Dipartimento di Scienze della Vita e dell'Ambiente

Programs

2016/2017

ADVANCED TECHNIQUES OF ENVIRONMENTAL CHEMICAL ANALYSIS

GIUSEPPE SCARPONI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 2^ semestre

Prerequisites

Knowledge of the topics related to the classical chemical analyses (gravimetry, volumetry) and basic instrumental methods (potentiometry, conductimetry, UV-Vis spectrophotometry).

Course contents

The course consists of theoretical lectures (5 credits, 40 hours) and laboratory practical work carried out individually or at small groups (1 credit, 8 hours) and fieldwork. An e-learning didactic activity is available in parallel to the normal frontal course. It includes: the didactic material, the self-evaluation tests, booking for the laboratory exercises, a section for the upload of laboratory reports from the students, information and booking for the field work, attendances to lectures and laboratory exercises, results of examinations.

Objectives of the course

Knowledge:
The course enables students to acquire the fundamental knowledge of the theoretical and methodological basis of the advanced instrumental techniques of Polarography/Voltammetry and Fluorimetry/Spettrofluorimetry for chemical analysis, and their applications in environmental field (spring waters, river waters, snow, atmospheric aerosol, organisms, food and beverages). He should acquire knowledge also of the principles of quality control and of the accreditation of chemical analytical laboratories.

Ability to apply the knowledge:
At the end of the course, the student should acquire the ability to carry out laboratory chemical analyses based on advanced polarographic techniques (SWASV) devoted to the analytical control of environmental matrices included the step of field sampling.

Soft skills:
The execution of laboratory analyses, as well as the drafting and editing of reports on the exercises carried out, contribute to improve for the student the degree of judgement autonomy in general, the communicative capacity, the learning capacity in autonomy, and the ability to draw conclusions from experimental data.

Program

Content. Polarography and advanced voltammetric techniques. Introduction. Relationship with other electrochemical techniques. Polarographic cell: two and three electrodes. Dropping mercury electrode (DME). Electrostability range. Polarogram. Polarographic wave. Half wave potential. Limiting diffusion current. Residual current. Supporting electrolyte. Theoretical aspects: diffusion current at a planar electrode, diffusion limiting current ad a dropping mercury electrode and relationship with concentration. The Ilkovic equation. Current-potential curve. Amplitude of the polarographic wave. Semilogaritmic diagram. Pseudopolarograms. Measurement modes of the limiting current and halfwave potential. Simultaneous, multielemental quali-quantitative analysis. The problem of the presence of oxygen: outgassing. Absorption maxima and their elimination. Qualitative and quantitative analysis. Methods: calibration curve, standard additions, piloti on (or internal standard). Modern techniques: Polarography/Voltammetry with linear scan (LSV), pulses (NPP), differential pulses (DPP), square wave (SWV), Anodic (or cathodic) stripping voltammetry (ASV, CSV) with differential pulses (DPASV) or square wave (SWASV). Sensitivity. Trace determination. Examples of environmental applications: seawater and estuarine waters; marine organisms, tissues and spicules of sponges, teleosts, bivalves; Antarctic atmospheric aerosol, snow and ice; spring and river waters; wine and food. Fluorimetry and Spettrofluorimetry. Photoluminescence: fluorescence and phosphorescence. Stokes' shift. Power of fluorescence radiation. Direction of the observation. Quenching. Quantic yield. Effect of the concentration: direct proportionality. Deviation from linearity: self-quenching, self-absorption. Comparison of fluorescence and absorption measurements. Fluorimetry and structure. Effect of temperature, solvent, pH and oxygen. Excitation and emission spectra. Instruments for fluorescence measurements: fluorimeters and spectrofluorimeters. Spectrofluorimeters with two monochromators: execution of excitation and emission spectra. Sources. Detectors. Single-beam and double-beam instruments. Corrected and uncorrected spectra. Corrected excitation spectrum and absorption spectrum. Calibration. Quantitative analysis (calibration curve, standard addition method, analysis of mixtures). Indirect determinations (titrations). Sensitivity. Contamination. Precision and accuracy. Resolution. Selectivity. Total luminascence spectrum (fluorogram). Practical aspects. Analytical applications. Exhample: determination of sulfur dioxide in the atmosphere. Quality control and quality assurance. Traceability. Good laboratory practice. Accreditation of laboratories.

Laboratory exercises (1 credit, 8 hours/student). Laboratory practice in a chemical laboratory under contamination control (clean room). Determination of heavy metals (Cd, Pb, Cu) by square wave anodic stripping voltammetry (SWASV) in natural waters and in the atmosphere. Evaluation of accuracy: use of certified reference materials.

Field work (two one-day school trips). Two one-day school trips are expected to be carried out (one in winter, one in summer) dedicated to field activity: sampling of snow and spring water with analyses on site (pH, conductivity, chloride, fluoride, iodide, nitrate), and visit to plants for bottling of mineral water.

Development of the course and examination

Methods for assessing learning outcomes:
The student consigns (on line) his own laboratory reports. The assessment method is an oral examination and subsequent revision/discussion of the script. For the final grade, up to two points maximum will be assigned with reference to the reports of laboratory exercises. The exam is passed

when the final score is higher or equal to 18.

