• Geometric search [5]
• Point map problem [6]
• Voronoi diagrams [7]
• Delaunay triangulation [8.{1-3}]
• Other geometric data structures [10]
• Quadtrees [14]
• 3D convex hull [11]

TEACHING METHODS

56 hours of lectures, 16 hours of an interactive and cooperative design of algorithms (interlaced during the course).

VERIFICATION OF LEARNING

Four tasks contribute to the final vote:

One written test in the class where the student should apply known algorithms to sets of data given as input
Two written homework where the student should develop algorithms similar to the ones seen during the lectures
One final-term project which will implement a known algorithm using known data structures
or, as an alternative
One seminar presenting the contents of a scientific paper and the written report describing the content of the paper

The first three written tasks and the project contribute, each, for 25% of the final grade. They are marked from 0 to more than 30.

The seminar and the report, marked from 0 to 30, contribute 25% together to the final grade.

Homework will be back no earlier than two weeks after the assignment. Returning the homework beyond the deadline results in a penalty of 2 points on its mark.

The project should be returned by May 31st. After the deadline, there will be a 1 point penalty on the mark for every month of delay, up to 5 points maximum.

It is not mandatory to take all the tests to pass the exam. When the weighted sum of the votes exceeds the score of 18, the student can ask to verbalize the exam.

All tests can be rescheduled in different ways for health needs.

TEXTS

de Berg, van Kreveld, Overmars, Schwarzkopf
"Computational Geometry, Algorithms and Applications"
Third edition (March 2008)
Springer

For further reading:
Samet
"Foundations of Multidimensional and Metric Data Structures"
Morgan Kaufman (2006)

MORE INFORMATION

The students have the availability of papers of geometry processing, which are the subjects of their seminars.

SM/0124/EN - BIG DATA

Academic Year 2021/2022

Professor DIEGO ANGELO GAETANO REFORGIATO RECUPERO (Tit.)
Period First Semester
Teaching style Convenzionale
Lingua Insegnamento INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[60/73] INFORMATICS	[73/00 - Ord. 2017] PERCORSO COMUNE	6	48

OBJECTIVES

KNOWLEDGE AND UNDERSTANDING: The course aims at teaching the student the foundations of the architectures for the analysis and management of big data and build a solid foundation for understanding their problems and the implementation of software exploiting these methodologies. The project delivered will focus on resolution via software and using big data architectures and frameworks on a research or industrial problem. The student will act autonomously through personal accounts on Amazon AWS instances and will be able to integrate the appropriate technologies with the big data methodologies and to solve certain tasks by using machine learning where necessary.

Examples of integration of various information technologies with the Apache Spark and Hadoop frameworks will be shown in class. Final seminars on various application domains will show students the problems and best practices of real problems.

APPLICATION CAPACITIES: the student must be able to use the proposed big data frameworks and use the programming languages (Python, Java, Scala) to work with them and the supporting libraries (eg MLlib library for solving machine learning problems). An account on Amazon AWS (with free credits) will have to be created to work on the project and the Amazon dashboard will be used to admin the generated instances and the account. Tools such as AWS CLI, FlinTrock, Terraform, Serverless will be employed for the automatic management of the instances of a cluster (used and developed software). Amazon Free tier allows working on the assigned project. The student will be able to carry out the design and development activities of complex problems related to the big data world.

JUDGMENT AUTONOMY: the course aims to stimulate students by proposing exercises, and problems to be solved by implementing them with the frameworks shown to autonomously judge their work. Skills developed concern the students' understanding of the big data problem and its analysis, development, and solution. Playing with the number of Amazon instances, students will be able to analyze how

the computational load decreases by increasing the number of nodes and vice-versa.

ABILITY IN COMMUNICATION: the student must be able to express with appropriate terminology the fundamental concepts of big data, machine learning, the concepts of map-reduce, Amazon AWS, HDFS, and the software that is produced for the management of big data.

A final report will be given to the professor and must be well organized and easy to read. It will include a link to a software repository with instructions on how to install and execute the project.

ABILITY TO LEARN: the student will be able to learn some fundamental concepts of the use of big data and machine learning frameworks to understand the difference between software written for the management of a large amounts of data with and without the use of big architectures date and recognize machine learning tasks. He/she will also be able to manage a cluster of Amazon nodes with installed big data and machine learning solutions. Amazon includes several tools for the management of Big Data that students can use within their projects (e.g., Amazon EC2, Amazon Athena, Amazon EMR, Amazon S3, AWS Lambda, Amazon ElasticSearch, etc.).

