32/16/037 - ANGLO-AMERICAN LANGUAGE AND LITERATURES

Academic Year 2021/2022

Free text for the University

Professor

FIORENZO IULIANO (Tit.)

Period

Second Semester

Teaching style

Convenzionale

Lingua Insegnamento

INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[32/16] TEXTS TRANSLATION	[16/00 - Ord. 2008] PERCORSO COMUNE	6	30

Objectives

MODULE A

- Knowledge and understanding

The module will focus on the coming-of-age novel within the literary history of the United States in the first half of the twentieth century.

- Applying knowledge and understanding

Students will be encouraged to analyze the texts in the syllabus, identify their formal and structural features, and critically discuss any passage.

- Making judgments

Students will be encouraged to identify and critically discuss the connections between the texts in the syllabus and the historical and cultural context of the

United States in the Twentieth century.

- Communication

Students will be encouraged to acquire the theoretical and methodological tools of literary criticism and textual analysis.

- Lifelong learning skills

Students will be also encouraged to critically analyze each text, and broaden up their reading of the texts in the syllabus other critical and historical discourses.

MODULE B

- Knowledge and understanding

The module will focus on the coming-of-age novel within the literary history of the United States in the second half of the Twentieth century.

- Applying knowledge and understanding

Students will be encouraged to analyze the novels, identify their formal and structural features, and critically discuss any passage with the support of supplementary readings.

- Making judgments

Students will be encouraged to critically discuss the novels on the syllabus.

- Communication

Students will be encouraged to acquire the theoretical and methodological tools of literary criticism and textual analysis.

- Lifelong learning skills

Students will be also encouraged to critically analyze the novels, and broaden up their reading of the text in the syllabus other critical and historical discourses.

Prerequisites

An upper-intermediate command of the English language is mandatory, in order to actively participate in class discussions and critically read the proposed texts.
A basic knowledge of the literary history of the United States, and of the methodological tools of textual analysis is also desirable.

Contents

MODULE A: The coming-of-age novel and American identity.
This module will address the genre of the coming-of-age novel in the literary and cultural context of the early twentieth-century United States.

MODULO B: The coming-of-age novel and the crisis of national identity.
This module will focus on the coming-of-age novel as a means of investigating and questioning national identity in late twentieth-century America.

Teaching Methods

Classes will be two hours each and will be taught in English. Typical classes are structured as follows:
1. introduction to the general topic
2. survey of the theoretical texts and/or historical issues that will come up during the analysis and discussion of the primary texts
3. reading of a limited number of passages from the text
4. analysis and debate of the passages read

Verification of learning

The final grade of students will be based on the following criteria:
1. attendance and participation to class activities
2. final exam
Participation to class activities will favorably contribute to the final grade. All students will have to take the final written exam, which will assess their knowledge of the texts and their capacity to critically engage the texts within a historical and literary framework. This will form the basis for evaluation and grading:
1. attendance and participation: 10%
2. knowledge of the historical and social background of each text: 25%
3. knowledge of the texts (ability to read and understand each text; ability to

contextualize a given passage from the text): 35%
4. critical analysis of the texts: 30%

Texts

TBA

More Information

The students who need 12 CFU will take both modules; those who only need 6 CFU will choose either Module A or Module B.

Students are asked to provide a close reading of each text, examine the significance of a text's literary conventions, and/or draw connections between a text and other texts on the syllabus. A critical response does not simply summarize the text or the lectures given in class.

Students interested in American studies are encouraged to take the course in History and Institutions of the USA.

32/19/041 - ENGLISH LANGUAGE TRANSLATION 1

Academic Year 2021/2022

Free text for the University

Professor

OLGA DENTI (Tit.)

Period

Second Semester

Teaching style

Convenzionale

Lingua Insegnamento

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[32/19] LANGUAGES AND CULTURES FOR LINGUISTIC MEDIATION	[19/00 - Ord. 2011] PERCORSO COMUNE	9	54

Objectives

The students will:
- achieve a good knowledge of Translation Theories and good skills needed to analyse language functions and interpret different text types and genres;
- learn to apply translation methodologies and discuss their own choices;
- learn to translate diverse genres and text types.

KNOWLEDGE AND UNDERSTANDING

The students will have to achieve a good knowledge and competence of Translation Theories, of diverse specialised discourse types of the English

language, of the English culture, of translation studies and strategies.

From the metalinguistic viewpoint, the students will acquire good skills on Functional Linguistics to be able to approach and analyse a text in the best possible way, interpret it and apply the most appropriate translation strategy.

APPLYING KNOWLEDGE AND UNDERSTANDING

The students will be able to understand and describe the metalinguistic features studied during the course and apply them to textual analysis and to the translation process.
More specifically, within the B1/B2 level of English, according to the CEFR, they will be able to analyse a text in English, understand its linguistic features, especially the intralinguistic ones, identify and solve intralinguistic issues and translate in the most appropriate way. They will be able to use standard techniques and tools; to apply their competences to identify solutions, to justify, support and argue their choices.

MAKING JUDGEMENTS
The students will distinguish, among the theories studied, the most suitable ones to analyse texts, evaluate contexts and choose the most effective communicative and translation strategies.

COMMUNICATION SKILLS
The students will:
- understand texts and conversations in English;
- effectively and efficiently translate information and ideas (at the B1/B2 level).
- communicate information in an efficient and effective way, as well as discuss problems and solutions.

LEARNING SKILLS

The students will acquire those tools which will enable them to autonomously study and increase their linguistic and metalinguistic skills in the English language and culture, and in the translating process.
They will acquire learning skills needed to continuously update and improve, to undertake graduate studies, such as Master's courses.

Prerequisites

English Language 1 / B1 level of the Common European Framework of Reference for Languages: Independent Users “Can understand the main points of clear standard input on familiar matters regularly encountered in work, school, leisure, etc. Can deal with most situations likely to arise whilst travelling in an area where the language is spoken. Can produce simple connected text on topics which are familiar or of personal interest. Can describe experiences and events, dreams, hopes and ambitions and briefly give reasons and explanations for opinions and plans.”

Contents

This is a 54-hour course of the B1/B2 level of the Common European Framework of Reference for Languages.
It will be divided into two parts: a theoretical part and a practical one.
The THEORETICAL PART focuses on the study of the following topics about Translation: Language functions, Context & Culture, Stylistics, Phonology and Graphology, Discourse & Text, Grammar, Vocabulary & Textuality, Semantics (Speech Function, Theme and Rheme, Cohesion and Coherence), Translation strategies.
The PRACTICAL PART involves a better understanding of the translation process, its application to diverse text types, and the development of a translation project involving the whole class.
Practice hours on the translation of diverse textual types.
A new project will be carried out on the translation of a specific text type.

Teaching Methods

The THEORETICAL PART will include lessons and seminaries. Mid-term assessments will be organized.
The PRACTICAL PART will require teamwork. The students, aided by the professor, will apply translation techniques and carry out a class project.
Practice hours on the translation of diverse textual types.
The lessons will mainly take place at the university, integrated and improved through online strategies, in order to guarantee an innovative and inclusive teaching/learning.

Verification of learning

The final exam consists of a WRITTEN EXAM aiming at assessing both the students' acquisition of Translation Theories and practice.
The students will be asked to answer four open questions on the theoretical part of the course. Afterwards, they will have to analyse and translate a short text, and comment their translation choices.
For those students who will regularly attend the lectures (70% of the total hours), the final mark will be made up of mid-term assessments as well, and of the practical work carried out in class, which will be evaluated.
The mid-term assessment will focus on the theoretical part and will consist of the four open questions. The students who pass it will be exempted from this part in the final exam.

FINAL ASSESSMENT:
The theory and the text analysis have a total evaluation of 25 points, then converted into a mark out of 30. The translation has a final mark out of 30, together with the translation comment. The final mark is an average of the two.
The students passing the mid-term assessment will be exempted from answering the open question part and its mark will be part of the final mark.
Written exams in presence might be replaced by other modes of evaluation:

individual or team works/essays, oral exams, written exams via online platforms (Moodle, Teams, etc.). Mid-term assessments might be suspended.

Texts

1. Ulrich, M. 1992. Translating Texts. From Theory to Practice. Rapallo: CIDEB Editrice.
2. Diadori, P. 2012. Teoria e tecnica della traduzione. Strategie, testi e contesti, Milano, Le Monnier Università. Excerpts: 2.1 'traduzione e tipologie testuali'; 2,3 'la traduzione del testo narrativo'; 2.9 'la traduzione del testo settoriale'; 2.10 'la traduzione del testo in Rete'; 3.3 'Gli strumenti'

Optional readings:
3. Munday, J. 2001. Introducing Translation Studies. Theories and applications. London & New York: Routledge. EXcerpts
4. Munday, J. (ed.). 2009. The Routledge Companion to Translation Studies. Revised Edition. London & New York: Routledge. EXcerpts
5. Hatim, B., Mason, I. 1990. Discourse and the translator. London and New York: Longman. Excerpts
6. Baker, M. 2011. In Other Words. A coursebook on translation. London & New York: Routledge. Excerpts

More Information

Students are required to download the files from the professor's official webpage: people.unica.it/olgadenti/

4932 - INTERNATIONAL MARKETING

Academic Year 2021/2022

Professor FRANCESCA CABIDDU (Tit.)
Period Second 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 goal of the course is to provide students with a general understanding of the various topics facing international and global marketers and to provide them with the analytical tools necessary to become successful international marketers. In the first three-quarters of the course, students will learn the theoretical concepts that they will then use to analyze actual cases at the end of the course.
A) KNOWLEDGE AND UNDERSTANDING
A1. Provide an understanding of the scope and function of international marketing theory and practice
A2. Increase the knowledge and skills to help in developing international market entry strategies.
A3. Develop skills related to the analysis of international marketing data, in particular, the use of secondary data in assessing the international marketing opportunities
(B) APPLYING KNOWLEDGE AND UNDERSTANDING
B1. Be able to develop a comprehensive course of action for an international business firm using formal decision-making processes;
B2. Be able to complete a final written project using skills acquired throughout the course;
B3. Be able to apply personal and interpersonal skills appropriate to being an effective member of an international marketing team.

C) MAKING JUDGEMENTS
C1. Be able to identify and research issues in business situations, analyze the issues, and propose appropriate and well-justified solutions
D) COMMUNICATION SKILLS
D1. Prepare written documents that are clear and concise, using appropriate style and presentation for the intended audience, purpose and context
D2. Prepare and deliver oral presentations that are clear, focused, well-structured, and delivered in a professional manner.
E) LEARNING SKILLS
E1. Self-manage the development of learning and study skills, both individually and as part of a collaborative learning group.

PREREQUISITES

Familiarity with the general topic related to marketing, with a special focus on market segmentation and marketing mix.

CONTENTS

After an initial sketch of globalization of markets and competition, we look in detail at the economic and cultural environment in which international and global marketers operate. The course then discusses global marketing research, global segmentation and positioning, global marketing strategies and market entry strategies available to global marketers. We will also take a closer look at the elements of the global marketing mix: product, price, distribution, and marketing communications. We will also deal with the issues that make planning and managing the marketing mix in an international context such a challenge, including finding a balance between standardization and adaptation of the marketing mix across borders. Towards the end of the course, students will be divided into a number of groups that will take turns to present and discuss a number of selected international marketing cases that illustrate how companies concretely face and deal with the theoretical concepts that have been introduced throughout the course.

The main topics will be:
1. Globalization imperative
2. Global Cultural Environment and Buying Behavior
3. Political and Legal Environment
4. Global Marketing Research
5. Global Segmentation and Positioning
6. Global Marketing Strategies
7. Global Market Entry Strategies
8. Developing New Products for Global Markets
9. Marketing Products and Services
10. Global Communication Strategies

TEACHING METHODS

Teaching methods include face-to face and online interactive case studies, directed reading, visiting speakers, lectures, interaction with managers, problem-solving activities and private/guided study.

VERIFICATION OF LEARNING

The evaluation criteria for attending students are as follows:
1. 10% Class Participation (discussion questions, verbal comments, case discussion)
2. 30% Written exam (three open questions based on chapter 1, 4, 5, 6-7)
3. 60% Final Project (Group project report)

The course assessment for non-attending students is the following:
100 % Final written exam with five open questions (2 hours) based on chapters 1,4,5,6, 7, 8, 9, 10, 11, 12, and 13 of the textbook.
- 3 open questions investigate the knowledge acquired
- 2 open questions investigate the students capabilities to apply the acquired knowledge
- 1 case analysis to investigate the students argumentative and judgmental capabilities to interpret and analyze real problems in international marketing management.

Evaluations may be subject to changes following the emergency from COVID-19. In this case, the exam will be conducted orally on the TEAMS

platform. The learning evaluation criteria are the same for the written exam. Specific and detailed indications will be shared by the teacher, also taking into account the indications that will be shared by the University.

Here are the considerations I use in evaluating class participation:
Meaningful contribution to class discussions.
Preparation.
Enhancement of classroom learning environment beyond specifically dictated preparation.
Attendance and punctuality
Polite and professional interaction with me, guests, and classmates.

Assessment logic:
To achieve a maximum score (30/30) the student must show to have acquired an excellent knowledge of all the topics covered during the course. In particular, they should have a comprehensive view on international marketing entry, international cultural and behaviors.
To pass the exam (18/30), the student must demonstrate that they have acquired sufficient knowledge of the basic topics covered during the course.

TEXTS

Masaaki Kotabe and Kristiaan Helsen, Global Marketing Management, 7th edition International Student Version. Wiley, 2017

MORE INFORMATION

Lecture slides, articles, and links to helpful resources will be posted to the course website.

BF/0013/EN - REGIONAL GEOLOGY

Academic Year 2021/2022

Free text for the University

Professor

LUCA GIACOMO COSTAMAGNA (Tit.)

Period

Second Semester

Teaching style

Convenzionale

Lingua Insegnamento

INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[60/77] PRESERVATION AND MANAGEMENT OF NATURAL RESOURCES AND THE ENVIRONMENT	[77/00 - Ord. 2021] PERCORSO COMUNE	6	56

Objectives

Learning a correct methodological approach to regional geology and sedimentology for the reconstruction of sedimentary basins as a guide for the research of the georesources.
Consolidation, practical visualization, and use, through field examples, of the basic sedimentological-stratigraphical principles and of the main geodynamic categories for their use in the field for wide-range reconstructions.
Concrete example of the basic concepts and theoretical processes of geology through the stratigraphic, sedimentological, and structural reconstruction of the geological history of SW Europe and Sardinia in the Mediterranean area.
Knowledge of the great lineaments and units of the geology of the different

regions of the globe, focused on SW Europe. More particularly, knowledge of the geological structure and geodynamic evolution of Sardinia in the context of the western Mediterranean and European area. Ability to read European geological maps, with particular regard to the "Geological map of Sardinia" at a scale of 1: 200,000.

Prerequisites

Basic Geology classes

Contents

Definition of regional geology: reconstructing in the field the great sedimentary basins of the past. Applications, aims and methods of regional geology.
The SW Europe and the Sardinian-Corsican block. The Sardinian-Corsican block as a cornerstone and a fundamental crossroads for the reconstruction of the history of SW Europe. Geological map of Sardinia in 1: 200,000 scale: first approach.
Basic recalls of sedimentology and stratigraphy. Main types of sediments, main depositional environments and their relationships. Stratigraphic principles and Walther's law. The stratigraphic-depositional units.
The great geodynamic-structural concepts. Orogenetic cycles, tectonic phases, tectonofacies, and (tectono)-sedimentary cycles. Wilson cycle.
Cadomian and Caledonian cycles. Cadomian and Caledonian cycles in SW Europe. Cadomian and Caledonian tectonic-sedimentary cycle in Sardinia: the different stratigraphic-depositional units and their paleoenvironmental and paleogeographic significance.
Variscan cycle. Variscan cycle in SW Europe. Variscan tectonic-sedimentary cycle in Sardinia: different stratigraphic units and their paleoenvironmental and paleogeographic significance; different structural units and metamorphic zoneography of the Variscan chain; extensional tectonics, collapse of the Variscan chain.
Permo-carboniferous and Triassic extensional sedimentary basins: tectonics and sedimentation. Post-variscan peneplanation in Sardinia. The Pangea. The Tethys.