Criteria for assessing learning outcomes:
In the oral examination, the student will have to demonstrate to have acquired a sound knowledge of basics and methods (theory and practice) of the chemical analytical methodologies of polarography and fluorimetry. In the laboratory reports, the student will have to demonstrate of having achieved the capacity to apply the acquired knowledge during the course to the execution of laboratory analyses on environmental matrices and the capacity to write critically, in autonomy and/or in-group, a test report.

Criteria for measuring learning outcomes:
The final mark is attributed in thirtieths. Successful completion of the examination will lead to grades ranging from 18 to 30, and 30 with laud.

Criteria for conferring final mark:
The final mark is attributed by summing to the evaluation of the oral examination that of the laboratory report, the latter up to two points. The laud is attributed when the score obtained by the previous sum exceeds the value of 30 and contemporaneously the student demonstrates complete mastery of the matter.

Recommended reading

- Lecture notes
- D. A. Skoog, F. J. Holler, S. R. Crouch. Chimica analitica strumentale, 2a ediz., EdiSES, Napoli, 2009.
- K. A. Rubinson, J. F. Rubinson. Chimica analitica strumentale, Zanichelli, Bologna, 2002.
- F. W. Fifield, P. J. Haines (eds.). Environmental analytical chemistry, Blackwell Science, Oxford, 2000

ALGAE BIOTECHNOLOGY

ALESSANDRA NORICI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 1^ semestre

Prerequisites

Knowledge in Botany, Plant Physiology, Biochemistry.

Course contents

Frontal lessons (5 credits, 40 hours) and practical lessons in laboratory (1 credit, 8 hours). During the lectures group discussions on scientific papers previously submitted to class as printed or electronic material, short presentations of students to explore themes that will attract particular interest, numerical exercises, instructions for laboratory practical works will be held.

Objectives of the course

Knowledge:
The course enables students to acquire theoretical and methodological basis of algae cultivation and biomass production (preparation of liquid and solid growth media, growth technique in batch, semi-continuous and continuous cultures), knowledge on manipulation of cultural parameters in order to metabolically divert resource allocation into intracellular lipid, carbohydrate or protein pools. Simultaneously it provides students with the knowledge on global environmental issues (climate change, depletion of energy resources, waste treatment) that require innovative biotechnological approaches.

Ability to apply the knowledge:
The student will also acquire the following professional skills: ability to culture different types of algal species on a small and large scale and to monitor their growth and the cell composition of the biomass; ability to propose innovative approaches in the field of algal biotechnology.

Soft skills:
Performing laboratory analysis, scientific paper discussion in groups and short presentation or brief insights on specific learning objectives of interest, help to improve the students' communication skills, learning and critical abilities in an autonomous and self-guided way.

Program

Content (frontal lessons and laboratories, 6 CFU, 48 hours):

Microalgae - Methods for cultivation: batch, semicontinuous and continuous cultures, culture media, auxotrophy and mixotrophy, sterile techniques.
Microalgae – Algal collections and bio-banks in the world; long-term conservation of biodiversity through cryopreservation and other methods ex situ; assays of cell viability.
Microalgae - From laboratory to industrial plants: types of open ponds and photobioreactors; technologies for cell immobilization in gel; harvesting; examples of integrated analysis of production phases (Life Cycle Assessment).
Macroalgae – Cultivation.
Lipid metabolism in plant cells - structure and function of lipids, the fatty acid biosynthesis, acetyl-CoA carboxylase, fatty acid synthase, elongation and desaturation of fatty acids, synthesis of membrane lipids, synthesis and catabolism of TAG, metabolic and genetic engineering of lipids.

Possible uses of plant biomass - energy use for the production of biofuels, human and animal nutrition, CO2 sequestration and flue gas remediation, waste water treatment, production of valuable bioactive molecules, nanotechnology.
Tools for cell analysis - Measurement of the photosynthetic efficiency of PSII, measurement of the cellular composition by FTIR spectroscopy; screening methods of functional types of plant cells for commercial use.

Laboratory - Techniques for microalgae cultivation; growth rate determination; extraction and determination of photosynthetic pigments; measurement of PSII photosynthetic efficiency; plant cell immobilization.

Development of the course and examination

Methods for assessing learning outcomes:
The exam consists of an oral interview with at least three questions. Each question is given a score between zero and thirty. Oral exam grade is calculated as the average of the scores. For the final mark, class presentations and discussions will also be evaluated, they will be awarded with a maximum of two points. The exam is passed when the final grade is greater than or equal to 18.

Criteria for assessing learning outcomes:
The student must demonstrate to know principles and methods (theory and practice) for the cultivation of microalgae and macroalgae, for the manipulation of cultural parameters used to produce algal biomass with the macromolecular composition required by different biotechnological applications.

Criteria for measuring learning outcomes:
The final mark is awarded out of thirty. The exam is passed when the grade is greater than or equal to 18. The highest mark with honors (30 cum laude) is also expected to be awarded.

Criteria for conferring final mark:
The final mark is given by adding the oral exam grade to the grade (up to a maximum of two points) resulting from the class work done during the course. The highest honors are attributed when the score obtained from the previous sum exceeds the value of 30 e when the student has demonstrated full mastery of the subject.

Recommended reading

Bibliography cited in teaching slides and notes during the course.
Biologia cellulare & Biotecnologie Vegetali, Pasqua, 2011, Piccin.