EXPECTED SKILLS: General and solid understanding of the fundamentals and application aspects related to the world of big data. Knowledge of big data programming using Apache Hadoop, Apache Spark. Management of clusters of Amazon instances and related management with tools such as AWS CLI, FlinTrock, Terraform, Serverless. Analysis of big data problems and how to tackle them using technologies implementing map-reduce philosophy.

PREREQUISITES

Knowledge of the Java language, Python (Scala optional). Knowledge of programming. Knowledge of the Linux shell, and its main commands. Knowledge of the English language (B1 level).

CONTENTS

1. Architecture of Big Data systems
   2. Definition of Big Data
   3. Introduction to the Hadoop framework
   4. Use of the HDFS filesystem
   5. Concept of MapReduce
   12 hours

   6. Introduction to the Spark framework SPARK
   7. Programming with RDDs
   8. Use of key/value pairs
   10 hours

   9. Loading and Saving data
   10. Advanced Programming with Spark
   11. Execution on a cluster
   12. Tuning and Debugging with SPARK
   8 hours

   13. SPARK SQL and GraphX
   14. Streaming with SPARK
   15. Fundaments of Machine and Deep Learning
   16. Machine learning with MlLib
   8 hours

   17. Amazon AWS and configuration
   8 hours

TEACHING METHODS

Lectures in class

Forum created on Moodle for questions, insights, solutions of exercises and software programs.

Facebook group and Telegram for further comments, and communications.

Further possibility to contact the teacher via email and Skype and get immediate answers.

Using repositories on GitHub to load your project and source code.

Lectures in class: 28 hours
Practices: 18 hours

VERIFICATION OF LEARNING

- Exercises and examples during the course

- Use of Mentimeter to maintain constant and high interaction with students.

- Development of small software tasks directly on the servers and immediate debugging and analysis of the results.

- Project assigned to small groups on a problem that uses large data. The project will be agreed with the teacher. Once developed and tested on the servers available, a scientific description of the whole method created together with results, experiences and comments will be given to the teacher. A repository on GitHub will contain the project with a readme file that will help the user to install and execute the project. The descriptions will sometimes be extended to Workshop or Journal jobs by the teacher and sent to International Workshops or Conferences or Journals. The score will depending on the size of the project and how many students will be part of it, one vote will be agreed. It will depend on the computational efficiency of the developed program related to the degree of the adopted parallelism and of the obtained precision using such a parallelism.

- Oral verification on the essential concepts of big data and the frameworks seen during the course and discussion of the project.

- The software created for the project, and its written and oral description will give an overall mark in 30.

The following indicates a classification of the final scores for the subject:
18-20: students know how to use some big data technologies for the management of simple tasks without optimization

20-22: students know how to use some big data technologies for the resolution of simple tasks with a basic level optimization

22-24: students know how to use some big data technologies to solve simple tasks with medium level optimization

24-26: students know how to use some big data technologies for the resolution of simple tasks with an advanced level optimization

26-28: students know how to use different big data technologies for the resolution of easy and difficult tasks by exploiting advanced optimization and innovative cloud platforms for the execution of the code.

28-30 cum laude: students know how to use different big data technologies to solve research problems that require advanced optimization of operations with data and using innovative cloud platforms for the execution of the code.

TEXTS

Learning Spark, Lightining-Fast Data Analysis. O'Reilly. Holden Karau, Andy Konwinski, Patrick Wendell & Matei Zaharia

- Hadoop with Python. O'Reilly. Zachary Radtka & Donald Miner

On the professor's website

(https://unica.it/unica/it/ateneo_s07_ss01.page?contentId=SHD30988) the slides shown during the course (both theoretical lessons and exercises) will be shown. They contain pointers to web pages where additional notes will be shown.

MORE INFORMATION

Use of slides, videos, and Internet pages during the lessons both for theoretical lessons and for exercises. Use of a Telegram group and possibly Moodle to post exercises, answer students' questions and create discussions on specific topics.