The different Tethyan oceans during the Late Palaeozoic - Mesozoic period. Alpine tectonic-sedimentary cycle in Sardinia. History of the extended Iberian Plate and its subdivisions: paleoenvironmental, stratigraphic, and structural connections with the Sardinian-Corsican block. Triassic, Jurassic and Cretaceous carbonate platforms in Sardinia and SW Europe. The Middle Jurassic Eastern Sardinia-Corsica structural high. Palaeogenic sequences in Sardinia. Laramic to pyrenean tectonic phase in Sardinia. Sardinian rift. Oligo-Miocene volcanism. Miocene successions. Relations between the kinematics of the Alpine and Apennine orogeny and the Sardinian-Corsican block. Notes on the Alps and the Apennines. The Campidano graben. Sedimentation and Plio-Quaternary volcanism in Sardinia. Practical use of the 1: 200,000 Sardinia Geological Map.
Field trips in geological key areas of Sardinia.

Teaching Methods

In-presence lessons and practice classes in the lab on rock samples and on geological maps under the supervision of the teacher or the tutor, directed to the understanding of the terrestrial processes, of their representation on maps, and their space-temporal dimension; field trips lead by the teacher for showing in the field the concepts developed in the class; didactic tools: slides, blackboard, photocopies, didactic collection of rocks.
According to the needs (COVID), the teaching could be done entirely online.

Verification of learning

Learning check during the class. The final evaluation of the advancement will be obtained through an oral/practical exam for verification of the knowledge acquired during the classes. The oral/practical exam consists of some questions for verification of the preparation obtained through the exhaustivity of the answer, the presence of mistakes and/or imprecision, the language property. Samples of rocks and geological maps will be used to check the practical abilities learnt by the students. Vote assigned in thirtieths.

Texts

PARK, G. (2014): The making of Europe. Dunedin, 164 pp.
TORSVIK T.H. & COCKS R.M. (2017): Earth History and Palaeogeography. Cambridge, 322 pp.
GASPERI G. (1995): Geologia Regionale. Pitagora Editrice, Bologna, pp. 464.
BALLY A.W., CATALANO R. & OLDOW J.(1985): Elementi di tettonica regionale. Evoluzione dei bacini sedimentari e delle catene montuose. Pitagora Editrice, Bologna, pp.276.
CARMIGNANI L. et al. (2001): Geologia della Sardegna, Note Illustrative della Carta Geologica della Sardegna a scala 1:200.000. Mem. Descr. Carta Geologica d'Italia, Serv. Geol. It., 60, 283 pp., Ist. Poligr. Zecca dello Stato, Roma.
CARMIGNANI L. (Coordinatore) (1996): Carta Geologica della Sardegna (scala 1:200.000). A cura del Servizio Geologico Nazionale, Regione Autonoma Sardegna. Litografia Artistica Cartografica (L.A.C.), Firenze.
CARMIGNANI L. & ROSSI P. (Coordinatori) (2000): Carta Geologica e strutturale della Sardegna e della Corsica (scala 1:500.000). A cura del Servizio Geologico Nazionale, Regione Autonoma della Sardegna, BRGM, Service Géologique National, Collectivité

More Information

Teaching material available for the students at the end of the class. Ppts of the slides used during the classes and the lab activities. Collection of rock samples and geological maps.
The Cagliari University provides support for students with specific learning disability (SLD). More information can be found at:
http://corsi.unica.it/scienzegeologiche/info-dsa/

BF/0037/EN - MOLECULAR VIROLOGY

Academic Year 2021/2022

Free text for the University

Professor

ENZO TRAMONTANO (Tit.)

Period

Second 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	64

Objectives

The course aims to introduce the student to a thorough study of molecular mechanisms underlying the replication of eukaryotic viruses and of the host-pathogen interactions, by providing the tools for understanding the different strategy of infection of the main families of pathogenic viruses.
In particular, the course is aimed at the understanding of the biology of the major families of pathogenic viruses, as well as of cellular and molecular host defense mechanisms, of the pathogens' strategies for avoiding the host immune response, and of the current approaches for the control of infectious diseases.
In addition, the study of the biology of viruses provides the theoretical basis to gain methodological skills in the laboratory of virology. The course provides competences to grow cells in cultures, to evaluate the innate immune system

activation in gene-reporter assays, and to evaluate the ability of viral proteins to inhibit the innate immune system activation.

Prerequisites

Good knowledge of general microbiology, biochemistry and molecular biology

Contents

Module I - Molecular Virology (6 CFU)

Origin of viruses: coevolution, retrograde evolution, theory of evasion genes.
Structure and classification of viruses.
Methodologies to study viruses
The phases of the viral replication cycle:
- Adsorption and entry
- Synthesis of viral RNA from genomic RNA
- Synthesis of viral RNA from genomic DNA
- processing of viral pre-mRNA
- Retrotranscription and integration
- Deregulation of cell cycle by viruses
- Control of translation
- Intracellular trafficking of viral proteins
- Virion assembly and budding
- Antiviral drugs
- Molecular mechanisms of intrinsic and innate immunity
- Molecular mechanisms of adaptive immunity

Laboratory (12 hours): preparation and growth of monolayer cells in culture; luciferase gene reporter assay to evaluate the innate immune system activation (interferon production) by viral RNA; luciferase gene reporter assay to evaluate the ability of viral proteins to inhibit the production of interferon

Module II - Molecular Microbiology (6 CFU)

Vaccines

Epidemiology, transmission, replication cycle, prophylaxis and therapy of the following viral families:
- Retroviridae
- Flaviviridae
- Coronaviridae
- Orthomyxoviridae
- Paramyxoviridae
- Filoviridae
- Hepadnaviridae
- Herpesviridae
- Papillomaviridae
- Adenoviridae

Mechanism of pathogenicity of pathogenic bacteria:
- bacterial multiplication in vivo (colonization, penetration into deep tissues of the host, avoidance of constitutive or inducible antibacterial defenses).
- toxigenicity of bacteria (exotoxins that act at the cell surface, exotoxins that act by altering the intracellular content of cAMP, exotoxins which act by inhibiting cellular protein synthesis, exotoxin anthrax, toxins neurotrope, endotoxins).
Mechanism of action of current antibacterial drugs.
Molecular basis of bacterial single drug- and multidrug-resistance.

Epidemiology, transmission, replication cycle, virulence factors, prophylaxis and therapy of the following bacteria:
- Helicobacter pylori
- Mycobacterium tuberculosis
- Pathogenic E. coli

- Neisseria
- Clamidia
- Staphylococcus
- Streptococcus
- Rickettsia
- Chlostridium
- Bacteroides
- Corynebacterium
- Lysteria
- Bacillus
- Hemophilus
- Bordetella
- Legionella
- Coxiella
- Vibrio
- Campylobacter
- Spirochete.

Laboratory (12 hrs): seminars

Teaching Methods

Lectures, seminars, experimental experience in the laboratory.

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 interac 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

Principles of Virology, by S. J. Flint, L. W. Enquist, V. R. Racaniello, and A. M. Skalka. Washington (DC)
ASM Press.

BF/0038/EN - EVOLUTIONARY GENOMICS

Academic Year 2021/2022

Free text for the University

Professor

PAOLO FRANCALACCI (Tit.)

Period

Second 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	64

Objectives

In-depth knowledge of the structural and functional organization of the genome in eukaryotes at the molecular level and of the epigenetic mechanisms controlling gene expression. Learning of the main molecular techniques of genetic dissection and analysis of genes and genomes.
KNOWLEDGE AND UNDERSTANDING ABILITY:
Knowledge of the most updated developments in the field of genomics and post-genomics. Acquisition of experimental methodologies used for the study of genomes and identification of genes.
APPLICATION CAPACITIES:
Development of practical skills in the use of experimental protocols in the field of

molecular genetics. Ability to critically evaluate experimental results and to present and discuss the results of scientific articles.

Prerequisites

Good basic knowledge of genetics and molecular biology

Contents

Structure of DNA, RNA, Proteins and definition of Genome, Transcriptome, Proteome.
Enzymes for DNA manipulation: DNA polymerases, Restriction endonucleases, Ligases, End-modification enzymes. DNA Cloning. The Polymerase Chain Reaction (PCR)
Genome mapping: Markers for genetic mapping. Principles of genetic mapping, Physical mapping
Genome Sequencing: Chain Terminator sequencing, next Generation Sequencing, Third- and fourth-generation methods, Shotgun method
The Human Genome Project. The Human Genome Diversity Project. Other Eukaryotic genome sequencing projects.
Genome Annotation: by Computer Analysis, by Gene Transcript Analysis, by Genome Wide RNA mapping
Genome Browsers
Identifying Gene Functions: by Computer Analysis, by Gene inactivation and overexpression, Genome Wide Association studies
Eukaryotic nuclear genomes
Prokaryotic genomes and Eukaryotic organelles
Viral genomes and mobile genetic elements
Genome replication: initiation, replication fork, termination
The cause of Mutations. Repair of mutations and DNA damage
Recombination and Transposition
Genome Evolution: the first RNA genomes. The first DNA genomes. Evolution of complex genomes: gene duplication, whole-genome duplication, rearrangement of

genes, the origin of introns.
The human genome evolution. Paleo-genomics. Population diversity. Autosomal DNA variability. Mitochondrial DNA and Y chromosome haplogroups.

Teaching Methods

Lectures in the classroom. Laboratory activities

Verification of learning

Oral interview.
The final judgment takes into account various factors:
a) expressive capacity
b) use of the scientific terminology relevant to the course
c) Understanding of the topics covered in the course
d) ability to link concepts and situate them within a logical framework

Texts

Brown T.A. Genomes 4. Garland Science
Helmer Citterich M. et al. Fondamenti di Bioinformatica. Zanichelli

BF/0039/EN - BASIS OF SCIENTIFIC METHODOLOGY

Academic Year 2021/2022

Free text for the University

Professor

LUCA FRIGAU (Tit.)
ANTONIO PUSCEDDU

Period

Second 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	56

Objectives

The aim of the module "Basic Statistics" is to provide students with the basics of biostatistics, to get tools and methodologies useful for data analysis and statistical inference. At the end of the module, the student will know the main indicators used for the descriptive data analysis. Furthermore, the student will be able to figure out what it means to carry out a sample and obtain estimates from statistical inference methods, as well as to use the statistical test tools appropriately.

The module of "Scientific Methodology" aims at providing the students with the

basic skills to design a scientific experiment according to a hypothesis-based approach. The students will first learn to distinguish the different explanatory power of correlative vs. hypothesis-based experiments and will be trained on the methods and associate potential biases of different sampling procedures. The course will provide the students with the necessary knowledge to carry out reliable experiments considering the variability patterns of response variables in the field and in the laboratory.

With reference to the Dublin Descriptors, the module aims at providing the student with:

a) Knowledge of the rationale, basic concepts and applicability of inferential statistics and of the different sampling strategies to address scientific questions with either correlative or hypothesis-based approaches;
b) Application capacity by learning of methodological skills with reference to:
i) use of the appropriate basic and hypothesis-based statistical tools and spatial-temporal scales of investigation;
ii) analysis and disentanglement of natural and experimental variability;
iii) assessment of sampling representativity and sampling errors;
iv) choice of different typologies of manipulation experiments and identification of the reference conditions;
c) Autonomy of judgment, through the acquisition of the basic principles of the interpretation of scientific data and statistical tests output; design of uni- and multivariate manipulation experiments for addressing biological questions;
d) Ability in communication, through the acquisition of appropriate terminological background and the use of appropriate graphic representations of multivariate statistical analyses;
e) Ability to choose the most appropriate statistical tools in different research scenarios.

Prerequisites

Concepts and methods developed during the Mathematics and Statistics course.

Contents

Module of Basic Statistics:
- Scale of measurement
- Graphical representation of data
- Measures of central tendency
- Variability measures
- Indexes of form
- Linear correlation and Linear regression.
- Random variables: Normal, Binomial, Chi-square, Student's T random, Fisher's F
- The concepts of Statistical hypothesis testing
- Hypothesis tests: Chi-square Test, Fisher's exact method, Log-likelihood ratio, Binomial Proportion Test, McNemar Test, T-tests, Wilcoxon rank Test, Welch's Test, Mann-Whitney U Test, Paired Samples T-tests, Anova I, Anova II
- Adjusting significance levels and/or P values in multiple testing
- Resampling methods for estimation: Bootstrap, Jackknife

Module of Scientific Methodology:
- Differences between experiments and monitoring procedures
- Multivariate nature of variation sources of biological systems
- Spatial and temporal scales of biological variation
- Definition and classification of scientific experiments
- Natural variability of biological processes and the need of sampling
- Explanatory power of correlative and hypothesis-based experiments
- Representative sampling and allocation in time and space
- Sampling methods: convenience, random, systematic, stratified and cluster sampling
- Sampling errors: sample size, systematic errors, selection biases, measurement biases, confounding factors
- Variability appreciation

- Design of univariate and multifactorial experiments
- Experimental factors and levels
- Orthogonal and hierarchical factors in multifactorial experiments
- Choice of reliable statistical tools to address experimental questions

Teaching Methods

Lectures, seminars, practical exercises in the classroom.

The lectures will be given mainly in presence, integrated and "augmented" with online strategies, in order to guarantee its use in an innovative and inclusive way

Verification of learning

The evaluation of each module is based upon a written exam that will consider the overall appropriateness, accuracy and consistency of the acquired knowledge, skills, and competencies. Evaluation will be made also considering the capacity of expression and the proper use of the discipline-specific language as well as the logical ability in the consequential fitting of the module contents by connecting different subjects and summarizing concepts through the graphic expression of ideas and concepts (for example by means of schemes of sampling strategy and experimental design).
The final evaluation results from the weighted average of the evaluations of the two modules. Specifically, the modules of Basic Statistics and Scientific Methodology weigh, respectively, 4/7 and 3/7.

Relational qualities:
Ability to talk and interact with critical spirit with the teacher and 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

- Experimental Design and Data Analysis for Biologists, G.P. Quinn, M.J. Keough
- Experiments in Ecology: Their Logical Design and Interpretation Using Analysis of Variance, A.J. Underwood

More Information

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

EC/0011- INTERNATIONAL ECONOMICS

Academic Year 2021/2022

Free text for the University

Professor

FRANCESCO PIGLIARU (Tit.)

Period

Second 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

This course provides basic knowledge of international trade economics, trade policy and the strategic choices of firms operating in the global context (assessment of knowledge and understanding). The course aims as well at providing tools for evaluating the role of a country and its firms in the global system (assessment of the ability to apply knowledge and understanding). Particular emphasis will be given to explaining why individuals and firms should be aware of the possibility that while trade generates gains at the aggregate level for each participating country, the distribution of these gains within a country is typically very uneven to the point that trade can make a large share of the existing firms worse off. So, strategical positioning of firms and individuals is crucial in order to avoid losses from trade.
At the end of the course students will be able to:

1. critically discuss the most important international trade theories and the principles which drive the strategic decisions of firms in the global context; (assessment of knowledge and understanding; evaluation of judgment ability)
2. analyse the statistics of international trade data to describe the position of a country and its firms in the global system; (assessment of the ability to apply knowledge and understanding)
3. analyse the position of a firm in the global system (assessment of communication skills; assessment of the learning process)

Prerequisites

Basic principles of microeconomics is the main prerequisite for this course.