ALGAL ECOPHYSIOLOGY

MARIO GIORDANO

Seat Scienze
A.A. 2016/2017
Credits 7
Hours 56
Period 1^ semestre

Prerequisites

The student must be able to conduct literature searches
Good knowledge of English
Very good knowledge of chemistry, biochemistry and physical-chemistry, plant physiology and botany

Course contents

The course will comprise 6 credits of theoretical classes and 1 credit of practical classes. The theoretical classes will be strongly interactive: students will be frequently asked to interact with the professor and with other students. AT the beginning of each class, one or more students will be called to summarize the previous class. This serves the scope to better assimilate the information and will provide the opportunity for clarifications and deepening of those aspects that will emerge as more difficult or of greater interest for the students.
The practicals will consist in the conduction of experiments: the students will be confronted with a scientific problem that they will have to solve by carrying out lab measurements: to this end, the students will be divided in groups of 4-5 individuals.
Further exercises will be carried out in class, in the form of oral discussions and/or brief seminars, and of resolution of numerical problems. Students will also have to analyze and discuss in class scientific papers on fundamental aspect of algae ecophysiology.
Crucial references will be made available on the e-learning platform.
In the presence of foreign students, the course will be held in English.

Objectives of the course

Knowledge:
The course will allow the students to acquire in-depth knowledge on the responses of aquatic photosynthetic organisms to environmental changes. Information will be provided also on the impact of on going global changes on primary production and on the biotechnological utilization of algae.

Ability to apply the knowledge:
The student, at the end of the course, will therefore be able to operate both in academia, and in general in basic research, and in applied research.
In addition to a profound appreciation of algal ecophysiology, the student will acquire the ability to independently and creatively analyze primary reference sources and employ them for the

construction and conduction of scientific projects.

Soft skills:
The highly interactive nature of the course will lead the student to develop skills in verbal and written scientific communication and in the critical analyses of literature.
The student will also be led to the development of the ability to interconnect information and notions in order to enact a multidisciplinary approach to any problem with which he should be confronted.

Program

Content (theroretical classes, 6 CFU):
Nutrients (N, S, P and trace elements): acquisition, assimilation and metabolic interactions
Light: chromatic adaptation and imact of light on vertical zonation
Substrate: conquering suratidel habitats
Algae and global climate change; physiological responses to increasing pCO2, exposure to UV radiation and temperature
Relationship between morphology and function: Effect of size and shape on phytoplabjton physiology
Evolution of aquatic photisynthesis: adaptation the long term environmental changes and evolutionary trends of teh photosynthetic apparatus
Applied aspects: algal cultures; products from macro- and microalgae.
Content (practical classes, 1 CFU).

Methods for the determination of photosynthetic pigments and of other organic pools in algal cells

Development of the course and examination

Methods for assessing learning outcomes:
The exam will be oral and will consist of an interview that may encompass the entire content of the course, included the topic covered during the lab sessions. The number of questions will depend on the level of competence of the students, but never fewer than three questions will be asked.

Criteria for assessing learning outcomes:
The acquisition of knowledge by the student will be evaluated on the basis of his/her ability to demosntrate the ability to master the information provided, exopress concept appripriately, utilize kowledge in thought experiment and calculations

Criteria for measuring learning outcomes:
Some of the questions will be formulated so that the student can show his/her knowledge without constraints, with the aim of evaluating his/her ability to organize concepts logically, coherently and exhaustively and in order to assess his/her comprehension of the concepts and notions provided during the course.
Other questions will be posed in the form of specific scientific problems. The student will have to demonstrate his/her ability to creatively integrate the notion acquired in class for the resolution of the problems.

Criteria for conferring final mark:
The student’s performance will be evaluated on the basis of the correctness of his/her answers

(40%), completeness of his/her answer (20%), appropriateness of expression (20%) and of his/her ability to identify the fundamental aspects of the subject of the query (20).

Recommended reading

Buchanan, Gruissem and Jones (2004). Biochimica e Biologia molecolare delle Piante. Zanichelli
Falkowski e Raven (1997). Aquatic Photosynthesis. Blackwell
Zeebe and Wolf-Gladrow (2002). CO2 in Seawater: Equilibrium, Kinetics, Isotopes . Elsevier
Lobban and Harrison (1996). Seaweed Ecology and Physiology. Cambridge University Press
Dring (1982) Biology of Marine Plants. E. Arnold
Borowitzka, Beardall, Raven (2016). The Physiology of Microalgae, “Developments in Applied Phycology Series”, Springer-Verlag, Berlin Heidelberg.

ANALYSIS OF POLLUTANTS

ANNA ANNIBALDI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 1^ semestre

Prerequisites

Knowledge of the topics of the courses on mathematic, physic, general, inorganic, organic and instrumental analytical chemistry

Course contents

The course consists of theoretical lectures (4 credits, 32 hours) and laboratory practical work carried out individually or at small groups and fieldwork (2 credit, 16 hours).

Objectives of the course

Knowledge. The course enables students to acquire the fundamental knowledge of the principal advanced analytical techniques for the analysis of pollutants in the environment (high pressure liquid chromatography HPLC, gas-chromatography GC, mass spectrometry MS, Inductively Coupled Plasma Mass Spectrometry ICP-MS), and the knowledge of the principal extraction methods for environmental analysis (Liquid-Liquid extraction, Solid Liquid Extraction) from the different matrices studied (air, water, soil) .The course enables students to acquire the fundamental knowledge on national and international legislations on limits and methods of analysis of environmental pollutants, too.