Lectures: 50%
Tutorials: 50%

SM/0163/EN - DEEP LEARNING AND APPLICATIONS

Academic Year 2021/2022

Professor GIOVANNI PUGLISI (Tit.)
DIEGO ANGELO GAETANO REFORGIATO RECUPERO

Period Annual

Teaching style Convenzionale

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[60/73] INFORMATICS	[73/00 - Ord. 2017] PERCORSO COMUNE	6	48

OBJECTIVES

KNOWLEDGE AND UNDERSTANDING: The course aims at teaching the student the foundations of machine learning and the evolutions to deep learning technologies, the problems that may be solved using them, the feature engineering process that needs to be performed when solving a classification or regression task. The project delivered (in English) will focus on the resolution via software and using deep learning technologies and frameworks on a research or industrial problem. The student will act autonomously through either personal accounts on dedicated servers managed by the professor or on personal pc and will be able to integrate the appropriate technologies with the deep learning methodologies and to solve certain forecast tasks. Examples of integration of various information technologies with the Keras and Tensorflow frameworks or through the use of NVidia's CUDA architecture for GPUs will be shown in class. Final seminars on various application domains (Semantic Web, Natural Language Processing, Sentiment Analysis, Text Classification, etc.) will show the problems and best practices of real problems.

APPLICATION CAPACITIES: the student must be able to use the proposed frameworks and use the Python programming language to work with them and the supporting libraries (e.g. TensorFlow and Keras to define neural networks for solving a machine learning problem). The student will be able to carry out design and development activities of complex

problems tackled with deep learning technologies. Moreover, through Google Colaboratory, each student will be able to use GPUs freely provided by Google remotely.

JUDGMENT AUTONOMY: the course aims to stimulate students by proposing exercises, and problems to be solved by implementing them with the frameworks shown to autonomously judge their work. Baseline methods will be provided to compare and measures the quality performances of students' solutions. Developed skills concern the students' understanding of the deep learning problems and its analysis, development and solution.

ABILITY IN COMMUNICATION: the student must be able to express with appropriate terminology the fundamental concepts of deep learning, machine learning, and the software that is developed. A final report in English will be given to the professor and must be well organized and easy to read. It will have to contain a link to a software repository with ReadMe file for instructions on how to run the software and what it does. There is the opportunity to extend their work to be published in research papers.

ABILITY TO LEARN: the student will be able to learn some fundamental concepts of the use of deep learning technologies, concepts and frameworks. He/she will be able to tackle a forecast problem by identifying the features to extract from the data in order to define a model and train the neural networks. Using either Colaboratory or other local GPUs, he/she will be able to speed up his/her computation.

EXPECTED SKILLS: General and solid understanding of the fundamentals and application aspects related to the world of deep learning technologies. Knowledge of CUDA, TensorFlow, Keras, Colaboratory, Python language and best practices related to the machine learning domain (features extraction, features engineering, training, testing, precision/recall analysis). Students will learn deep learning technologies

focused on applications to Image Processing, Computer Vision, Natural Language Processing and Semantic Web.

PREREQUISITES

Data mining
Programming skills (Python, Matlab)

CONTENTS

Foundations:
What is Deep Learning and why?
Training, Validation and Test sets
K-cross validation
Data Preprocessing for Neural Networks
Feature Engineering
Overfitting and underfitting
Getting started with Neural Networks
Data representations for Neural Networks
Anatomy of a Neural Network
Advanced Deep-learning Best Practices
6 hours

Deep Learning for Computer Vision:
Convolutional Neural Networks
ConvNet Layers (Convolutional Layer, Pooling Layer, Fully-Connected Layer)
ConvNet Architectures (LeNet / AlexNet / GoogLeNet / VGGNet, ResNet)
Training Neural Networks for Computer Vision
Activation functions, initialization, dropout, batch normalization, update rules, ensembles, data augmentation, transfer learning
Image classification
Semantic segmentation
Object detection
18 hours

Deep Learning for Text and Sequences:
Working with Keras and TensorFlow

Working with Text Data
Understanding n-grams and bag-of-words
One-hot encoding of words and characters
Using Word Embeddings with the Embedding Layer
Creating Word Embeddings
Using Pretrained Word Embeddings
Understanding Recurrent Neural Networks
Understanding LSTM and GRU layers
A concrete LSTM example in Keras
Advanced use of Recurrent Neural Networks
A temperature-forecasting problem
Using recurrent dropout to fight overfitting
Stacking recurrent layers
Using bidirectional RNNs
Using mechanism with attention
A use case within the Sentiment Analysis domain
24 hours

TEACHING METHODS

Frontal lectures and exercises

VERIFICATION OF LEARNING

The final grade is computed as weighted average of:
- deployment of a computer vision project (1/2)
- deployment of a natural language processing or Semantic Web project (1/2)

The project must be agreed with the teacher.