Contents

1. Causes and Consequences of International Trade

a) Comparative Advantage with one factor of production
b) Comparative Advantage with two factors of production
c) Distribution of gains from trade between countries
d) Trade and within-country inequality
e) Trade with increasing returns
f) Implications for traditional trade models of new technologies and trade patterns (GVC)
g) The multinational firm

2. Trade Policy
a) Trade Policies
b) The political economy of trade policy

Teaching Methods

The course will be based on formal lectures, 6 hours per week.
Students will have the option to write a short essay on an agreed topic. The mark

obtained by the essay will count as one-third of the final exam mark.
In general, the teaching will be mainly face-to-face, supplemented and "augmented" with online strategies to ensure its fruition innovatively and inclusively.

Verification of learning

A written in-person examination with questions on main IT trade theories and policies (assessment of knowledge and understanding).

The use of a proper language represents another important element in the evaluation process (assessment of communication skills).

To determine the final grade the following elements will be considered:
- The proper use of the model
- The use of graphs
- The ability to explain through an intuitive language the solution
- The logic of the reasoning presented

The final grade is out of thirty. To achieve a maximum score in the written examination, the student must show that they 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.

The use of a proper language represents another important element in the evaluation process (assessment of communication skills).
The use of a proper language represents a fundamental element in the evaluation process (assessment of communication skills).

To determine the final grade the following elements will be considered:

- The proper use of the model
- The use of graphs
- The ability to explain through an intuitive language the solution
- The logic of the reasoning presented

The final grade is out of thirty. To achieve a maximum score in the written examination, the student must show that they 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

A ppt file with 100+ slides is available, covering all the topics included in the course in analytical detail.
To download the file go to MS Teams and click "Unisciti a un team o creane uno". Enter the code arbctmc when required. This will allow you to join the "International Economics IM" team and access all the available teaching material.

Textbook:

International Economics: Theory and Policy
Paul R. Krugman, Maurice Obstfeld, Marc Melitz
ISBN-10: 0138018987 ISBN-13: 9780138018986

Ch.s 2 to 12

or

International Trade. Theory and evidence.
J R Markusen, J R Melvin, W H Kaempfer, K E Maskus
downloadable for free from:

https://mpra.ub.uni-muenchen.de/21989/1/MPRA_paper_21989.pdf

As an alternative:

On globalization:

Fixing Globalisation: Time to Make it Work for All
OECD
http://dx.doi.org/10.1787/9789264275096-en

http://www.oecd-ilibrary.org/economics/economic-globalisation_9789264111905-en

More Information

Examples of questions similar to those you should expect for the final exam are present in our space in MS Teams. See above for instructions on how to access our team and the available teaching material.

OFFICE HOURS: Thursdays at 10:00 through the MS Teams platform, team "International Economics IM", channel "Lezioni".

The textbooks are also available in electronic form. On the website of the textbook, students can find additional material.

EC/0011 - INTERNATIONAL ECONOMICS

Academic Year 2021/2022

Professor FRANCESCO PIGLIARU (Tit.)
Period Second 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

This course provides basic knowledge of international trade economics, trade policy and the strategic choices of firms operating in the global context (assessment of knowledge and understanding). The course aims as well at providing tools for evaluating the role of a country and its firms in the global system (assessment of the ability to apply knowledge and understanding). Particular emphasis will be given to explaining why individuals and firms should be aware of the possibility that while trade generates gains at the aggregate level for each participating country, the distribution of these gains within a country is typically very uneven to the point that trade can make a large share of the existing firms worse off. So, strategical positioning of firms and individuals is crucial in order to avoid losses from trade.
At the end of the course students will be able to:
1. critically discuss the most important international trade theories and the principles which drive the strategic decisions of firms in the global context; (assessment of knowledge and understanding; evaluation of judgment ability)
2. analyse the statistics of international trade data to describe the position of a country and its firms in the global system; (assessment of the ability to apply knowledge and understanding)
3. analyse the position of a firm in the global system (assessment of communication skills; assessment of the learning process)

PREREQUISITES

Basic principles of microeconomics is the main prerequisite for this course.

CONTENTS

1. Causes and Consequences of International Trade

a) Comparative Advantage with one factor of production
b) Comparative Advantage with two factors of production
c) Distribution of gains from trade between countries
d) Trade and within-country inequality
e) Trade with increasing returns
f) Implications for traditional trade models of new technologies and trade patterns (GVC)
g) The multinational firm

2. Trade Policy
a) Trade Policies
b) The political economy of trade policy

TEACHING METHODS

The course will be based on formal lectures, 6 hours per week.
Students will have the option to write a short essay on an agreed topic. The mark obtained by the essay will count as one-third of the final exam mark.
In general, the teaching will be mainly face-to-face, supplemented and "augmented" with online strategies to ensure its fruition innovatively and inclusively.

VERIFICATION OF LEARNING

A written in-person examination with questions on main IT trade theories and policies (assessment of knowledge and understanding).

The use of a proper language represents another important element in the evaluation process (assessment of communication skills).

To determine the final grade the following elements will be considered:
- The proper use of the model
- The use of graphs
- The ability to explain through an intuitive language the solution
- The logic of the reasoning presented

The final grade is out of thirty. To achieve a maximum score in the written examination, the student must show that they 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.

The use of a proper language represents another important element in the evaluation process (assessment of communication skills).
The use of a proper language represents a fundamental element in the evaluation process (assessment of communication skills).

To determine the final grade the following elements will be considered:
- The proper use of the model
- The use of graphs
- The ability to explain through an intuitive language the solution
- The logic of the reasoning presented

The final grade is out of thirty. To achieve a maximum score in the written examination, the student must show that they 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

A ppt file with 100+ slides is available, covering all the topics included in the course in analytical detail.
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Textbook:

International Economics: Theory and Policy
Paul R. Krugman, Maurice Obstfeld, Marc Melitz
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Ch.s 2 to 12

or

International Trade. Theory and evidence.
J R Markusen, J R Melvin, W H Kaempfer, K E Maskus
downloadable for free from:
https://mpra.ub.uni-muenchen.de/21989/1/MPRA_paper_21989.pdf

As an alternative:

On globalization:

Fixing Globalisation: Time to Make it Work for All
OECD
http://dx.doi.org/10.1787/9789264275096-en

http://www.oecd-ilibrary.org/economics/economic-globalisation_9789264111905-en

MORE INFORMATION

Examples of questions similar to those you should expect for the final exam are present in our space in MS Teams. See above for instructions on how to access our team and the available teaching material.

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The textbooks are also available in electronic form. On the website of the textbook, students can find additional material.

EC/0054 - INTERNATIONAL ENVIRONMENTAL LAW AND POLICY

Academic Year 2021/2022

Professor DANIELE AMOROSO (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	6	36

OBJECTIVES

The course “International Environmental Law & Policy” is given in the second term of the second year of the Corso di Laurea Magistrale in “Sustainable Tourism Management and Monitoring”. It pursues a three-fold aim: a) to provide students with basic knowledge as to the functioning of the international and UE legal orders, having regard to their sources of law, their compliance mechanisms, and their incorporation within the Italian legal order; b) to offer a broad introduction to the principles governing international and EU environmental law, by paying particular heed to the foundational principle of sustainable development; c) to show how this legal framework applies to tourist management.
Under the Dublin Descriptors, the Course Learning Outcomes are as follows:

1) Knowledge and understanding
Students will learn:
- the most important English terminology concerning international environmental law. They will be able to read English textbooks and articles, as well as – in the same language - to defend their arguments in speaking and writing

- how to deal with the (international and EU) legal institutional framework concerning environmental planning
- international and EU environmental law principles and rules, and related policies

2) Applying knowledge and understanding
Students will be able
- to interact with environment-related institutions and organizations at both national and international level
- to apply their multidisciplinary competences to interpret, describe and resolve issues concerning tourism development

3) Making judgments
- Students will be able to make their own assessment and/or judgment on the basis of the interpretation of available data, as well as to identify, collect and process further elements in order to obtain greater awareness on specific or common issues concerning sustainable tourism development
- Students will know how to start an initiative or take a decision, with the awareness that every activity is carried out in a situation of uncertainty or risk, and taking into account – besides legal/technical aspects – also economic, ethical and social ones.

4) Communication skills
- Students will be able to communicate, in an effective manner, information, projects and courses of action to stake-holders, relevant organizations, economic and social operators, as well as to the community at large, both at a national and at an international level. They will also be able to discuss their own ideas, raise problems, put forth solutions.

5) Learning skills
Students will develop
- the autonomous learning skills, which are needed by managers in order to operate in line with the dictates of international and EU environmental law;

- the ability to search for different bibliographical sources (both in Italian and in English) in order to acquire new competences
- the competence, curiosity and inclination to continue their studies

PREREQUISITES

No formal prerequisites are envisaged. Yet, before approaching the course, it is strongly advised to pass the English language exam.

CONTENTS

1) BASIC CONCEPTS (6 hours)
1.1) Definition of International Law and EU Law
1.2) The Functioning of International and EU Law (Sources of International and EU Law; Compliance Mechanisms)

2) GENERAL PRINCIPLES OF INTERNATIONAL AND EU ENVIRONMENTAL LAW (9 hours)
2.1) The Principle of Sustainable Development
2.2) The Principle of Common but Differentiated Responsibilities
2.3) The Principles of Prevention and Precaution
2.4) The Polluter Pays Principle

3) SELECTED ISSUES OF INTERNATIONAL AND EU ENVIRONMENTAL LAW (12 hours)
3.1) The Convention on International Trade in Endangered Species of Wild Fauna and Flora
3.2) The Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters
3.3.) The Ramsar Convention on Wetlands of International Importance
3.4.) The UNESCO World Heritage Convention
3.5.) The European Landscape Convention
3.6.) The Fight Against Climate Change
3.7.) The Protection of the Environment in EU Law

4) ENVIRONMENTALLY SUSTAINABLE TOURISM IN INTERNATIONAL AND EU LAW (9 hours)
4.1) The UN World Tourism Organization and the Global Code of Ethics for Tourism
4.2) The EU Law and Policies on Sustainable Tourism

TEACHING METHODS

The course will last 36 hours and will include 30 hours of academic teachings and 6 hours of workshops.
During the hours of academic teachings, the topics outlined in the Course Programme will be explained to the students, whose active participation will be strongly encouraged.
In the Workshops, students will be asked to apply to selected case studies the knowledge acquired during academic teachings. To this end, fictitious scenarios for role-playing will be made up. Attendees' participation to the simulation will be taken into due account for the purposes of the final assessment.
Lessons will be delivered simultaneously both in the classroom and online, thereby establishing a mixed teaching methodology that can be experienced in university classrooms but at the same time also remotely. Each student, at the beginning of the semester, can opt, with a binding choice, for attending the classes physically or virtually. Depending on the availability of the classrooms and the number of students who will opt for physically attending the classes, there may be a rotation for the actual access to the classroom.

VERIFICATION OF LEARNING

The exam will consists of an oral interview, where students will be asked to expose the contents of the course programme. In this respect, it will be verified whether the student has acquired: knowledge and understanding, the competence to apply such knowledge and understanding to specific cases, the ability of making judgments, as well as communication and learning skills.
The interview will be articulated as follows:
- question 1 on basic concepts (6/30 points);

- question 2 on general principles of international and EU environmental law (8/30 points);
- question 3 on selected issues of international and EU environmental law (8/30 points);
- question 4 on environmentally sustainable tourism in international and EU law (8/30 points);

A 2 points bonus could be added to the assessment of students who stand out for their ability to expound on the issues dealt with in the Course in a comprehensive and critical manner. In this connection, the quality of the participation to the workshops will be also taken into account.

Grading
On the basis of the above-mentioned assessment methods, grading will be expressed as follows:
- from 18/30 to 20/30: the student has a basic knowledge of the programme, without serious conceptual mistakes;
- from 21/30 to 25/30: the student has a good knowledge of the programme, but his/her analytical tools remain quite elementary;
- from 26/30 to 29/30: the student has a good (or more than good) knowledge of the programme, and has acquired likewise good analyitical tools;
- 30/30 (if the case, cum laude): the student is able to sistematize in a logical and coeherent manner the knowledge acquired during the Course, to apply critically the learned legal framework to specific cases and to master the legal lexicon.

TEXTS

P.-M. Dupuy and J.E. Vinuales, International Environmental Law, Cambridge University Press (last ed.), Part I, Part III and Chapter 12

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/0086 - INTERNATIONAL FINANCIAL REPORTING

Academic Year 2021/2022

Professor ALESSANDRO MURA (Tit.)
Period Second 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

This course is designed to provide students with a higher and more thorough understanding of some specific comprehensive problems in financial accounting, including IASB's Conceptual Framework, Revenue recognition and Construction Contracts, Cash Flow Statement, Business combinations, Equity Method of Accounting for Investments, Preparation of Consolidated Financial Reports.

PREREQUISITES

Students beginning this course are expected to be familar with:
the double entry system of book-keeping,
basic accounting principles and policies
accounting treatments and valuation of non-current assets (intangible assets, property, plant and equibpment, inventory, other payables and receivables, bad debts and provision for doubtful debts, income tax;
principles of financial statements (Statement of profit or loss and other comprehensive income; Statement of financial position)

CONTENTS

IASB's Conceptual Framework for Financial Reporting
Cash flow statement (IAS 7)
Business Combinations

Consolidated Financial Statements (IFRS 10)
Investments in Associates (IAS 28),
Revenue recognition (IFRS 15).

TEACHING METHODS

Class sessions will consist of lecture, problem solving, and discussion.
Discussion will focus on readings, exercises, cases, and relevant current events.
Excel spreadsheets and Internet searches will be utilized.

VERIFICATION OF LEARNING

The final assesment will be based on a written examination comprising both open questions and a case study, relating to the various topics covered during the course.

TEXTS

Elliot B., Elliot J.: Financial Accounting and Reporting, Pearson, 2019
Mackenzie, Bruce et al.: IFRS – Interpretation and Application of International Accounting Standards, New York (Wiley), 2019

MORE INFORMATION

Lecture slides, lecture notes, class exercises and solutions problems and other useful readings will be posted on my web page at this link:
http://people.unica.it/alessandromura/didattica/materiale-didattico/ega-international-financial-reporting/
For access, use this password: EGAEM2018
My email address is sandromura@unica.it
Students' assistance is due on Tuesday from 9.00 to 10.00 a.m. and Thursday from 4 to 5 p.m.

FA/0209 - BIOSENSORS

Academic Year 2021/2022

Free text for the University

Professor	STEFANO LAI (Tit.)
Period	Second Semester
Teaching style	Convenzionale

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[60/76] BIOTECHNOLOGY	[76/20 - Ord. 2018] Farmaceutico	4	32

Objectives

The course will provide students a general view about technologies and applications of sensors for chemical and biological species.
-Acquiring knowledge and understanding: the student will learn fundamental concepts, technologies and issues related to the development of biochemical sensors, including golden standard systems and new generation devices;
-Appying knowledge and understanding: the student will be able to apply the foreground on biochemical sensors and systems for the setup of laboratory experiments.
-Making informed judgements and choices: the student will be able to understand data and plots related to biochemical sensors, evaluating performances and, if necessary, defining strategies for performance improvement and optimization;
- Communicating knowledge and understanding: the student will be able to report about the foreground using appropriate technical terms, and to use appropriate metrics to describe performances of considered applications:
- Capacities to continue learning: the student will be able to integrate the concepts

related to different fields – physics, chemistry, biology and electronics – for the analysis of biochemical sensors; the student will be also able to integrate the concepts provided during lessons with the most up-to-date results reported in literature.

Prerequisites

Basic concept of physics, physic of the solid matter and chemistry are fundamental prerequisites.