Ability to apply the knowledge:
The student should also acquire the following professional skills: ability to collect and analyse environmental samples on field, ability to extract the pollutants by collected matrices (MAE, LLE, ecc) and relative chromatographic analyses. Finally the student should acquire the capability to value the analytical data obtained according to law limits, provided by national and international institutions.

Soft skills:
The analyses of environmental samples contribute to improve for the student the degree of judgement autonomy in general, because the student will learn the capability to value the data obtained in line with the corresponding limits law, encouraging a discussion above. The communicative capacity will be stimulated during the lessons by discussing with the teacher some scientific report or papers (even in English language) on environmental monitoring anda pollutants analyses in different matrices. The execution of field and laboratory analyses contributes to improve for the student the degree of judgement autonomy in general, the communicative capacity (which

derives also from the teamwork), the learning capacity in autonomy, and the ability to draw conclusions from experimental data.

Program

CContent (lectures, 4 CFU, 32 hours).
Sampling methods, sample preparation, treatment and storage. Extraction methods for environmental analysis: Liquid-Liquid extraction, Solid Phase Extraction (SPE), Solid Phase Micro-Extraction (SPME), Solid-Liquid Extraction, Soxhlet and Soxtec methods, Accelerated solvent extraction, Microwave extraction. Quality of analytical data: accuracy and precision, repeatability and reproducibility, detection limit, validation of analytical data. Application of instrumental analytical techniques for pollutant analysis. Chromatographic techniques: high pressure liquid chromatography (HPLC), gas-chromatography (GC); mass spectrometry (MS); coupling HPLC-MS and GC-MS; Inductively Coupled Plasma Mass Spectrometry ICP-MS. Pollutants analysis. Dangerous and priority pollutants. Emerging pollutants. National and international legislations on limits and methods of analysis of environmental pollutants

Development of the course and examination

Methods for assessing learning outcomes:
The examination is an oral exam: during the examination the teacher evaluates the student learning.

Criteria for assessing learning outcomes:
During the oral examination the student will be demonstrate to know the principal techniques of extraction and analysis of the pollutants, at least on three topics of the whole programme.

Criteria for measuring learning outcomes:
The final mark is attributed in thirtieths. Successful completion of the examination will lead to grades ranging from 18 to 30, and 30 with laud.

Criteria for conferring final mark:
The final mark is attributed by evaluating the learning of the student on the contents of the course and by evaluating the complete mastery of the matter.

Recommended reading

- Copy of slides available
- J.R. Dean, Extraction methods for environmental analysis, John Wiley & Sons, 1999
- R. Cozzi, P. Protti, T. Ruaro, Elementi di analisi chimica strumentale, Analisi chimica dei materiali, Analisi chimica ambientale, Zanichelli, Bologna, second edition 2013.
- K.A. Rubinson, J.F. Rubinson, Chimica Analitica Strumentale, Zanichelli, Bologna, 2002.
- D.A. Skoog, J.J. Leary, Chimica analitica strumentale, EdiSES, 4° Edizione.
- APAT, Metodi analitici per le acque, manuali e linee guida 29/2003, APAT., 2003.

APPLIED ECOTECHNOLOGY

ANTONIO DELL'ANNO

Seat Scienze
A.A. 2016/2017
Credits 8
Hours 64
Period 1^ semestre

Prerequisites

Basic knowledge of Chemistry, Ecology and Environmental Microbiology

Course contents

The course is articulated in theoretical lectures integrated with the analysis of case studies and numerical exercises.

Objectives of the course

Knowledge:
The course provides the basic knowledge for planning interventions for the reduction of anthropogenic impact on natural ecosystems and on strategies and technologies applied for the environmental recovery and restoration. In addition, students will acquire knowledge about the relevant regulations governing the remediation and environmental restoration as well as those for the management and treatment of waste waters and solid wastes.

Ability to apply the knowledge:
The student will acquire the following professional skills: ability to identify appropriate strategies and technologies to reduce the effects of different types of pollution on ecosystems and to clean up contaminated environments under current regulations.

Soft skills:
The student will acquire skills useful for interfacing with agencies and institutional bodies responsible for the monitoring of the environmental quality and for the release of authorization for the remediation of contaminated sites.

Program

Basic principles for quality assessment, management and restoration of ecosystems, environmental policy and legislation. Strategies and technologies for the identification, containment and treatment of oil spills. Problems related to biofouling development on artificial substrates, models of biofouling development, techniques for biofouling identification and monitoring, strategies and technologies for

biofouling containment. Legislation in the field of environmental remediation, characterization plan of contaminated sites, systems for cleaning up and securing of contaminated sites,
in situ and ex situ technologies for environmental remediation, separation, transformation and immobilization processes of contaminants, chemical, physical and biological technologies, role of microorganisms in environmental remediation,
biostimulation and bioagumentation, co-metabolism, reductive de-halogenation, kinetic models of biodegradation of organic contaminants, bio-stabilization of metals and radionuclides, bioleaching of metals, biotechnological applications for environmental remediation, phytoremediation, use of microbial mats for environmental remediation, cost versus benefit analysis. Principles of functioning of wastewater treatment plants: primary, secondary and tertiary treatments, reference legislation for water discharges, processes for the stabilization of sludges and their final destination, constructed wetlands and lagoons. Principles of management and treatment of solid wastes.
Exercises: use of kinetic models for the assessment of the performance of bio-treatments applied to contaminated sites

Development of the course and examination

Methods for assessing learning outcomes:
The student will demonstrate his/her expertise by an oral examination on at least three questions.