The following indicates a classification of the final scores for the subject:
18-20: students know how to use some deep learning technologies for the management of simple tasks without achieving a significant improvement of accuracy with respect to classical machine learning methods

20-22: students know how to use some deep learning technologies for the resolution of advanced tasks without achieving a significant improvement of accuracy with respect to classical machine learning

methods

22-24: students know how to use some deep learning technologies to solve simple tasks achieving a small improvement of accuracy with respect to classical machine learning methods

24-26: students know how to use some deep learning technologies to solve simple tasks achieving a substantial improvement of accuracy with respect to classical machine learning methods

26-28: students know how to use some deep learning technologies to solve advanced tasks achieving a substantial improvement of accuracy with respect to classical machine learning methods

28-30 cum laude: students know how to use some deep learning technologies to solve advanced tasks achieving a substantial improvement of accuracy with respect to classical machine learning methods by using complex analysis and extensions of deep learning technologies

TEXTS

Francois Chollet, “Deep Learning with Python”, Manning Publications, 2017.

Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.

MORE INFORMATION

Slides, links, software repositories, and various teaching material will be provided along the course

SM/0172/EN - OPTOELECTTRONICS

Academic Year 2021/2022

Professor GIOVANNI LUIGI CARLO BONGIOVANNI (Tit.)
Period First Semester
Teaching style Convenzionale
Lingua Insegnamento INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[60/68] PHYSICS	[68/40 - Ord. 2020] FISICA MEDICA E APPLICATA	6	48
[60/68] PHYSICS	[68/50 - Ord. 2020] FISICA SPERIMENTALE DELLE INTERAZIONI FONDAMENTALI	6	48
[60/68] PHYSICS	[68/60 - Ord. 2020] FOTONICA E NANOMATERIALI	6	48
[60/68] PHYSICS	[68/70 - Ord. 2020] TEORIA, SIMULAZIONE E PROGETTAZIONE DI NUOVI MATERIALI	6	48

OBJECTIVES

The expected learning outcomes from the course of Photonics- defined accordingly to the general educational objectives of the “Laurea Magistrale” (Master’s Degree) in Physics- are:
1) (Knowledge and understanding). Knowledge and understanding of the basic physical properties of semiconductors and light-matter interaction: electronic states; light absorption and emission; statistics and thermodynamics of excited electronic states; electrical transport; conversion of light energy into electrical energy and viceversa.
2) (Applying knowledge and understanding). Adequate knowledge and comprehension of the working principles of solid-state optoelectronic devices: solar cells and light emitting diodes.
3) (Making judgment). Capability of providing a critical analysis of the complex photophysical phenomena occurring in different classes of semiconductors and optoelectronic devices.
4) (Communication skills). Capability of describing photophysical phenomena and working principles of optoelectronic devices both to a specialized and non-specialized audience through the use of a correct terminology.
5) (Learning skills). Physical, mathematical and experimental skills necessary to face- with a good degree of autonomy- advanced courses

(e.g., PhD studies) or to work in a laboratory of spectroscopy, photonics and optoelectronics.

PREREQUISITES

In order to successfully face the course of Photonics, an adequate knowledge of Electromagnetism and Quantum Mechanics is essential. Basic notions on Condensed Matter Physics, Thermodynamics and Statistics are important.

CONTENTS

Working principles of solar cells

-Solar cell 1. The photovoltaic effect. Conversion efficiency. Solar cell equivalent circuit. Solar spectrum, semiconductor bandgap and photoconversion efficiency. (J. Nelson, The physics of Solar Cells; chapt. 1, 2.1-3, 2.5.4, 2.6)

- Solar cell 2. Semiconductors. Distribution function of electrons. Density of states for electrons. Density of electrons. Holes. Doping. Quasi-Fermi distributions. Fermi energy and electrochemical potential. Work function. Generation of electrons and holes. Recombination of electrons and holes. Light emission by semiconductors. Transition rates and absorption coefficient. (The physics of Solar Cells, P. Würfel chapt. 3.1-3.7)