Contents

- Introduction to the concept and merit figures of sensors;
- The biochemical sensor;
-Transduction approaches:
▪ Basic concepts in electrochemistry (cells, redox reactions at electrodes, potentiometric vs amperometric approaches);
▪ Basic concepts in optical and fluorescent transduction;
▪ Basic concepts in gravimetric detection;
▪ Basic concepts in electronic transduction;
- Golden standard techniques for biochemical sensing:
▪ Gas sensors based on the glass electrode;
▪ sensors for pH and ionic concentration;
▪ Clark electrode for glucose;
▪ Genetic sensing (microarrays);
▪ Immuosensing (electrophoresis, ELISA);
- New concepts for biochemical sensor development:
▪ Electrochemical biosensing (second generation enzymatic sensors , conductometric enzymatic sensors, immunological sensors, genetic sensors);
▪ Optical biosensors (SPR);
▪ BioMEMs;
▪ Electronic Biosensors (chemFETs e bioFETs)

Teaching Methods

Students will acquire the main concepts of the course by attending to frontal lessons.

Verification of learning

The final mark will be established by means of written tests, including open questions and multiple-choice questions. The maximum score will be 32/30: with a score equal or larger than 31, the student will receive the magna cum laude

Texts

-Slides of the lessons;
-De Rossi, Ahluwalia, Mazzoldi, Pede, Scilingo, “Sensori per misure biomediche”, Collana di Ingegneria Biomedica, Patron Editore.

More Information

Basic concept provided in the course will be integrated with the most up-to-date publications in the field of bioelectronics.

FA/0226/EN - EXPERIMENTAL PHARMACOLOGY

Academic Year 2020/2021

Free text for the University

Professor	NICOLA SIMOLA (Tit.)
Period	Second Semester
Teaching style	Convenzionale
Lingua Insegnamento	INGLESE

Informazioni aggiuntive

Course	Curriculum
[50/21] PHARMACEUTICAL CHEMISTRY AND TECHNOLOGY	[21/00 - Ord. 2014] PERCORSO

Objectives

The course provides the tools for understanding the biological bases of the action of drugs, and for the application of the experimental techniques aimed at determining their therapeutic potential. For this purpose, the course includes laboratory exercises for learning in vitro pharmacology techniques and computer-based exercises aimed at acquiring skills on in vivo experimental models used for the evaluation of the biological properties of specific classes of drugs.

KNOWLEDGE AND UNDERSTANDING

Knowledge of the experimental models used for the evaluation of the pharmacological activity of bioactive molecules, both at the basic research and at

the applicative levels, with regard to the combined use of the aforementioned models and the optimization of the experimental procedures.
In particular:
In vitro and ex vivo pharmacological models
Knowledge of the main methods of immunochemistry and molecular biology and knowledge of the methods that employ preparations of isolated organs, with reference to their application in studies of pharmacology.
In vivo pharmacological models
Knowledge of the characteristics and conditions of applicability of in vivo pharmacological models, of the characteristics of the various experimental animals and their differential use in pharmacological research, as well as of the national and international regulatory references that underlie the use of experimental animals in biomedical research. Acquisition of theoretical skills that allow the design aof n efficient experimental plan that combines the experimental models studied during the course.

ABILITY TO APPLY KNOWLEDGE AND UNDERSTANDING

Acquisition of application skills through laboratory activities that allow understanding the principles governing the correct use of the experimental techniques employed in pharmacological research. The students will also carry out practical activity in rodent displays in order to acquire the techniques of drug administration and the basic principles of surgical techniques that are used for the generation of the experimental models studied during the course.
Examples of skills that will be acquired during the course are:
Proper maintenance of experimental animals
Principles underlying the use of in vitro and ex vivo techniques
Practical activity with sectioning instruments suitable for obtaining preparations to be used for immunohistochemistry methods
Example activities through computer support aimed at demonstrating the in vivo effects produced by drugs belonging to different classes, as well as the differences

and similarities between the aforementioned effects.
Ability to understand the fundamental characteristics and any critical issues of the experimental models most commonly used in pharmacological research.
Ability to recognize and control the interfering factors that can affect the interpretation of the results obtained in experiments of pharmacology.

JUDGMENT AUTONOMY

Ability to collect, analyze and properly interpret data and ability to set up and develop research protocols.

COMMUNICATION SKILLS

Ability to properly and proficiently communicate information and ideas and to design solutions relevant to the professional context of reference, through the use of adequate technical / scientific terminology.

LEARNING ABILITY

Ability to continuously update knowledge in the contemporary professional context, at both national and and international levels, also in relation to student mobility programs activated by the University and now widely consolidated.
Ability to draw on bibliographical sources in Italian and English, in order to acquire new scientific skills.
Learning skills required to undertake subsequent studies in PhD schools.

Prerequisites

The students must have adequate knowledge of the notions acquired in previous years from the courses of Anatomy, Physiology, Biochemistry and General Pharmacology.

Having passed the examinations of General Pharmacology and Pharmacognosy (Farmacologia Generale e Farmacognosia) is mandatory in order to take the examination of Experimental Pharmacology (Saggi e Dosaggi Farmacologici).

Contents

GENERAL TESTS USED IN EXPERIMENTAL PHARMACOLOGY

▪ General guidelines for care and use of laboratory animals. Animal models, animal species of vertebrates and invertebrates used in research, blood sampling techniques, anesthesia techniques,
drug delivery routes. National and international legislation on the use of experimental animals inbiomedical research. Methods alternative and complementary to animal testing
▪ Research and development of new drugs
▪ Biological dosages in preparations of isolated organs
▪ In vivo and in vitro receptor binding and autoradiography
▪ Electrophysiology and its applications to pharmacological research
▪ Immunohistochemistry and its use in pharmacological research
▪ Microdialysis and its use in pharmacological research. Notes on the techniques of fast-scan cyclic voltammetry and optogenetics
▪ Cell cultures and their use in pharmacological research
▪ Notes on the most common techniques of molecular biology (northern and western blot, in situ hybridization, antisense hologinucleotides, PCR, cloning, transgenic animals)

TESTS SPECIFICALLY USED FOR THE STUDY OF DIFFERENT CLASSES OF DRUGS
▪ Cardiovascular activity (methods for inducing hypertension in laboratory animals, antiarrhythmic activity, activity on heart failure)
▪ Psychotropic and neurotropic activity [effects on behavior and motor coordination, anxiolytic activity, antiepileptic activity, rewarding activity, neuroleptic activity, antidepressant activity]

▪ Activity in models of neurological diseases (Alzheimer's disease, Parkinson's disease, Huntington's disease, amyotrophic lateral sclerosis, multiple sclerosis)
▪ Effects of drugs on memory and learning
▪ Effects of drugs in experimental models of cerebral ischemia
▪ Analgesic, anti-inflammatory, anti-arthritic, antipyretic activity
▪ Anti-histamine activity
▪ Miscellaneous models of interest in pharmacology (migraine, visceral pain, postoperative pain, nausea, diabetes, hyperphagia, models of metabolic pathologies, models of lung pathologies, models
of pathologies of the digestive system)

Teaching Methods

The course of Experimental Pharmacology includes two weekly frontal lessons lasting about two hours each. During the lectures the Professor will deal with the topics described in the detailed teaching program under "Course contents". The total duration of lectures is 40 h.

The course also includes laboratory lessons during which students will learn to apply the various experimental models that will be illustrated during the lectures. The total duration of the laboratory lessons is 36 h.

Lectures and laboratory lessons will be in ENGLISH.

During lectures and laboratory lessons, the Professor may be supported by didactic tutors, in order to facilitate students' learning. In addition, the Professor and the didactic tutors will be available for explanations and clarifications outside the lesson timetable, whether they are frontal or laboratory.

The teaching will be delivered simultaneously in presence and online, thus outlining a mixed teaching that can be enjoyed in university classrooms but at the same time also at a distance. At the beginning of the semester, the student will

opt for face-to-face or distance teaching and the selection will be binding for the entire semester. If the number of students will exceed the capacity of the classrooms, determined on the basis of government provisions on health matters for the purpose of combating 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 involved.

In compliance with law 413/93, students who submit a conscientious objection to animal testing will be exempted from attending the laboratory lessons. This application must be submitted to the Professor by 1 November of the Academic Year of delivery of the course.

Verification of learning

The acquisition of learning outcomes will be verified in an oral examination, during which the Professor will ask the student a series of questions relating to the topics covered during the course. In addition to demonstrating that they have acquired the notions contained in the course program, the candidate must demonstrate reasoning skills and logical deduction. During the oral examination, the candidate must also demonstrate to have acquired the rational bases that underlie the use of the experimental models studied, to have understood the similarities and differences between these experimental models, as well as the applicability, advantages and disadvantages of the various experimental models studied.

EVALUATION CRITERIA

Final judgement
The final /grade takes into account the combination of the various factors listed below:
a) Quality of knowledge, skills, competences possessed and manifested:
a1) appropriateness, correctness and congruence of knowledge, skills and competences.

b) Exhibition method:
b1) Expressive ability;
b2) Appropriate use of the specific language of the discipline;
b3) Logical and content linking skills;
b4) Ability to establish a coherent general design, i.e., taking care of the structure, organization and logical connections of the exhibition discourse;
b5) Ability to synthesize, also through the use of the symbolism proper to matter and graphic expression.

c) Relational qualities, including availability to exchange and interact with the teacher during the interview.

d) Personal qualities:
d1) Critical spirit;
d2) Self-assessment capacity.

Based on these considerations, the final judgment may be the following:

a) Sufficient (from 18 to 20/30)
The candidate demonstrates to have acquired few notions, with a superficial level of knowledge, and several gaps. The expressive abilities shown are modest, although sufficient to support a coherent dialogue. In addition, the logical skills and the ability to make connections among different topics are of an elementary level and are accompanied by poor synthesis ability, stunted graphic expression and poor interaction with the Professor during the interview.

b) Decent(21 to 23)
The candidate demonstrates discreet acquisition of notions, but with little deepening. The candidate also demonstrates a few shortcomings, and expressive skills are adequate to support a coherent dialogue. Command of the scientific

language of the discipline is acceptable, and so is the ability to make connections among different topics, synthesis and graphic expression are of adequate level.

c) Good (24 to 26)
The candidate demonstrates a rather broad background of notions, with moderate deepening and limited gaps. Expressive skills and command of the scientific language of the discipline are of good level, and so are dialogical ability, critical spirit, synthesis and graphic expression skills.

d) Very good (27 to 29)
The candidate demonstrates a very extensive, well-researched knowledge with marginal gaps; remarkable expressive skills and high command of the scientific language of the discipline; remarkable dialogic ability, good competence and relevant aptitude for logical synthesis, accompanied by high-level graphic expression skills.

e) Excellent (30)
The candidate demonstrates a very extensive and in-depth knowledge of notions, and any gaps are to be considered irrelevant. The candidate also demonstrates high expressive skills and mastery of the scientific language of the discipline, excellent dialogic ability, strong aptitude for making connections among different topics, excellent synthesis and graphic expression skills.

Honors (30/30 lode) are given to candidates who stand clearly above the average, and whose possible notional, expressive, and logical limits are on the whole absolutely irrelevant.

Texts

▪ FARMACOLOGIA E TOSSICOLOGIA SPERIMENTALE,P.Dolara, F.Franconi, A.Mugelli, Pitagora Bologna, Italy;

- PRINCIPI DI SCIENZA DELL'ANIMALE DI LABORATORIO, L.F.M.van Zutphen, V. Baumans, A.C.Beynen, La Goliardica Pavese, Pavia, Italy

- DRUG DISCOVERY AND EVALUATION: Pharmacological Assays H.G. Vogel, Springer

- PDF files of lectures provided by the Professor

More Information

During the course of the lessons, the Professor makes the slides of the lessons available to the students, as well as additional study and in-depth material, such as PDFs of original scientific works in English, photocopies of books other than the recommended texts, handouts.

IA/0013/EN - MACHINE LEARNING

Academic Year 2021/2022

Free text for the University

Professor

FABIO ROLI (Tit.)

Period

Second 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 objective of this course is to provide students with the fundamental elements of machine learning and its applications to pattern recognition. The main concepts and methods of machine learning are presented, as well as basic methods to design and evaluate the performance of a pattern recognition system.
Course outcome: understanding of fundamental concepts and methods of machine learning and its applications to pattern recognition. Ability to analyze and evaluate performance of simple algorithms for pattern classification. Ability to solve simple problems on designing and performance assessment of pattern classification algorithms.

Prerequisites

This course is intended for undergraduate students who have a basic knowledge of linear algebra, calculus, and probability theory.

Contents

Course contents
1) Introduction
2) Elements of Bayesian decision theory
3) Introduction to pattern classification methods
4) Elements of parametric methods for learning-based pattern classification
5) Elements of non parametric methods: k-nn classifier and decision trees
6) Elements of linear discriminant functions and support vector machines
7) Elements of performance evaluation
8) Elements of unsupervised learning
9) Ensemble learning
10) Adversarial machine learning
11) In-class exercises
12) Python Programming language and computer exercises

Teaching Methods

Course organization:
Theory: 30 hours
Exercises: 10 hours
Laboratory: 16 hours
Seminars: 4 hours

Verification of learning

Home computer-exercise assignment + Oral examination
You can do intermediate assessments instead of the oral examination
You can do intermediate assessments instead of the home computer-exercise assignment
You can do the oral examination only after the computer exercise

Teams of 3 students maximum can do the home computer exercise
Grading policy = Computer exercise (10/30) + Oral examination (20/30)

Texts

Pattern Classification (2^ edizione), R. O. Duda, P. E. Hart, e D. G. Stork, John Wiley & Sons, 2000

More Information

All the course material is available on the course web site:
https://unica-ml.github.io/#

IA/0116/EN - CYBERSECURITY TECHNOLOGIES AND RISK MANAGEMENT

Academic Year 2021/2022

Free text for the University

Professor

GIORGIO GIACINTO (Tit.)
GIORGIO FUMERA

Period

Second Semester

Teaching style

Convenzionale

Lingua Insegnamento

INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[70/91] INTERNET ENGINEERING	[91/00 - Ord. 2018] INGEGNERIA DELLE TECNOLOGIE PER INTERNET	10	100
[70/90] COMPUTER ENGINEERING, CYBERSECURITY AND ARTIFICIAL INTELLIGENCE	[90/00 - Ord. 2018] PERCORSO COMUNE	10	100

Objectives

The teaching unit in Cybersecurity Technologies and Risk Management aims at providing the students with the un updated view of the threat landscape, the vulnerabilities of each component of any information processing system, the attack techniques, and the related prevention, mitigation, and detection solutions based on risk analysis and management approaches. This teaching unit comprises standard lectures, as well as labs to expose students to the professional tools

used by computer security professionals. In addition, the syllabus also includes an overview of international and national standards, regulations and best practices. The learning outcomes of this teaching activity, 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 motivations behind computer attacks, current and future trends;
- cryptographic techniques for enforcing secrecy, authenticity and integrity for information storage and sharing;
- the vulnerabilities of Internet protocols, and the related best practices and tools to properly configure the communication devices, to filter and monitor the live traffic, and detect suspicious network events;
- the security and privacy mechanisms available at the operating system level;
- social engineering techniques, and open source intelligence approaches;
- the best practices for disaster recovery and business continuity;
- the methodologies for threat modeling to proactively assess the security of applications and systems;
- the quantitative and qualitative risk analysis and management approaches;
- the techniques and organizational approaches to reduce cyber risks;
- the certifications for computer security professionals, and for process and product development.
- elements of privacy protection techniques in microdata release

Applying knowledge and understanding
After the completion of this teaching activity, the student should be able to:
- use cryptographic functions and applications to encrypt files and network communications;
- use the tools for the analysis of network traffic;
- set up on operating system according to the security requirements of the

operating environment;
- extract valuable information from open source information sources;
- model an application or system using the threat modeling methodology;
- estimate the cyber risk of a computer system or application, according to the environment in which it operates;
- select the most effective measures to reduce the cyber risk.

Making judgements
The student will be able to analyze the components of a computer system, including cyber-physical systems, to spot any vulnerability to cyber attacks, and propose the prevention and mitigation techniques that best fit the systems aims, and goals, from a risk-based viewpoint.