Criteria for assessing learning outcomes:
Students must demonstrate that they have acquired the knowledge on: the main drivers altering ecosystems and environmental quality, strategies and technologies to reduce human impacts on ecosystems, strategies and technologies for the remediation of contaminated sites in relation to current legislation, strategies and technologies for oil spill containment, strategies and technologies for biofouling treatment, wastewater treatments, management of solid wastes. The questions will allow assessing the student's ability to communicate clearly the information gained during the course.

Criteria for measuring learning outcomes:
The final vote is awarded out of thirty. The exam is passed when the vote is greater than or equal to 18. It is expected to attribute the highest score with honors (30 cum laude).

Criteria for conferring final mark:
The final vote is attributed following the oral test. Praise is given if the student demonstrates full mastery of the subject.

Recommended reading

Lecture notes
R. Danovaro, Recupero ambientale: tecnologie bioremediation e biotecnologie, UTET, 2001.
Enitecnologie Agippetroli, La bonifica biologica di siti inquinati da idrocarburi, Hoepli, 2001.
Hinchee, R. E. et alii, Applied Biotechnology for Site Remediation, Lewis Publishers Inc., 1994.
Vismara R, Depurazione biologica, teoria e processi, Hoepli, 2001.
Grillo N. G, Trattamento delle acque reflue. La fitodepurazione, Geva, 2003.

APPLIED MARINE ECOLOGY

CINZIA CORINALDESI

Seat Scienze
A.A. 2016/2017
Credits 7
Hours 56
Period 2^ semestre

Prerequisites

knowledge of biology and marine ecology, marine zoology and algae diversity. It is highly recommended to have taken the exam in Biology and Marine Ecology.

Course contents

Theoretical lectures and practical exercises in field will be carried out. The lectures will be given by projecting didactic material in the PowerPoint format and scientific videos about the issues tackled. All the material of the lessons will be made available to students and placed in the Moodle platform Department. Scientific articles will also be made available to students as research material. All communications concerning the educational trip, including the program and list of participants will be posted in the Department website.

Objectives of the course

Knowledge:
The course allows students to acquire the knowledge about all major forms of pollution and human impact in marine environment, the responses of communities and marine ecosystems (even in terms of functioning), the method of study and identification of these forms of impact, mitigation tools and strategies to restore degraded ecosystems. It will also present the European rules for monitoring and quality control of marine ecosystems.

Ability to apply the knowledge:
At the end of the course the student will be able to apply the scientific method and the knowledge gained in terms of: identification of the impacts, monitoring and mitigation techniques and restoration of degraded ecosystems in relation to the new European Directive Marine Strategy Framework Directive. This will be critical to create a specific profile for monitoring, conservation and recovery of marine ecosystems.

Soft skills:
The skills acquired during the course and their applications in field will help to improve students' ability to formulate scientific hypotheses, to analyze current problems, the data processing and final evaluation of the results obtained. The individual scientific capabilities and group collaboration will be stimulated through the development of work projects in field with subsequent presentation of the results.

Program

Contents:
Marine pollution: vulnerability and pollution of marine ecosystems, different types and sources of marine pollution (organic pollution, chemical, biological, light, acoustic, thermal, exploitation of resources and energy from the sea, introduction of non-native species), critical points of the coastal ecosystems of the Mediterranean and self-purification indicators of the sea.
Eutrophication, dystrophy, mucilage and toxic algae: trophic status indicators and models, strategies for control and for the study of toxic algae.
Pollution due to hydrocarbons: Ecological effects of oil spills, strategies to contain and recover the oil spill. Plastic and microplastic impact on marine life and ecosystems.
Impact of pharmaceuticals and personal care products: sources and potential effects on organisms.
Microfuoling and macrofouliung: technological applications of the biofilm, the sampling methods and analysis of microbial biofilm, eco-compatible strategies for biofouling control. The impact of trawling on marine habitats: methods and tools for studying the impact of trawling, direct and indirect environmental effects of trawling, by catch and ghost fishing. The impact of intensive aquaculture: ecological effects of mariculture in the Mediterranean Sea and strategies for studying and mitigate the impacts.
The introduction of non-native species: definition and sources of alien species, alien species in the Mediterranean Sea, the effects of the invasion of alien species and strategies to avoid the impact.
Frauds associated with marine food: the case of the Pangasius and Halibut. Global changes and multiple stressors. Environmental Restoration: trans-planting of seagrass and corals, technologies and guidelines for the restoration of coral reefs. Criteria for assessing the quality of the marine environment: biological indicators and biotic indexes, the Marine Strategy Framework Directive.
Case studies: pollution in the Mediterranean Sea, eutrophication and mucilage in the Adriatic Sea, the Fukushima disaster, chemical contaminants in the Mediterranean, the incidents of large tankers and the case of Agip Abruzzo and Deepwater Horizon, invasion of alien species in Black Sea, impact of fish farms in the Mediterranean, the
restoration of seagrasses in Gabicce Mare (PU, Italy), the restoration of deep environments, the impact of sunscreens on coral reef.