-Solar cells 3. Conversion of thermal energy into chemical energy. Maximum efficiency for the production of chemical energy. Conversion of chemical energy into electrical energy. Transport of electrons and holes. Separation of electrons and holes. Diffusion length of minority carriers. (The physics of Solar Cells, P. Würfel chapt. 4, 5.1-5.4)

-Solar cells 4. Basic structure of solar cells. Basic mechanisms in solar cells. The pn junction. Electrochemical equilibrium of electrons in a pn-junction in the dark. Potential distribution across a pn-junction. Current-voltage characteristic of a pn-junction. Heterojunctions. Semiconductor-metal contact. Limitations on Energy Conversion in Solar Cells. Tandem Cells. (The physics of Solar Cells, P. Würfel chapt. 6.2,6.4,6.6-6.8, 7.1-7.3,8.1)

Working principles of light emission diodes

-LED 1. Human eye sensitivity and photometric quantities. (Principles of solar cells, LEDs and Diodes, A. Kitai chapt. 3.9)
-LED 2. LED Operation and device structure. Emission spectrum. Non-radiative recombination. Optical Outcoupling. GaAs LEDs. GaAsP LEDs. Double heterojunction AlGaAs LEDs. AlGaInP LEDs. INGaN LEDs. (Principles of solar cells, LEDs and Diodes, A. Kitai chapt. 5.1-5.10)
-LED 3. Conjugated Systems. Polymer OLEDs. Small-molecule OLEDs. (Principles of solar cells, LEDs and Diodes, A. Kitai chapt. 6.1-6.4)

Lab experiments
-Spectroscopic characterization of LEDs and AMOLEDs.
-Optoelectronic characterization of single- and triple-junction photovoltaic cells.

TEACHING METHODS

Lectures will be prevalently held in classrooms, also integrated with online teaching resources, by using specific online platforms managed by the University of Cagliari. The course of Photonics is structured in 16 lectures (32 hours) and interactive lab experiments (16 hours). Demonstrative experiments are focussed on photophysical phenomena and characterization of the optoelectronic devices introduced and discussed in the Lectures.
- Interactive lectures. Combination of frontal and interactive didactics with the use of informatic tools and different hardware supports (conventional blackboard and slides).
- Cooperative problem solving. Recitation sections allow students to clarify subject matter that was either not fully understood or inadequately addressed in the limited time of lecture. In these sections, the class is organized in small groups, which solve the proposed problems cooperatively. The professor of the course discuss the proposed solutions with each group. The technique of cooperative problem solving allows students to confront each other, improving the student's ability to understand important concepts required to pass the course and to self-evaluate their own level of knowledge and understanding
- Homeworks. Every weak, student can solve specific exercises concerning the topics addressed during the class lectures.
- Additional help to students can be provided during the office hours,

namely two hours a weak during the lecture semester and by appointment otherwise.
- Further information can be exchanged also via the web site of the course (http://people.unica.it/giovannibongiovanni/) or via email.

VERIFICATION OF LEARNING

The examination consists in a oral test, a written report on lab Experiments, and the resolutions of the problems assigned during the teaching semester. The three typologies of exam will allow to verify theoretical knowledge, applying knowledge and understanding, oral and written communication skills, capability of gathering and interpreting experimental data.
The (i) oral exam and the (ii) reports on Lab experiments contribute with a maximum score of 12 (i) and 6 (ii) points, respectively. (iii) Resolution of homework exercises provides 12 additional points. The finale mark is the sum of the scores obtained in the three tests [(i+ii+iii)/30]. The exam is rated with the final mark 30/30 cum laude if the total score is >= 32/30.

TEXTS

-The physics of Solar Cells, P. Würfel
-The physics of Solar Cells. J. Nelson.
-Principles of solar cells, LEDs and Diodes, A. Kitai

MORE INFORMATION

Slides, exercises, self-assessment questionnaire and additional info available at:
1-http://people.unica.it/giovannibongiovanni
2-https://unicadrsi-my.sharepoint.com/:f:/g/personal/giovannilc_bongiovan_unica_it/Esm_LGy1GQZOgVYgFUQkhGcB8M5366Tpevl0TGyRQjPlzA?e=wvxfqw

Useful information on Specific Impediments to Learning is available at http://corsi.unica.it/fisica/info-dsa/