Communication skills
After the completion of this teaching activity, the student should be able to explain in an organic way the main vulnerabilities that might affect a given computer system (hardware, software, and network), by associating the related consequences, and proposing in a convincing way the prevention and mitigation techniques according to a risk-based approach.

Lifelong learning skills
The evolution of the computer security landscape, strictly related to the technological evolution, and the availability of new personal devices, requires lifelong learning skills to keep updated with the current trends, both in terms of the motivation behind attacks, and the most recent attack techniques. The students will thus be guided to analyse the most relevant information sources on the web.

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Prerequisites

The student should have a deep knowledge of the organization of modern computer architectures, modern operating systems, programming languages, software engineering, Internet, and Databases.

Contents

The current cyber threat landscape: history and future trends (6h)
Cryptographic tools and applications (6h)
User authentication (6h)
Network Security (9h)
Software Vulnerabilities (4h)
Operating System and Virtualisation Security (5h)
Machine Learning tools for Cybersecurity (6h)
Social Engineering and Open Source Intelligence tools (6h)
Privacy (6h)
Risk analysis and risk management methodologies (18h)
Threat Modeling (12h)
Estimation of the cyber risk (6h)
Incident analysis and recovery (6h)
Certifications, standards and regulations (4h)

Teaching Methods

This teaching unit is organized with
- lectures
- for each topic, lab exercises with open-source professional tools used for security analysis and testing

The teaching material is available at the official web site of this teaching activity:

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.

Teaching Methods

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- lectures
- for each topic, lab exercises with open-source professional tools used for security analysis and testing

The teaching material is available at the official web site of this teaching activity:

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.

In the case the epidemiological situation will require the adoption of on-line lectures, they will be given through a streaming platform. Practical parts will be organised through interactive platforms.

Verification of learning

The exam is subdivided into two parts
- a test with 8 to 10 open-ended and closed-ended questions, each question on a different topic, that cover all the topics of the subject
- a project on one of the topics covered in this teaching activity.

The written test is evaluated with a score between 0 and 24. 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 maximum total score that will be assigned to the project is 8, and will take into account the correctness and completeness of the proposed solution.
The final mark will be computed as the sum of the scores assigned to the written test and to the practical exercises. The max total score will be equal to 32.
Students attaining the final score equal to 32 will be assigned the '30 cum laude' mark.

If the epidemiological situation will prevent the possibility of having the written text, an oral exam will be organised with the same number of questions as the written test described above. The evaluation will be carried out according to the same criteria of the written test.

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Texts

MAIN TEXTS
Stallings, Brown, “Computer Security: Principles and Practice”, 4th Edition, Pearson, 2018

Pfleeger CP, Pfleeger SL, Margulies J, "Security in Computing", Prentice Hall, 2015

Tony Uceda Velez, Marco M. Morana, “Risk Centric Threat Modeling: Process for Attack Simulation and Threat Analysis”, Wiley, 2015

OTHER TEXTS
Paul C. van Oorschot, Computer Security and the Internet, Springer, 2021
PDF files of each chapter available at
https://people.scs.carleton.ca/%7Epaulv/toolsjewels.html

Andersson R., "Security Engineering 3/ed", WIley, 2020
the PDF of the 2/ed are available online
http://www.cl.cam.ac.uk/~rja14/book.html

Texts

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Stallings, Brown, “Computer Security: Principles and Practice”, 4th Edition,

Pearson, 2018

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Andersson R., "Security Engineering 3/ed", WIley, 2020
the PDF of the 2/ed are available online
http://www.cl.cam.ac.uk/~rja14/book.html

More Information

The material is available at the following link
https://elearning.unica.it
where a copy of the slides used in the course as well as exercises, project, and other additional learning material is uploaded

More Information

The material of this subjects is available in the e-learning platform of the University of Cagliari:
https://elearning.unica.it
where a copy of the slides used in the course, exercises, projects, and other additional learning material is uploaded.

IA/0117/EN - FAULT DIAGNOSIS AND ESTIMATION IN DYNAMICAL SYSTEMS

Academic Year 2021/2022

Free text for the University

Professor

MAURO FRANCESCHELLI (Tit.)

Period

Second 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	5	50

Objectives

In observance with the teaching objectives of the master degree in Computer Engineering, Cybersecurity and Artificial Intelligence, the learning outcome of this course is to let the student obtain basic competences in relation to methods for state and exogenous inputs estimation in dynamical systems; as detailed in the following.

* Knolwedge and understanding:
The student will understand state variable models for the representation of dynamical systems through differential and difference equations and the

structural properties of such systems. The student will understand the most significant methods for state estimation and input reconstruction in dynamical systems, even accounting for some uncertainties in the dynamical models.

* Applying knowledge and understanding:
The student will know how to define the structural properties of a dynamical system. the student will know how to apply the fundamental methods for the design of state observers and unknown input observers (disturbances).

* Making judgements:
The student will be able to identify advantages and disadvantages of some observer designs.

* Communication:
The student will be able to describe with clarity technical and scientific concepts related to the estimation and diagnosis of dynamical systems.

* Lifelong learning skills:
The student will learn how to combine knowledge from various sources with the aim to achieve a wider understanding of the issues related to the design and implementation of systems for state estimation and diagnosis.

Prerequisites

The compulsory propedeutics are listed in the Learning Regulations (Regolamento didattico) of the Degree Course.

To follow the lectures with profit, the student is required to have obtained from previous courses the next knowledge, competencies, and skills:

Elements of mathematical analysis, matrix algebra, geometry, and physics. Laplace Transform. Integral and differential calculus. Representation and analysis

of single input/single output dynamical systems. Elements of Matlab-Simulink programming.

Contents

Introduction (2 hours frontal lectures)

Topics and objectives of the course. Entrance test for prerequisite knowledge.

Representation of dynamical systems (6 hours frontal lectures, 2 hours exercitation)

State space representation of continuous time and discrete time dynamical systems. Analysis of continuous time linear systems. Analysis of discrete-time linear systems, natural and forced response. Discretization of dynamical systems. Canonical forms of linear systems, continuous time and discrete time.

Stability of dynamical systems (Continuous and Discrete-time) (6 hours frontal lectures, 2 hours exercitation)

Equilibrium points. Stability and Asymptotic stability of equilibrium points. Stability criteria for continuous time and discrete-time linear systems. Linearization of a nonlinear system around an equilibrium point. Stability of nonlinear systems: indirect (also called first) and direct (also called second) Lyapunov methods for continuous time and discrete time dynamical systems.

Structural properties of dynamical systems and state feedback (Discrete-time) (6 hours frontal lectures, 2 hours exercitation)

Controllability and Observability. Controllable and observable canonical forms. Controllability and observability matrix. Full-state feedback control by eigenvalue assignment. Design procedure.

Estimation in dynamical systems (Discrete-time) (8 hours frontal lectures, 4 hours exercitation)

The state estimation problem, asymptotic (Luenberger) state observers. Full-order and reduced (minimum) order observers. Design procedure. Observer-state feedback and Separation principle. Kalman filter (Discrete-time) and Extended Kalman filters. Nonlinear systems and High-gain observers.

Fault diagnosis (8 hours frontal lectures, 4 hours exercitation)

Introduction to Fault Detection and Identification (FDI). Methods for model based fault diagnosis. Fault models. The residual generation and evaluation problem. Residual generation by state observers. Unknown input observers. FDI by banks of unknown input observers. Reconstruction of exogenous signals. Parameter and order estimation for linear systems. Residual generation by parameter estimation methods. FDI by online parameter estimation. Open research problems.

Teaching Methods

The course is taught with frontal lectures and exercitations which involve the use of software for numerical calculus and simulation of dynamical systems (Matlab).

Verification of learning

The achievement of the learning objectives is verified by an oral examination in which the students show understanding of state variable models for the representation of dynamical systems, their properties and the most significant methods for diagnosis and estimation. The student will show autonomy in making judgments regarding the design choices proposed in the course. The student will be able communicate with the appropriate technical language. During the oral examination, the student discusses the exercitations developed in the course.

The evaluation of the oral examination is quantified by a mark express in thirtieths.

The oral exam evaluates:
1. The knowledge of the topics of the course (40% final mark)
2. The application of the obtained knowledge (30% final mark)
3. The autonomy in making judgments in regard to design choices (20% final mark)
4. The use of technical language (10% final mark)

Texts

Katsuhiko Ogata, “Discrete-time control systems” second edition, Prentice Hall International editions, 1995

Silvio Simani, Cesare Fantuzzi and Ron J. Patton "Model-based fault diagnosis in dynamic systems using identification techniques" Springer-Verlag 2002.

L. H. Chiang, E. L. Russell and R. D. Braatz “Fault Detection and Diagnosis in Industrial Systems “ Springer 2001

Hassan K. Khalil "Nonlinear systems" third edition, Pearson Eduction Limited 2014.

Jean-Jacques E. Slotine, Weiping Li "Applied Nonlinear Control" Prentice-Hall, 1991.

Alessandro GIUA, Carla SEATZU, Analisi dei sistemi dinamici- 2a edizione, Springer-Verlag Italia, MIlano, 2009.

Other sources and papers provided during the lectures.

More Information

Lecture slides are provided to the students together with the Matlab and Matlab Simulink scripts of examples and exercises.

IA/0121/EN - MEASUREMENTS AND CYBERSECURITY FOR SMART GRID

Academic Year 2021/2022

Free text for the University

Professor

PAOLO ATTILIO PEGORARO (Tit.)

Period

Second 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	2	20

Objectives

The module “Measurements and Cybersecurity for Smart Grid” is designed to provide first year students of the “Laurea Magistrale” Degree in Computer Engineering, Cybersecurity and Artificial Intelligence (Bachelor graduated students) with a deeper understanding of measurements for Smart Grid, with particular attention to monitoring systems and their vulnerabilities.
The module aims at providing an overview of the most important and promising technologies in SG monitoring.
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 measurements for Smart Grids. Knowledge of devices and architectures of the monitoring system and of the criticalities concerning measurement data quality and security.
- Applying knowledge and understanding
Ability to identify, both at design and management level, the fundamenal elements for measurement information communication and elaboration. Ability to analyze the impact of bad data attacks on the monitoring system outcomes.
- Making informed judgements and choices:
Ability to evaluate results, select relevant information and suitable approximations to analyze the measurement systems of interest. The student must test their capability to perform technical choices and justify them.
-Communication skills
Capability to communicate technical information orally and within a presentation. Ability to discuss problems and solutions with specialists and non-specialists.
-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 Computer Engineering, Cybersecurity and Artificial Intelligence" for admission to the first year.
Basic knowledge of electronics and conventional instrumentation for electrical quantities
Knowledge of the fundamental measuring methods and uncertainty evaluation and propagation.

Contents

Introduction (2 hours)
- course presentation

- overview of base measurement concepts

Measurements for Smart Grid (10 hours)
- Phasor Measurement Units (PMUs) and Wide Area Monitoring Systems (WAMS)
- Synchronization issues and techniques
- Measurements for state estimation and network management
- Bad data and measurement information quality

Smart Metering Infrastructure and Cyber Security (10 hours)
- Smart meter and Advanced Metering Infrastructure (AMI)
- Architecture and functional entities of Advanced Metering Infrastructure (AMI)
- Security of AMI
- Vulnerabilities and Threats
- Consumer Privacy within AMI

Teaching Methods

The module is composed of 16 hours of theory lessons and 4 hours of practice, for a total of 20 hours. During the theory lessons, the teacher sets out the topics in the program; whereas during the practice sessions, students can see real devices and understand the actual components of real systems useful to build the measurement infrastructure.

Verification of learning

The assessment of the student's learning outcomes is performed by means of an oral interview, during which the student has to perform a brief presentation (15-20 minutes) on a detailed study she/he has carried on autonomously on a topic among those proposed by the professor (together with possible starting material). The specific topic includes one or more subjects discussed during the course and is intended to bring the attention to practical examples and applications of the theoretical aspects. The knowledge on the measurements for Smart Grid achieved during the course will allow the student to analyze real cases of monitoring

systems and to investigate their vulnerabilities along with possible countermeasures. Each student will be asked to answer specific questions on topics studied during the course starting from the presentation content.
Students will be able to test their capability to find key elements of the communication and computation systems used to transmit and process measurement data. Their capability to evaluate in an auotonomous way best solutions in a specific context and to highlight the approximations needed to analyze the measurement systems will be verified and evaluated.
The score of the examination is provided by a grade out of thirty. To pass the exam the student must attest a basic knowledge of all the topics discussed. In order to achieve the maximum score, the student must demonstrate to know the topics in an excellent way. The assessment takes into account the capability of both effectively presenting the theoretical subjects and highlighting their practical aspects. The capability of summarizing and explaining the concepts during the presentation to an audience of engineers experienced on measurements for Smart Grid but not necessarily expert of the specific application, will be also evaluated. The student, with the presentation, will also prove the ability to deal with scientific and technical literature and to continuously acquire knowledge from literature and/or standards.

Texts

AA. VV.: "Phasor Measurement Units and Wide Area Monitoring Systems", Eds. C. Muscas, A. Monti, F. Ponci, Academic Press, 2016. (PMU, WAMS, state estimation and monitoring architecture)

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.

IA/0134/EN - STOCHASTIC MODELS

Academic Year 2021/2022

Free text for the University

Professor

ALESSANDRO PILLONI (Tit.)

Period

Second Semester

Teaching style

Convenzionale

Lingua Insegnamento

INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[70/91] INTERNET ENGINEERING	[91/00 - Ord. 2018] INGEGNERIA DELLE TECNOLOGIE PER INTERNET	5	50
[70/90] COMPUTER ENGINEERING, CYBERSECURITY AND ARTIFICIAL INTELLIGENCE	[90/00 - Ord. 2018] PERCORSO COMUNE	5	50

Objectives

The course aims to provide an introduction to stochastic models commonly used in telecommunications for the modelling and management of traffic, sizing and planning of shared resources.

--- Knowledge and comprehension skills
The student will learn to model, analize and optimize complex interconnected systems, subject to stochastic inputs and characterized by stochastic performance.

--- Knowledge and applied comprehension skills

The theoretical training will be complemented by a series of examples and applications (from the domain of telecommunication) to stimulate the active participation of the students and develop skills for autonomous reasoning.

--- Making judgements
Students will be capable to critically evaluate the results of the analysis and the design.

--- Communication skills
Practical exercises could be solved in small groups so as to develop the ability to collaborate and critically discuss the encountered problems.

--- Learning skills
The aim of the course is also to help the student integrate the knowledge coming from other, thus acquiring a broader vision of the problems connected with the design and management of telecommunications networks.

Prerequisites

For an effective approach to the study of this course, students should have the following skills.

--- Knowledge
Basics of linear algebra. Esponential and logarithmic functions and their properties. Oridinary linear differential equations. Integrals. Polynomials. Geometric series. Laplace transformation.

--- Capacity
Algebraic and differential calculus. Analysis and representation of functions depending on one or more variables. Variable transformations.

--- Competence

To be able to apply the methods of algebra, differential calculus and function analysis.

Contents

--- Presentation of the course
Introduction to traffic problems and advantages and disadvantages coming from their solution in a discrete event system framework. The importance of formal methods in the telecommunication framework.

--- Probability and stochastic processes
Basic definitions on probability and stochastic processes, fundamental for the understanding of queueing networks and traffic models.

--- Markov chains
Basic definitions. Evolution equations. State classification. Stationary and limit distribution. Ergodicity. Birth-death processes.

--- Queuing theory and basic notions on teletraffic
Basic notions on queuing theory. Classification according to the Kendall notation. Deterministic queues. Stochastic queues with infinity capacity. Stochastic queues with limited capacity and problems of buffers dimensioning. The Engset formula. Stationary and limit distributions. Ergodicity and Little law.

--- Queuing networks
Open queueing networks: traffic equations, Jackson theorem, Little law. Closed queuing networks: equivalent continuous time Markov chain, Gordon and Newell theorem. Examples in the telecommunication framework.