Development of the course and examination

Methods for assessing learning outcomes:
The exam consists of an oral test with questions that generally are dealing with the analysis of forms of impact on the marine environment, the identification of methodologies and adequate monitoring and recovery strategies.

Criteria for assessing learning outcomes:
I will evaluate the student's knowledge of the topics covered in the course, the ability to link the information and identify the correct procedures of analysis, assessment and resolution of proposed problems.
Criteria for assessing learning outcomes:
On the basis of criteria for learning evaluation a final mark out of thirty will be given. The exam is passed when the final grade is higher than or equal to 18. Students with an excellent preparation can be awarded with the highest mark cum laude (30 cum laude).

Criteria for conferring final mark:

The marks will be given depending on the number of correct and complete responses, and the level of detail of the proposed topics. The highest mark cum laude will be given if the student demonstrates full competence of the subject, critical thinking and depth of the topics covered.

Recommended reading

Some texts suggested for studying/research:
Slides of the course and scientific articles
R. B. Clark. 2001. Marine Pollution. Oxford
Della Croce N., Cattaneo R., Danovaro R. 1997. Ecologia e Protezione dell’ambiente marino costiero. UTET Università
Cunnigham, Cunnigham,Saigo. Ecologia Applicata. McGraw-Hill

APPLIED ZOOLOGY

BARBARA CALCINAI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 2^ semestre

Prerequisites

Good knowledge in zoology

Course contents

Lectures (4 credits, 32 hours approximately) and laboratory training carried out individually; training on the field and in the lab (2 credits, 16 hours approximately).

Objectives of the course

Aims
Knowledge:
The course enables students to acquire the theoretical knowledge and mainly technical knowledge on the use of organisms as bio-indicators for the analysis, evaluation and management of aquatic habitats (especially in current water and purification processes) and land habitats.
Simultaneously it provides students with basic knowledge about management problems of some mammals ungulates living in the Marche region and the management of non-native fauna.

Ability to apply the knowledge:
The student will gain the following vocational skills: ability to carry out sampling and analysis to assess the state of the quality of bodies of water (such as rivers and streams), soil quality, and treatment processes, through the use of bio-indicators; Furthermore the student will be able to face the problems relating to the management of wildlife and non-native fauna.

Soft skills:
Laboratory activities, carried out individually, contribute to stimulating judgment and contribute to check the knowledge gained during the lecturers.

Program

Content of the lectures (4 credits, 32 hours):
The concept of bio-indicator and biomonitoring. Soil: definition, characteristics and functions. The soil fauna: features and functions. Biomonitoring for the assessment of biological soil quality; the

characteristics of river ecosystems; the fauna of fresh waters: characteristics, adaptations and diversity. The biological indicators in freshwater; quality indices: the system of saprobes; index EBI; system of evaluation of the biological quality of rivers Star ICMI. Native and non-native crustaceans of the Italian rivers. The sludge biotic index (SBI) and its use. Microfauna involved in purification processes. Microfauna and role in water purification.
Wildlife management; examples of conflicts between humans and wildlife; parameters and characteristics of a natural population. Introduction to the census of terrestrial natural populations techniques. Examples of management of wildlife; exemplaes of allochthonous species: the red squirrel vs the gray squirrel: the conservation of the red squirrel; alien shrimps in the freshwater. The boar: biology and management. The deer biology and management.
Laboratory Praticals (2 credits, 16 hours):
Application of the index of biological quality of the soil (QBS-ar); collection of organisms via Berlese's selector. Observation and identification of taxa used in the index. Microscopic techniques for identification of the various taxa of macroinvertebrates. Calculation of biotic indices of rivers. Identification of the microfauna of sludge (Protozoa). Calculating the sludge biotic (SBI).
Field activities: one-day field trip at a sewage treatment plant, and one-day field activity to perform the sampling of fresh water for calculation of the quality index.

Development of the course and examination

Methods for assessing learning outcomes:
The exam consists of an oral test. During the oral exam, students must demonstrate that they have acquired the basic knowledge presented during the lecturers; Furthermore, the students must also be able to apply the studied biotic indices, illustrating the procedures for collecting, processing and analysis of the organisms. The students must also be able to perform the calculation of the indices to assess the quality of the rivers, soil, of purification.

Criteria for assessing learning outcomes:
The level of knowledge acquired, exposed during the oral test, referring to lectures and to the practical training, will be evaluated to assess the students' preparation.

Criteria for measuring learning outcomes:
The final mark is assigned as a fraction of 30. The exam is successfully passed when the mark is equal to or higher than 18/30. The highest mark can be assigned cum laude.

Criteria for conferring the final mark:
The final mark is given considering the levels of knowledge acquired and shown during the oral test, and it is conferred considering the preparation of the theoretical and training parts.

Recommended reading

Sansoni G. 1998. Atlante per il riconoscimento dei Macroinvertebrati dei corsi d'acqua italiani.
Ghetti P.F., 1995. Manuale di applicazione: Indice Biotico Esteso - I macroinvertebrati nel controllo della qualità degli ambienti di acque correnti. Provincia Autonoma di Trento, Servizio Protezione Ambiente.
Madoni P. 1996. Atlante fotografico – Guida all'analisi microscopica del fango attivo
Notes taken during the lecturers and powerpoint presentations handed out by the lecturers.
Other publications available on line and Internet sites are also recommended and listed in the

powerpoint presentations.