--- Simulation tools
Use of tools for the simulation and analysis of the proposed models, with special focus on tools in a Matlab environment.

Teaching Methods

32 hours devoted to theory*
18 hours devoted to exercises and practical case studies**

* To meet specific educational needs related to the epidemiological situation, the possibility to provide of live streaming lectures or recordings of the same is considered.
** To meet specific teaching needs related to the epidemiological situation, the exercises could be carried out through forms of remote interaction with the available IT supports.

Verification of learning

The final evaluation consists in an oral exam during which the students should show the knowledge of the basic techniques and methods for dealing with the modelling of a stochastic process, while demonstrating the ability of carrying on a critical analysis of its evolution and properties.

He has also to show and adequate expertise in solving resource allocation design problems related with the dimensioning and management of traffic, sizing and planning of systems with shared resources, under given Quality-of-Service specifications.

To pass the exam the student has to demonstrate an appropriate and correct knowledge of the mathematical tools and methods of analysis and design seen during the course, while showing, during the solution of simple exercises, autonomy in making judgments in regard to its design choices.

Furthermore, the student has to show adequate skills in speaking and using a technical language as well as a sufficient synthesis and critical analysis ability.

The final oral examination begins by asking the candidate to present, in English, a topic of his/her choice among the main ones of the course. Based on his/her presentation, the exam will continue by asking the candidate to answer other questions related to the course topics and/or by submitting exercises similar to those seen during classroom exercises.

The oral exam evaluates:
1. The knowledge of the topics of the course (30% final mark)
2. The application of the obtained knowledge to approach the solution of exercises and design problems related with the course topics (30% final mark)
3. The autonomy in making judgments in regard to design choices (30% final mark)
4. The use of technical language (10% final mark)

(*) Students can always ask, via email, to do the final oral exam.
(**) During the final oral examination, under request, the student is allowed to consult the file available at the next url:
https://www.unica.it/unica/protected/224901/0/def/ref/MAT220247/
and consisting of a collection of most of the formulas of interest about Markovian systems.

Texts

--- Notes prepared by prof. A. Pilloni, prof. A. Giua and prof. C. Seatzu
--- Book (available online and free): Zukerman, Moshe. “Introduction to queueing theory and stochastic teletraffic models.” arXiv preprint arXiv:1307.2968 (2013).
--- Chapter 3 and Appendices B, C and D of the book: A. Di Febbraro, A. Giua. “Sistemi ad Eventi Discreti” MvGraw-Hill, 2002, 88-386-0863-6.

More Information

Parts of the lessons will be devoted to numerical exercises that will be solved in class and discussed with the instructor.

The text of the classwork will be regularly provided to the students during the course, or send by email to the students upon specific request.

IA/0140/EN - NETWORKED CONTROL SYSTEMS AND SECURITY

Academic Year 2021/2022

Free text for the University

Professor

MAURO FRANCESCHELLI (Tit.)

Period

Second 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	5	50

Objectives

In observance with the teaching objectives of the master degree in Computer Engineering, Cybersecurity and Artificial Intelligence, the learning outcome of this course is to let the student obtain advanced competences in relation to methods for control and analysis of networked and multi-agent systems also in relationship to security challenges from a control theoretical perspective; as detailed in the following.

* Knolwedge and understanding:
The student will understand formal models for the representation of networked and multi-agent dynamical systems through differential and difference equations

and the structural properties of such systems. The student will understand the most significant methods for analysis and distributed control and their vulnerability against malfunction or external attack.

* Applying knowledge and understanding:
The student will know how to define the structural properties of networked dynamical system in connection with algebraic graph theory and the representation of networks through graphs. The student will be able to characterize the emerging behavior of networks of coupled dynamical systems where the global or collective behavior is caused by simple and local interaction rules among its components.

* Making judgements:
The student will be able to identify advantages and disadvantages of the networked control methods also in relationship their vulnerability to single component failures or attack.

* Communication:
The student will be able to describe with clarity technical and scientific concepts related to networked and multi-agent dynamical systems.

* Lifelong learning skills:
The student will learn how to combine knowledge from various sources, including recent scientific papers, with the aim to achieve a wider understanding of the issues related to the design and implementation of networked systems and their security challenges froma control theoretic perspective.

Prerequisites

The compulsory propedeutics are listed in the Learning Regulations (Regolamento didattico) of the Degree Course.

To follow the lectures with profit, the student is required to have obtained from previous courses the next knowledge, competencies and skills:

Elements of mathematical analysis, matrix algebra, geometry and physics. Laplace Transform. Integral and differential calculus. State space representation and analysis of dynamical systems. Elements of Matlab-Simulink programming.

Contents

Introduction (2 hours frontal lectures)

Topics and objectives of the course. Introduction to networked and multi-agent systems and motivating examples.

Introduction to algebraic graph theory (4 hours of frontal lectures)

Graphs as formal models for networks of dynamical systems. Definition of undirected and directed graphs and their properties. Classes of graph connectivity. Periodic and aperiodic graphs. The condensation graph and its properties. Weighted graphs. The adjacency matrix. Matlab for building and visualizing graphs. Random graphs. Proximity graphs.

Elements of non-negative matrix theory for dynamical systems (4 hours of frontal lectures, 2 hours of exercitation)

Motivating example: consensus and agreement in networks and dynamical systems. Introduction to discrete time linear systems. Definition and properties of non-negative matrices, stochastic matrices, irreducible matrices, primitive matrices, positive matrices. The Gershgorin disks theorem. The Perron-Frobenius theorem. Applications of the Perron-Frobenius theorem.

Discrete-time diffusion of information in networks and consensus (6 hours of frontal lectures, 2 hours of exercitation)

Social networks, multi-robot systems and sensor networks as examples of discrete-time averaging and consensus in networks of systems. Average Consensus algorithms and convergence results. Links between graph theory, matrix theory and dynamical systems and proofs of the results. Convergence rate of consensus algorithms.

Design of edge of weights: equal neighbors model and Metropolis Hasting weights. Centrality measures: degree centrality; eigenvector centrality; Katz centrality; Pagerank centrality; closeness and betweeness centrality.

The Laplacian matrix and continuous-time consensus protocols (4 hours of frontal lectures, 2 hours of exercitation)

Definition of the Laplacian matrix. Structural properties. Examples on mechanical and electrical networks. Rank of the Laplacian matrix. Spectrum of the Laplacian matrix. Definition and meaning of algebraic connectivity, example on clustering problem.

The Laplacian flow dynamics. Examples of physical netoworks that evolve according to the Laplacian flow (mechanical/electrical networks). Second order Laplacian flows and their applications to multi-robot systems. Consensus theorems and convergence results.

Coordination of multi-robot networks (8 hours of frontal lectures, 2 hours of exercitation)

Advanced Lyapunov stability analysis for nonlinear systems and invariant set

theorems. Application scenarios of multi-robot systems. The rendezvous and leader following problem.

Introduction to coordination of mobile multi-robot system. The method of artificial edge potentials. Flocking and formation control. Design of artificial potentials for nonlinear rendevous, flocking, collision avoidance, connectivity maintenance. Convergence criteria.

Definition of rigid graphs, Infinitesimal rigidity, rigidity matrix and properties of its rank. Minimally rigid graphs and the Hanneberg sequence. Stability of rigid formations.

Control over wireless networks (6 hours of frontal lectures)

Motivating examples. General linear systems with packetdrops. Lyapunov theory for Mean Square Stability of Linear Systems with Packet Drops. Vulnerability to jamming or DoS cyber-phisical attacks. Consensus via randomized Gossip algorithms.

Secure data aggregation and coordination (6 hours of frontal lectures, 2 hours of exercitation)

The bizantine generals problem. Majoritiy voting. Modeling Malicious agents. Calculating functions in the presence of malicious agents. Selection of recent results and open research problems on security for networked systems: Secure consensus, Resilient distribution optimization.

Teaching Methods

The course is taught with frontal lectures (40 hours) and exercitations (10 hours) which involve the use of software (Matlab) for numerical calculus and simulation

of dynamical systems. A total of five assignments with practical and theoretical exercises are proposed during the exercitations and discussed in class to guide and test the understanding of the topics by the students during the course.

Verification of learning

The achievement of the learning objectives is verified by an oral examination in which the students show understanding of the formal models of networked and multi-agent systems, their properties and the methods for their analysis and control. The student will show autonomy in making judgments in regard to the design choices proposed in the course. The student will be able communicate with the appropriate technical language. During the oral examination, the student chooses to discuss either the course assignemnts or a small project developed on the topics of the course and agreed upon with the lecturer.

The evaluation of the oral examination is quantified by a mark express in thirtieths.

The oral exam evaluates:
1. The knowledge of the topics of the course (40% final mark)
2. The application of the obtained knowledge (30% final mark)
3. The autonomy in making judgments in regard to design choices (20% final mark)
4. The use of technical language (10% final mark)

Texts

Lecture slides/notes

F. Bullo, Lectures on Network Systems, v0.85, 2017

F. Bullo, Lectures on Network Systems , v1.4, 2020
http://motion.me.ucsb.edu/book-lns/
Suggested readings:

othre suggested readings:

Mehran Mesbahi and M. Egerstedt, Graph Theoretic Methods in Multi-agent Networks, Princeton University Press, 2010

Ishii, Hideaki, and Roberto Tempo. "The PageRank problem, multiagent consensus, and web aggregation: A systems and control viewpoint." IEEE Control Systems 34.3 (2014): 34-53.

Other sources and papers provided during the lectures.

More Information

Lectures notes/slides are provided. Five assignments and their solution is discussed during the lectures.

IA/0146/EN - MIXED-SIGNAL CIRCUITS AND SYSTEMS

Academic Year 2020/2021

Free text for the University

Professor MASSIMO BARBARO (Tit.)

Period Second Semester

Teaching style Convenzionale

Lingua Insegnamento INGLESE

Informazioni aggiuntive

Course	Curriculum
[70/83] ELECTRONIC ENGINEERING	[83/00 - Ord. 2018] PERCORSO COMUNE

Objectives

Acquiring knowledge and understanding: understand the basic mechanisms of mixed-signal (analog and digital, integrated and discrete) circuits.
Applying knowledge and understanding: develop the ability to analyze a mixed-signal system made up of several analog and digital modules (on the same chip or board) and determine its behavior and optimize its performances.
Making informed judgement and choices: develop the ability to properly use CAD/EDA tools and decide a design approach for systems-on-chip or system-on-board
Communicating knowledge and understanding: getting the technical language of design.
Capacities to continue learning: ability to read a datasheet and apply theory to development of new systems on chip or systems on board.

Prerequisites

Basic knowledge of analog and digital electronic devices and circuits

Contents

Design of analog integrated circuits: design entry (Virtuoso Composer), simulation environment (ADE Analog Design Environment), HDL for analog circuits (Verilog-A), simulation (Spectre)
Design for manufaturing: Monte-Carlo and corner analyses
Front-end of Line (FEOL): layout design (Virtuoso), DRC and LVS (Assura), post-layout simulation
RTL-to-silicon: design entry and digital simulation (NC-verilog), synthesis (Genus)
Mixed-Signal: analog-digital co-simulation
Back-end of Line (BEOL): Floorplan, Place&Route, Clock-tree generation, Tape-out (Innovus)
Design of Printed Circuit Board (PCB) with OrCAD-Allegro
Design example (sigma-delta ADC, digital interfaces)

Teaching Methods

Lectures (30h) and lab sessions (30h). Lectures are interactive and meant to stimulate the students to propose solutions and ideas.

Verification of learning

The assessment of the exam involves the development of a small project which, for the students following the lessons, will be partially developed during the hours of practice.
The student will have to demonstrate to be able to develop a module of a mixed-signal system through the conception of the block diagram, the development of the single blocks, their simulation and implementation on CAD.
The score of the exam is given by a mark expressed in thirtieths, determined for 80% by the evaluation of the project and for the remaining 20% by its presentation.

The active participation of the students in the exercises will contribute to the evaluation of the project.
In the evaluation of the exam the determination of the final grade takes into account the following elements:
1. Ability to partition the problem into its components
2. Ability to develop the required analog and digital modules
3. Simplicity and clarity of the project
4. Use of CAD

The fulfillment of aspect 1 is a necessary condition for the achievement of an evaluation equal to 18. The votes above 18 will be awarded to the students whose tests satisfy all four aspects listed above.

Texts

Lectures slides and other material provided by the professor.

More Information

To meet specific educational needs related to the epidemiological situation, it is possible that some lectures will be live streamed or that recording of the lectures will be made available online. Furthermore, the lab sessions could be carried out through forms of remote interaction with the available IT supports.

IA/0147/EN - ANALYSIS AND CONTROL OF CYBER-PHYSICAL SYSTEMS

Academic Year 2020/2021

Free text for the University

Professor

ALESSANDRO GIUA (Tit.)

Period

Second 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

Objectives

This is an advanced course presenting a wide range of techniques for the analysis and control of cyber-physical systems. Both discrete event and hybrid models will be considered.

Dublin descriptors:
- Knowledge and understanding of cyber-pysical systems and of the formalism used to describe them.

- Applying knowledge and understanding to solve original problems concerning modeling, analysis and control of cyber-physical systems.
- Making judgements: how to manage the complexity of a cyber-physical system, selecting an appropriate mathematical model.
- Communication skills: precise description of the dynamical behavior of a cyber-physical system and of its specifications.

Prerequisites

Competences acquired in introductory courses (laurea degree) on the analysis and control of continuous-time linear dynamical systems described by input-output and state variable models

Contents

1 - Classification of dynamical systems (2h lecture)
Time-driven systems. Discrete-event systems. Hybrid systems.

2 - Automata models for discrete event systems (10h lecture + 4h homework)
Formal languages: alphabets and words, languages and operators. Deterministic finite automata: languages and properties. Nondeterministic finite automata and their languages. Equivalence between deterministic and nondeterministic automata. Fault diagnosis using automata: diagnoser, diagnosability. Modeling with automata and concurrent composition.

3 - Supervisory control of discrete event systems (6h lecture + 2h homework)
Plant, specification, supervisor and closed-loop system. Controllability and supremal controllable sublanguage. Supervisory design for language specifications. Supervisory design for state specifications.

4 - Hybrid systems and hybrid automata (8h lecture+ 2h homework + 2h lab)
State variable models of time-driven systems. Examples of hybrid systems. Autonomous hybrid automata and generalizations. Hybrid automata with inputs.

Evolution of a hybrid automaton. Pathological cases of continuous and hybrid evolutions.

5 - Reachability analysis of hybrid systems (8h lecture + 2h homework + 2h lab)
State transition systems (STSs). STS associated with a hybrid automaton. Reachability of a STS. Equivalences between states of a STS. Bisimulation between states of an STS and quotient system. Classes of rectangular automata. Timed automata: regions, equivalence between states and region graph. Initialized rectangular automata and reduction to timed automata. Elements of model checking.

6 - Stability and stabilization of linear switched systems (8h lecture + 2h homeworks + 2h lab)
Elements of stability for linear and time invariants systems. Direct method of Lyapunov. Quadratic forms and singular values. Stability analysis of switched systems by common Lyapunov function. Quadratic Stabilization Stabilization by slow switching.

Teaching Methods

The course includes theoretical lectures (42h) and exercise sessions (18h). Exercises assigned to students shall be solved in class or in the lab under the instructor's supervision and later discussed in class.

Due to the covid-19 emergency, lectures and exercise sessions may also be offered via streaming or recorded videos.

Verification of learning

All exams are oral.

Students attending classes are also offered the additional option of passing the exam taking a mid-term and a final written test.

Texts

A. Giua, Notes for the course Analysis and Control of Cyber-Physical Systems. 2020.

More Information

The course website collects useful material to prepare the exam and further explore topics of interest.