AQUACULTURE, REPRODUCTION AND DEVELOPMENT OF ORNAMENTAL AND COMMERCIAL SPECIES

IKE OLIVOTTO

Seat Scienze
A.A. 2016/2017
Credits 7
Hours 56
Period 1^ semestre

Prerequisites

Basic knowledge about zoology, anatomy and reproductive biology is required.

Course contents

The course is made of lectures (6 credits, 48hrs) and small groups practical classes (1 credit, 8hrs). During the theorical classes slides, short videos and some Indonesian fishing equipment will be used.

Objectives of the course

Knowledge:
The present course allows the student to obtain knowledge about aquaria and fish farms management, the equipment, element cycles in the tanks, knowledge about the most important fish species, reproductive strategies, the importance of phyto and zooplankton in aquaculture, as well as deeper knowledge about the embryonic and larval development of fish.

Ability to apply the knowledge:
the student will aquire the following skills: aquaria and tanks management, performing chemical-physical tests.

Soft skills:
Laboratory activities, as well as the discussion by the students of some specific topics are essential to improve the student's skils in terms of communication, ability in making conclusions and presenting data to a audience.

Program

Contenuti (lezioni frontali, 6 CFU, 48 ore):
Introduction
Coral reef ecosystem: distribution and characteristics
The aquarium: tanks, lightening, heaters

Filtration systems and water chemistry: the nitrogen cycle, different filtration systems, pH, temperature and salinity
Sand, grave, rocks and invertebrates.
Marine aquarium fishes : pomacentrids, apogonids, serranids, butterfly fish, pomacantids, wrasses, gobies, surgeon fish , balistids, zanclids, dottybacks. Distribution, characteristics.
The life cycle of reef fishes: reproductive strategies.
Fishing and transport methods: the market of the aquarium trade
Reproduction in captivity: photoperiod and temperature.
Food web: phyto and zooplankton. Culturing methods.
HUFAs in marine fish diet
Examples of captive bred organisms: pomacentrids, gobies, pomacantids, wrasses, dottybacks , seahorses.
Intensive and estensive aquaculture
Floating in-shore cages
off-shore cages and tension- legs
Farming marine species (Sea Bream, Sea Bass, flounder, Salmon): reproduction; tecniche di intensive farming, larval feeding, growth out.
Farming fresh water species (trout, surgeon): reproduction; tecniche di intensive farming, larval feeding, growth out.
Farming crustaceans and mollusks

Development of the course and examination

Methods for assessing learning outcomes:
The exam is an oral talk about different topics of the program.

Criteria for assessing learning outcomes:
Evaluation of the program through a theorical and practical approach

Criteria for measuring learning outcomes:
The final scors is in thirties. The exam is evaluated as positive if a minimum score of 18 is obtained by the student. The maximum score is 30 e lode.

Criteria for conferring final mark:
the student will obtain 30 e lode if he/she shows a deep knowledge of the topics.

Recommended reading

Slides

CALADO, OLIVOTTO, PLANAS, HOLT. Marine ornamental species aquaculture, 1st Edition, Wiley Blackwell.
SAROGLIA M., INGLE E. "Tecniche di Acquacoltura"; Edagricole
BARNABE' G. "Acquaculture" Vol. I, II, Technique et Documentation Lavoisier
ROBERTS R.J. Patologia dei pesci" Edagricole Bologna
Wilkerson, J.D., 1998. Clownfishes. A Guide to Their Captive Care, Breeding and Natural History, 1st Ed. Microcosm Ltd. Shelburne.
Thresher, R. E., 1884. Reproduction in reef fishes. T F H Publications, Inc Ltd.

BIOCHEMICAL ANALYSIS

FABIO TANFANI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 2^ semestre

Prerequisites

Basic knowledge in Biochemistry and Human Anatomy is desirable.

Objectives of the course

Knowledge:
At the end of the course, students will have achieved an overall knowledge on the fundamental points, both from the theoretical and methodological points of view, of the principal techniques for biochemical/clinical biochemistry analyses and their applications in a clinical biochemical laboratory. Moreover, students will have achieved basic knowledge on free radicals and antioxidants, their role in biological systems and the different methods used for studying them.

Ability to apply the knowledge:
At the end of the course, students will have achieved an overall knowledge on the fundamental points necessary for understanding and executing the most common laboratory tests. Students will reach this goal through lectures on certain analytical methods, on biochemical/clinical laboratory tests, and their general significance regarding the characterization and qualitative and quantitative determination of the principal classes of biomolecules of specific interest for biomedical diagnostics.

Soft skills:
The laboratory practicals at the individual level and in groups, and the discussion and interpretation of the results obtained, will contribute to improve the decision-making skills of each student in general, as well as the ability to communicate within a group, and the ability to reach conclusions.

Program

Contents of the lectures:
Withdrawal, conservation and elimination of biological samples. Quality control in a clinical biochemical laboratory. Qualitative and quantitative analyses of the most important enzymes and isoenzymes present in tissues and biological liquids. Luminescence and its analytical applications. General information on plasma proteins and their separation, characterization and determination. Physical, chemical and microscopic analysis of urine. Analyses of the principal biochemical constituents involved in carbohydrate and lipid metabolisms. Classification, separation and analysis of plasma lipoproteins. Routine hematology. Blood groups. Metabolism of bile pigments. Tumour markers. Free radicals and antioxidants in biological systems and methods for studying oxidative

stress.