IA/0150/EN - MICROWAVE SYSTEMS FOR REMOTE SENSING

Academic Year 2020/2021

Free text for the University

Professor

GIORGIO MONTISCI (Tit.)

Period

Second 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

Knowledge and understanding of the electromagnetic behaviour and design criteria of passive microwave components at microwave frequencies.

Applying knowledge and understanding: to
be able to define and evaluate the operative features of microwave system, starting from its electromagnetic behaviour.

Making judgements: provide a critical and synergistic use of the methods and techniques for the analysis and design of microwave components and circuits.

Communicating skill: To be able to clearly express technical ideas and proposals.

Learning skills: To be able acquire information from different sources in order to achieve a deeper and conscious insight in the electromagnetic characterisation of microwave components and circuits.

Prerequisites

knowledge of the main physical phenomena related to electromagnetic field propagation; Transmission Line Theory; differential calculus; ordinary differential equations; vectorial algebra; matrices; eigenvalues and eigenvectors; Fourier and Laplace transform.

Contents

- Planar Microwave Filters
- Waveguides
- Antennas and Microwave Sensors

Teaching Methods

Lecture = 56 h
Exercises & Laboratory = 14 h

Verification of learning

The final evaluation of the student consists of an oral test in which several questions are proposed about microwave components and systems.
The student must demonstrate the knowledge of the criteria for the analysis and design of microwave components and systems.

The score of the examination will be mainly attributed based on the answers to the questions proposed in the final oral examination.

In order to pass the exam the student must demonstrate a sufficient knowledge of all the topics of the course, a basic knowledge of the topics covered in the tutorials and laboratory work.
To achieve a score of 30/30 cum laude, the student must demostrate an excellent knowledge of all the topics covered during the course.

Texts

David M. Pozar: Microwave Engineering

More Information

The notes of the lectures will be available after each lesson.

IA/0151/EN - WEARABLE AND FLEXIBLE ELECTRONICS

Academic Year 2020/2021

Free text for the University

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/0152/EN - BIOSENSORS AND BIOELECTRONICS

Academic Year 2020/2021

Free text for the University

Professor	STEFANO LAI (Tit.)
Period	Second Semester
Teaching style	Convenzionale
Lingua Insegnamento	INGLESE

Informazioni aggiuntive

Course	Curriculum
[70/83] ELECTRONIC ENGINEERING	[83/25 - Ord. 2018] ELECTRONIC TECHNOLOGIES FOR EMERGING APPLICATIO

Objectives

The course will provide to students a general introduction to the principal application fields of bioelectronics, with a particular focus on theoretical and pratical aspects in biosensor design. The main characteristics of biointerfaces, where interaction between biological matter and inorganic materials take place, will be discussed. Transduction strategies for biochemical signals and biopotential will be analized. State-of-the-art and the most up-to-date trends in literature about biosensor technologies and applications will be deepened.
-Acquiring knowledge and understanding: the student will learn fundamental concepts, technologies and issues related to the development of bioelectronic applications;
-Appying knowledge and understanding: the student will be able to apply the foreground on bioelectronics, biointerfaces and electronic devices for the analysis and design of bioelectronic and biosensor systems;

-Making informed judgements and choices: the student will be able to understand data and plots related to bioelectronic applications, deriving information about properties of biointerfaces, biosensors and biopotentials, evaluating performances and, if necessary, defining strategies for performance improvement and optimization;
- Communicating knowledge and understanding: the student will be able to report about the foreground using appropriate technical terms, and to use appropriate metrics to describe performances of considered applications:
- Capacities to continue learning: the student will be able to integrate the concepts related to different fields physics, chemistry, biology and electronics for the design and analysis of bioelectronic systems; the student will be also able to integrate the concepts provided during lessons with the most up-to-date results reported in literature.

Prerequisites

Basic concept of physics, physic of the solid matter, chemistry and electronic devices are fundamental prerequisites. A basic knowledge of softwares for data elaboration and presentation is preferential.

Contents

-Introduction: bioelectronics – general definition and application fields;
-Basics of chemistry: chemical elements, biochemical reactions and their kinetic; the chemistry of water: acids, bases and pH;
-Basics of biochemistry: biochemical and electrical properties of biomolecules (lipids, carbohydrates, peptides and nucleic acids);
-Basics of biophysics: electrostatic interactions in liquids; physics of membranes; basics on spectroscopy;
-Cells: cell organization, cell membrane and ionic transport through cell membrane; action potential and its propagation; from action potential to basic biopotentials (ECG, EMG, EOG, EEG).
-Basics of electrochemistry: electrochemical cells, electrode/electrolyte interface

and reactions at the electrode surface, reference electrodes and electrochemical techniques;
-Standard techniques for biochemical investigations;
-Biosensors: definition and classification of biosensors with respect to transduction mechanism (optical, gravimetric, electrochemical, electronic). Biosensors for the detection of biomolecules; technologies for biosensors.
-Acquistion of bielectrical signals: electrodes for the acquisition of bioeletrical signals. Recording of action potentials and biopotential; instrumentation for readout and conditioning of biopotentials.

Teaching Methods

The main part of the course will be organized in theoretical lectures. Practical activities will be carried out in class at the end of each module. During these activities, students will be divided into small groups and they will be asked to solve tests about the theory discussed during the lectures. These practical activities will be partially supervised in class, and will be completed autonomously by students. They will be mandatory, and a final report must be provided by students.
In observance of possible limitations related to the epidemiologic situation, lessons and classroom exercizes could be provided with different modalities (recordings or live streaming) through available platforms.

Verification of learning

Two modalities are foreseen:
- project + oral on part of the program (defined by the teacher);
- oral on the whole program of the course

Texts

- Florinel-Gabriel Banica, "Chemical Sensors and Biosensors - fundamentals and applications" - Wiley ED.

-Pethig, R. R., & Smith, S. (2012). Introductory Bioelectronics: For Engineers and Physical Scientists. John Wiley & Sons.

More Information

Slides employed during lessons will be provided as a support for study. Basic concept provided in the course will be integrated with the most up-to-date publications in the field of bioelectronics.

SM/0099/EN - USER INTERFACE TECHNOLOGIES

Academic Year 2021/2022

Free text for the University

Professor

LUCIO DAVIDE SPANO (Tit.)

Period

Second Semester

Teaching style

Convenzionale

Lingua Insegnamento

INGLESE

Informazioni aggiuntive

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

Objectives

Knowledge and understanding

The course provides the knowledge for understanding and exploiting different technologies for developing user interfaces, starting from the simplest ones (form-based on a single device) to the more complex ones (multi-device, augmented and virtual reality etc.), with examples of different interaction styles and modalities. The student will learn how to prototype them in an effective way, in order to include different techniques into the application at hand. Finally, the course will discuss the software architectures for developing user interfaces their evolution through the user interface history and examples of modern development

toolkits.

Applying knowledge and understanding

The student will be able to engineer and develop advanced user interfaces, integrating different development technologies, managing their complexity and guaranteeing the overall usability. Moreover, s/he will be able to analyse the technical requirements and the development cost for the different interaction styles and modalities. These skills will be consolidated with the final project, consisting in the ideation of an innovative interactive project. Finally, the student will learn how to use his/her knowledge for taking a decision in a project.

Making judgments

The student will be able to judge autonomously advantages and disadvantages of applying different interaction styles and modalities according to the application at hand. According to this judgment, s/he will be able to take decisions autonomously in both design and implementation.

Communication

The student will develop an advanced knowledge of the technical language used for describing the development of the user interfaces in human computer interaction, on oral and written, with a particular focus on writing technical documentation in English. The student will be able to explain and discuss interaction problems related to different modalities, confronting with both professionals and not expert people e.g., the different stakeholders involved in involved in the development process.

Lifelong learning skills

The teaching material consists mostly of scientific literature and technical toolkit documentation. This will help the student in approaching state of the art sources for the discipline in the future.

Prerequisites

The course requires a basic human computer interaction knowledge (Human Computer Interaction course from the Bachelor Degree) and a good knowledge of programming techniques (Computer Science Bachelor Degree or equivalent).

Contents

1. Introduction: the past, present and future of user interfaces (2h, 3h lab)
2. User Interface Architecture and Toolkits (6h lectures, 9h lab)
3. Information Visualization (4h lectures, 6h lab)
4. Gestural Interaction (4h lectures, 6h lab)
5. Virtual, Augmented, Mixed and Extended Reality (6h lectures, 9h lab)
6. Computational Interaction (2h lectures, 3h lab)

Teaching Methods

The course consists of lectures (24h) and lab sessions (36h). Lectures will discuss the course topics. Students will apply them through a group project, consisting of the ideation, design, implementation, and evaluation of an advanced user interface, using one or more techniques discussed in the course. Students will write a paper describing the interface and they will present it at the end of the course.

In accordance with the Manifesto of Studies for the A.Y. 2021-22, and compatibly

with the circumstances due to the pandemic situation, 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.

Verification of learning

For passing the exam the student is required to perform 4 tests:

- A test on the course topics (singularly, 20% of the final grade)
- Develop a project in a small group (group, 40% of the final grade)
- A paper on the project in English (group, 20% of the final grade)
- The project presentation (group, 20% of the final grade)

The grades are individual even for group assignments.

Texts

The teaching material consists mainly of scientific literature on the different topics, that will be provided to the student through the Moodle platform.

More Information

The high-quality final projects will be submitted as posters or demos in HCI related conferences.

SM/0171 - DECISION SCIENCE

Academic Year 2021/2022

Free text for the University

Professor

MASSIMO DI FRANCESCO (Tit.)
ENRICO GORGONE

Period

Second Semester

Teaching style

Convenzionale

Lingua Insegnamento

ITALIANO

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 1st year of the Master Degree in Computer Science.
This course aims to provide students with a deep knowledge in the theory and practice of (Integer) Linear Optimization, which has relevant applications in computer science, economics, engineering, as well as a number of other domains.
The goals of the course are the following:
▪ To teach students how to model several problems by (Integer) Linear Optimization
▪ To present the state-of-the-art in the theory and practice for solving (Integer) Linear Optimization problems.

▪ To provide students with a rigorous analysis of algorithms for (Integer) Linear Optimization.

2. Ability to apply knowledge and understanding.

Students must apply the methods presented in the course to solve realistic problems, which are similar to those faced in the lectures. In the oral exam student must explain how some algorithms work.

3. Autonomy of judgment.

The modelling stage will be put in the position of critically thinking at the problem setting, evaluating which data are requested in their formulation. Students must also evaluate the most suitable algorithms to solve specific models.

4. Communicative Skills.

Communicative skills will be further evaluated in the oral exam.

5. Learning Skills.

The course provides students with sufficient 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 Discrete Mathematics and Numerical Analysis, which can be learned both in the Bachelor Degree Program and in the Master Degree Program.

2. Skill. Students must be able to read and formalize algorithms' pseudocodes.

3. No a-priori competences is requested.

No exam has to be passed before the exam of Decision Science.

Contents

▪ Mathematical Programming
▪ Linear Programming Models
▪ The simplex Method
▪ Duality theory
▪ Integer Programming

Teaching Methods

The course consists of 48 hours of lectures in Italian. 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.

- 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

Matteo Fischetti. Lezioni di Ricerca Operativa. Kindle Publishing (2018).
Bersimas D., Tsitsiklis J.N. Introduction to Linear Optimization. Dynamic Ideas (1997).

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/0180/EN - QUANTUM OPTICS

Academic Year 2021/2022

Free text for the University

Professor

ANGELICA SIMBULA (Tit.)

Period

Second 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	[68/60 - Ord. 2020]	FOTONICA E NANOMATERIALI	6	48
[60/68] PHYSICS	[68/70 - Ord. 2020]	TEORIA, SIMULAZIONE E PROGETTAZIONE DI NUOVI MATERIALI	6	48
[60/68] PHYSICS	[68/80 - Ord. 2020]	FISICA TEORICA DELLE INTERAZIONI FONDAMENTALI	6	48

Objectives

The course aims to provide Master students a general description of phenomena linked to the quantization of electromagnetic field and of the applications of non-classical states of light. After few introductory lessons, the first part of the course will be devoted to quantization of electromagnetic field, starting from a semiclassical approach, highlighting how it affects photon statistic. The main non-classical states of light (vacuum field, coherent states, squeezed states, Fock states) will be defined together with the corresponding quantum-mechanical operators. Besides giving a deeper view of the implications of quantum mechanics,

the first part of the course will introduce properties of light that cannot be explained with a semiclassical approach. This will be achieved also analysing some key experiments, that are at the basis of experimental techniques which are still used to characterize quantum states of light. This first part will provide the tools necessary to face the following second part, where quantum technologies will be then introduced, focusing on quantum communication and computing and on their implementation with optics and integrated photonics, bringing the student close to strongly innovative topics. The last part of the course deals mainly with resonant radiation-matter interaction and cavity effects in weak- and strong-coupling regimes, always exploiting what learned in the previous parts of the course.
The student will be asked to actively take part to the lessons and to solve exercises in order to consolidate the topics of the course. Along all the course there will be a constant link to literature, keeping a connection between the course topics and the research activity in this field, both from fundamental physics and technological applications point of views.

Prerequisites

The student must know the classical treatment of electromagnetic field and be familiar with Dirac notation of quantum mechanics, together with a basic knowledge of structure of matter and of classical optics.

Contents

A first introductory part will be dedicated to a refreshment of arguments needed to understand the following lessons, with topics chosen depending on students background (may include: nonlinear optics, quantum mechanics, pure and mixed states), about 2 or 3 lessons. The course is then composed by three main parts:

FIRST PART – Electromagnetic field quantizazion and non-classical states of light (about 10 lessons)
Quantization of electromagnetic field, vacuum field, Casimir effect, Fock States,

Coherent states, representation method. Squeezed states generation and homodyne detection technique, applications in gravitational wave detection. Photon statistics (possonian, super- and sub- poissonian), photon detection, shot noise and noise suppression, bunching and antibunching. Hanbury-Brown Twiss experiment, first and second order correlation function.

SECOND PART: Quantum Technologies (about 8 lessons)
KLM scheme, single photon sources and detectors. Quantum bits and quantum computing , Bloch sphere, different implementations on qubits and logic gates, semiconductor and photonic quantum processors.
Bell's Theorem, Bell and CHSH inequalities violation experiments, Franson interferometer. Indistinguishable photons, Hong-Ou-Mandel effect, entangled photon pairs. Exercise with quantum computer about Bell states and GHZ states. Quantum communication and quantum cryptography protocols, QKD distribution, BB94 protocol.

THIRD PART: Atom-photon interaction (about 4 lessons)
Radiative transitions, resonant light-atom interaction in weak- and strong-field limit, Rabi oscillations. Atom-photon interaction in cavity in weak and strong coupling regime, photon lifetime in optical resonators, Purcell effect, Rabi splitting and vacuum Rabi splitting, integrated resonators and photonic crystal cavities.

Teaching Methods

The course will rely mainly of frontal teaching, with the help of a blackboard and slides, which could be provided to students before each lesson, if asked. Several exercises will be dedicated to the most important topics, and may be connected to the analysis of published works in literature. Depending on the epidemiological situation several exercises in presence are planned, including an exercise with IBM quantum computer platform on browser, and in optical spectroscopy laboratory.

Educational activities A.A. 2021/2022
Lessons will be given mainly in presence, integrated and “augmented” with online strategies with the aim of guarantee an inclusive and innovative fruition.

Verification of learning

The student evaluation will be based on the proposed exercises and a final oral exam that will consist of a seminar about a chosen topic, with deepening including references to literature. At the end of the seminar, there will be a discussion based also on the other topics of the course that can be linked to it. The student must be able to clearly explain and discuss the chosen topic also referring to other parts ot the course. The score of the exam is expressed in thirtieths (1/30); 18/30 is the minimal threshold to pass. The exam is aimed at verify the level acquired by the students, based on the criteria described in "Knowledge and understanding capability". To pass the exam with maximum score (30/30 "cum laude") students should actively participate to lessons, correctly solve all the proposed exercises, and demonstrate to have the capability to elaborate a deep and critical analysis of the chosen topic and to connect it to other parts of the course, during the final exam.

The determination of the score considers the following elements:
1. Active participation during frontal lessons
2. Correct solving of the proposed exercises
3. Clarity in the exposition of the final seminar
4. Capability to argue and discuss during and after the seminar

Texts

Main textbook:
Mark Fox - Quantum Optics: An introduction - Oxford Universtity Press

Supplementary textbooks

Rodney Loudon - The Quantum Theory of Light - Oxford University Press
Scully, Zubairy – Quantum Optics - Cambridge University Press
Gerry, Knight – Introductory Quantum Optics – Cambridge University Press

More Information

The teacher will make available at student's disposal: recordings of online lessons (depending on epidemiological status), slides end eventual supplementary materal such as reviews, paper.

SP/0014 - CONTEMPORARY CHINA

Academic Year 2021/2022

Professor BARBARA ONNIS (Tit.)
Period Second 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 aims at providing students with the methodological and analytical tools useful to interpret both the domestic policy and the foreign policy of the People's Republic of China during the Cold War and the post Cold War period, with particular reference to the problems posed to the Party-State by the end of socialism in the West, and thus by the collapse of the bipolar system and the development of a new more complex geopolitical order; and China's contemporary effort to re-gain its status as a global power and behave as a responsible power, in order to boost its influence all over the world.
In accordance with the Dublin descriptors, at the end of the course, students will have acquired specialized knowledge on Contemporary Chinese issues, pertaining to both domestic and foreign policy domains, and will master the fundamental tools for reading and interpreting the current international reality, in which China plays an increasingly important role. At the same time they will have gained autonomy of judgment over the political choices of the Chinese government both at domestic and foreign policy level; comunicative abilities based on the proper use of the proper language of the domestic and foreign policy of the RPC; finally, they will have developed autonomous learning skills within China's domestic and foreign policy.

PREREQUISITES

Good basic knowledge of the history and institutions of Contemporary China
Good knowledge of contemporary history and international relations of East Asia.
Knowledge of the English language at least at the pre-intermediate level (Level B1 of the Common European Framework of Reference for Languages).

CONTENTS

IINTERNAL POLITICS

- Reform and openness policies and China's integration in the international system
- Strategies to maintain political and social stability: The resilience of the Chinese Communist Party through the five generations of Chinese leadership

FOREIGN POLICY

- The different stages of PRC's foreign policy: from self-imposed isolation to global cooperation
- China's foreign policy principles and instruments
- Chinese foreign policy actors
- Chinese Scholars and the debates on China's foreign policy (case studies)
- Soft power with Chinese characteristics as an instrument for China's global growth and a tool for forging a "model"
- The turn to multilateralism and the gradual participation to the regional and international organizations
- China as a responsible power (analysis of specific case studies: - China and the Asian Financial Crisis: China and the use of veto power; China's growing involvement in the UNPKO)
- Beijing's growing participation in the global governance: from climate change to health issues
- China and the implementation of the 2030 Agenda for Sustainable Development
- China and the Covid-19 crisis: from 'virus spreader' to 'world savior'

- The new “Wolf Worriors diplomacy” and its implications for China’s Foreign Policy
- The implications of the Coronavirus for China’s international relations

TEACHING METHODS

36 hours: 14 two-hours lectures and 4 two-hours seminars, with the collaboration of external lecturers.
Lectures will be held with the help of PPT, videos, distribution of copies of documents, newspapers’ articles, and other useful texts to stimulate the classroom debate and prepare the final exam.

VERIFICATION OF LEARNING

Oral exam divided into two parts:

1) PPT presentation on topics covered during the course and examined in-depth with the reading of the bibliographic material (and other documents) made available by the lecturer (50%).

2) Traditional oral test (50%).

The evaluation of the determination of the final mark will take into account 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, as well as the links domestic and foreign policies;
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 and domestic and foreign policy (point 2) with acceptable argumentation (point 1) and a good general language (point 4).

In order to get 30 cum laude the student must 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

Essential:

- M. Lanteigne, Chinese Foreign Policy. An Introduction, Routledge, 4 edition 2019 (selected chapters)
- Feng Huiyun, He Kai and Yan Xuetong (eds.), Chinese Scholars and Foreign Policy. Debating International Relations, Routledge, 2019 (selected chapters)

Additional readings:

- A.-M. Brady, Authoritarianism Goes Global (II): Chinas Foreign Propaganda Machine, Journal of Democracy, vol. 26, n. 4, October 2015, pp. 51-59, https://www.wilsoncenter.org/article/chinas-foreign-propaganda-machine
- China's Progress Report on Implementation of the 2030 Agenda for Sustainable Development (2019), https://www.fmprc.gov.cn/mfa_eng/topics_665678/2030kcxfzyc/P020190924780823323749.pdf
- P. Haenle, What the Coronavirus means for China's Foreign Policy, 11 March 2020, https://carnegieendowment.org/2020/03/11/what-coronavirus-means-for-china-s-foreign-policy-pub-81259
- Kawashima Shin, COVID-19, China, and the World Order, April 7, 2020, https://www.nippon.com/en/in-depth/d00553/covid-19-china-and-the-world-order.html
- M. Lanteigne, The Role of UN Peacekeeping in China's Expanding Strategic Interests, US Institute of Peace (2018), https://www.jstor.org/stable/pdf/resrep20238.pdf
- L. Jakobson and Ryan Manuel, How are Foreign policy decisions made in China?, Asia & the Pacific Policy Studies, vol. 3, no. 1, 2016, pp. 101110 ,

https://onlinelibrary.wiley.com/doi/pdf/10.1002/app5.121
- E. Proper, “The Roar of Wolf Warriors: China’s Increasingly Aggressive Diplomacy”, in INSS Insight No. 1419, December 31, 2020, https://www.inss.org.il/publication/china-policy/
- J. Wuthnow, Xin Li & Lingling Qi, Diverse Multilateralism: Four Strategies in Chinas Multilateral Diplomacy, in Journal of Chinese Political Science, vol. 17, n. 3, September 2012, pp. 269-290 https://link.springer.com/article/10.1007/s11366-012-9202-6
- D. Cheng, “Challenging China’s Wolf Warriors Diplomats”, The Heritage Foundation, July 6, 2020, https://www.heritage.org/sites/default/files/2020-07/BG3504.pdf

MORE INFORMATION

Lessons' slides will be provided to students.
At the end of the course, a list of potential questions will be provided to students for the preparation of the oral part of the exam.

The Course of Contemporary China is taught entirely in English and there will be seminars by external researchers that will focus on specific topics.

SP/0071 - ECONOMICS OF GLOBALIZATION

Academic Year 2021/2022

Professor ANNA MARIA PINNA (Tit.)
Period Second Semester
Teaching style Convenzionale
Lingua Insegnamento INGLESE

Informazioni aggiuntive

Course	Curriculum	CFU	Length(h)
[2/66] INTERNATIONAL RELATIONS	[66/00 - Ord. 2018] PERCORSO COMUNE	6	36

OBJECTIVES

The aim of this course is to provide basic knowledge of international trade, trade policy and on the functioning of international organizations in regulating flows between countries (assessment of knowledge and understanding). The course aims as well at providing tools for evaluating the role of a country in the global system (assessment of the ability to apply knowledge and understanding). During lectures the recent process of globalization will be critically discussed with respect to the several aspects which contribute to the increased integration at the global level and to the different development paths at the country level (evaluation of making judgment).

At the end of the course students will be able to:
1. critically discuss the most important international trade theories (both their theoretical foundations and empirical validations) and the principles which led to the rise and functioning of international organizations which regulate flows between countries; (assessment of knowledge and understanding; evaluation of making judgment)
2. prepare and discuss a Country Report summing up main indicators assessing the position of a country in the global system; (assessment of communication skills; assessment of the learning process)

PREREQUISITES

Undergraduate level statistics, micro and macroeconomics

CONTENTS

1. Cause and Consequences of International Trade

a) The Globalization process in history.
b) Globalization now: Outsourcing, and Multinational Enterprises (First and Second Unbundling - Richard Baldwin)
c) The Gravity Model
d) The Comparative Advantage Theory
e) Economies of Scale and International Trade
d) Firms in the Global Markets: stylized facts

2. Trade Policy
a) The Instruments of Trade Policies

TEACHING METHODS

The course develops in 36 hours of lectures, 8 of which will be developed with the active participation of students in the form of presentations to the class, 4 of which will be run in the computer LAB

Con riferimento alle “Modalità di erogazione della didattica A.A. 2021/2022”, come riportato nel Manifesto Generale degli Studi si stabilisce che “la didattica verrà erogata prevalentemente in presenza, integrata e “aumentata” con strategie on line, allo scopo di garantirne la fruizione in modo innovativo e inclusivo”

VERIFICATION OF LEARNING

5 credits of final mark: written examination with questions on main IT trade theories (assessment of knowledge and understanding), on concrete trade policy cases and on the functioning of international trade organizations (assessment of the ability to apply knowledge and understanding).

1 credit of final mark: writing of a country / firm report based on the analysis of international trade data (evaluation of making judgement).

The use of proper language represents another important element in the evaluation process (assessment of communication skills).
Students who do not present a Report by the assigned deadline will be asked to comment on a set of international trade indicators referred to one or more countries (assessment of the ability to apply knowledge and understanding; evaluation of making judgment). The use of proper language represents a fundamental element in the evaluation process (assessment of communication skills).

To determine the final grade the following elements will be considered:
- The proper use of the model
- The use of graphs
- The ability to explain through intuitive language the solution
- The logic of the reasoning presented

The evaluation of the report will be based on the following points:
- Completeness of the dimensions under study (import-export - trade balance - trade policy participation and involvement in main international trade organizations);
- Lack of discussion unrelated to the position of a country in the international markets;
- Indication of sources of information in data elaborations, graphs, tables and comments (just including a final list of References is not sufficient);

- A clear link between the discussion graphs and tables presented;
The final grade is out of thirty. To achieve a maximum score in the written examination, the student must show that they 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.

Participation in-class activities are quite recommended, although it does not enter the evaluation it is considered an important part of the training for students who are preparing for an international relations career.

Telematic (distance) exams will be done according to the following procedure:
1. One or more groups of multiple-choice tests
2. Open questions demands
3. Oral exam
The date and time for 1 and 2 will be communicated through esse3 system, after that, you will have the calendar for part 3.

TEXTS

International Economics: Theory and Policy
Paul R. Krugman, Maurice Obstfeld, Marc Melitz
ISBN-10: 0138018987 ISBN-13: 9780138018986

- Further info:
http://catalogue.pearsoned.co.uk/educator/product/International-Trade-Theory-and-Policy-OLP-with-etext-Global-Edition/9781292074061.page
Chapters: 1-2-3(3.1-3.2-3.3-3.4)-5 (5.1-5.2)-9

Or

Chapter 18 of The Economy ebook developed by the CORE project: www.core-econ.org

Dani Rodrik, The Globalization Paradox (Chapters 1-4; 7-10)

Richard Baldwin, 2018 The Great Convergence - First and Second Unbundling

Other readings for those interested in the argument
https://voxeu.org/article/economics-time-covid-19-new-ebook

Fixing Globalisation: Time to Make it Work for All
OECD
http://dx.doi.org/10.1787/9789264275096-en

SP/0073 - INTERNATIONAL POLITICS OF ASIA

Academic Year 2021/2022

Free text for the University

Professor

BARBARA ONNIS (Tit.)

Period

Second 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 aims at offering the essential interpretative and historical tools to understand the international politics of East Asia. It will start from the end of World War II, but it will be mainly focused on the post-Cold War era, when East (and North-East Asia in particular), became one of the most dynamic, innovative and fast-developing areas of the world. After a long eclipse East Asia has re-emerged as a centre of world creation and growth, thus contributing to profoundly determine the dynamics of international politics.
The goal will be to supply the methodological and analytical tools in order to understand the role played by East Asia after the end of the bi-polar order and the beginning of a new multipolar order.

In accordance with the Dublin descriptors, at the end of the course students will have achieved the expected learning goals by perfecting the basic knowledge and skills already acquired during the Course of History and Institutions of Asia through the deepening of skills and the acquisition of new fundamental tools for reading the post Cold War international system (I), with special reference to the new problems posed by the end of bipolar system and the development of a new and more complex geopolitical order, where East Asia plays a central role. At the same time they will have gained autonomy of judgment (II) over the political choices of the main Asian actors; communicative abilities (III) based on the proper use of the proper language of the history and international politics of Asia; finally, they will have developed autonomous learning skills (IV) within East Asia 's international politics.

Prerequisites

Good knowledge of History and Institutions of Asia.
Good English level.

Contents

I. The Cold War era
- The transformation of Asia and the changing global order
- US hegemony and the building of new national identities
- New Asian renaissance and the East Asian miracles

II. The post-Cold War period
- The transformation of Asia and the changing global order (II): the repositioning of the powers in East Asia
- The Asian challenge: the emergence of new regional poles
- The intensification of Asian regionalism (case studies of leading regional cooperation mechanisms: ASEAN, Six-Party Talks, SAARC and SCO).
- East Asia role in the international governance: from climate change to health

issues; Asia and the UN 2030 agenda for sustainable develpoment
- East Asia and the Covid-19 pandemic crisis

Teaching Methods

Lectures and seminars on specific topics.
Lectures form external scholars.

Verification of learning

Oral exam divided into two parts:

a) PPT presentation on topics covered during the course (50%).

The topic must be agreed with the lecturer and the presentation must be sent to the lectureer at least one week before the date of the exam

2) Traditional oral esam (50%).

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 and be able to link different historic periods and domestic and foreign policy with acceptable argumentation and a good general language.

In order to get 30 cum laude the student must demonstrate to have acquired an excellent knowledge of all the topics of the course, with an excellent argumentation, an excellent ability of linking different periods with an excellent language.

Texts

Essential readings:
- M. Yahuda, The International Politics of the Asia Pacific, Fourth Edition,

Routledge, 2019 (Chapters 2,3,4 + an additional chapter to be chosen between chapter 5 and 8)

Additional readings (for specific topics):
- ADB, Emerging Asian Regionalism: A Partnership for Shared Prosperity", 2007 (https://www.adb.org/sites/default/files/publication/159353/adbi-emerging-asian-regionalism.pdf)
- Asia Maior - An Italian Think Tank on Asia (different volumes available online at https://www.asiamaior.org/)
- M. Duchatel, F. Godement, V. Zhu, "Fighting Covid-19:
East Asian Responses to the Pandemic", POLICY PAPER - APRIL 2020 (https://www.institutmontaigne.org/ressources/pdfs/publications/fighting-covid-19-east-asian-responses.pdf)
- ESCAPE, Achieving Sustainable Development Goals in East and North-East Asia, 2017
(https://www.unescap.org/sites/default/files/publications/Achieving%20Sustainable%20Development%20Goals%20in%20East%20and%20North-East%20Asia.pdf)
- Peter J. Katzenstein, "Regionalism and Asia", New Political Economy, 5:3, pp. 353-368, 2000, DOI: 10.1080/713687777
Dong Wang, The United States and China. A History from the Eighteenth Century to the Present, 2013
- - O. Frattolillo, Reassessing Japan's Cold War: Ikeda Hayato's Foreign Politics and Proactivism During the 1960s, Routledge 2019
- Huiyun Feng, Kai He, Yan Xuetong (eds.), Chinese Scholars and Foreign Policy. Debating International Relations, London, Routledge, 2019
- Richard Stubbs, "ASEAN's leadership in East Asian region-building: strength in weakness", The Pacific Review, 27:4, 523-541, 2014, DOI: 10.1080/09512748.2014.924229

More Information

1. Lessons' slides will be provided to students.
2. At the end of the course, a list of potential questions will be provided to students for the preparation of the oral part of the exam.