Laboratory Practicals:
Determination on normal and pathological lyophilized serum of the concentration of proteins, enzymes and metabolites routinely analysed in biomedical diagnostics, using diagnostic kits and spectrophotometric measurements. Determination of metabolites and physical examination of urine using dipsticks and diagnostic kits. Determination of antioxidant activity on different samples of white and red wine using a spectrophotometric assay based on a stable, coloured radical. At the end of each practical, the student has to hand in the data obtained for comparison with data from other groups/students, followed by discussion/interpretation of the results obtained.

Development of the course and examination

Methods for assessing learning outcomes:
The exam consists in a written examination and subsequent revision/discussion. The first part of the exam consists in 15 multiple test questions to be completed in 30 min, and one point is given to each correct answer. The second part of the exam consists of three open questions to be completed in one hour, and for each question a mark from 0 to 5 is given. The result is calculated from the sum of the two written tests. When registering the exam mark, a maximum of two further points may be added, following a brief oral test which is optional.

Criteria for assessing learning outcomes:
In the written exam, the student has to demonstrate that he/she knows and has mastered all the topics of the course and the basics and methods (theory and practice) of the most common biochemical/clinical biochemical analyses. He/she must also be able to critically evaluate the results and the significance of the analyses. During laboratory practicals, the student must show that he/she is able to apply the knowledge acquired during the course in order to perform simple laboratory tests.

Criteria for measuring learning outcomes:
The final exam mark is out of 30. The exam is considered passed when the mark is greater or equal to 18. There is also the possibility of giving full marks with honors (30 cum laude).

Criteria for conferring final mark:
The final exam mark is given by summing the marks of the two written tests. To this mark, if the student wants (optional), a maximum of two additional points may be added, following a brief oral test at the time of registering the exam mark. The honors (cum laude) is given when the mark obtained from the written tests reaches 30, since the student has demonstrated of having completely mastered the topic, or if the mark obtained from the written tests reaches 29 followed by correctly answering the oral questions.

Recommended reading

Notes taken during the lectures and powerpoint presentation handed out by the lecturer.

Further reading:
Biochimica Clinica, A. Gaw, M.J. Murphy, R.A. Cowan, D.J. O'Reilly, M.J. Stewart, J. Shepherd, Terza Edizione (Edizione italiana a cura di M. Lo Bello, L. Rossi), Elsevier Masson S.r.L. 2007.

BIOCHEMISTRY (A-L)

ANDREA ANTONINO SCIRE'

Seat Scienze
A.A. 2016/2017
Credits 8
Hours 64
Period 1^ semestre

Prerequisites

Basic knowledge of general and inorganic chemistry, organic chemistry, mathematics and physics.

Course contents

Both theoretical lessons (up to 7 CFU, 56 hours) and laboratory experiments performed in small teams (at least 1 CFU, 8 hours) are provided. To support the theoretical lessons, in the Moodle platform are inserted: didactic material, instructions, protocols and booking forms for the laboratory experiments.

Objectives of the course

Knowledge:
The course provides knowledge on the structure and function of the main biological molecules and their role on the production and the conversion of the metabolic energy, the metabolic energy pathways and their regulation, the general strategies that underlie the processes of life.

Ability to apply the knowledge:
The student will be able to apply what learned and understood both for studying subjects as Molecular Biology, Plant Physiology, Pharmacology, etc., for which is necessary to know the main biochemical mechanisms and for dealing with complex and multidisciplinary problems.

Soft skills:
The execution of the laboratory experiments will contribute to improve the ability of judgment of the student, the ability of learning and to draw conclusions and the ability to communicate that derives from the working in teams.

Program

Contents (theoretical lessons, up to 7 CFU, 56 hours):
Aminoacids: structure and properties. Proteins: structure and function. Hemoglobin and myoglobin, saturation curves and cooperativity. Enzymes: enzymatic catalysis, activation energy. Enzymatic kinetics: Michaelis-menten model, determination of kinetics parameters, reversible competitive and

non competitive inhibition. Enzymatic activity regulation: allosteric enzymes. Lipids: fatty acids, triglycerides, glycerophospholipids, sphingolipids and cholesterol. Biological membranes: structure and chemical-physical properties. Glucides: structure and function, glycoconjugates and glycoproteins. Metabolism: basic concepts and aims. Role of ATP and of the so-called “high energy” compounds in the energetic metabolism. Glucose metabolism. Glycolysis. Pyruvate metabolism. Phosphate pentose pathway. Gluconeogenesis and glycogen metabolism. Cori cycle. Citric acid cycle. Electron transport chain. Oxidative phosphorylation. Malate-aspartate and glycerol 3-phosphate shuttle systems. Fatty acids activation and transport. Fatty acids degradation. Formation and metabolic role of ketone bodies. Fatty acids synthesis. Protein nitrogen metabolism and aminoacids degradation. Urea cycle. Signal transduction: general aspects and intracellular ways of signal amplification and turn-off. Transduction mechanisms in adrenaline and insulin ways. Protein degradation: ubiquitin and proteasome 20S role.
Laboratory experiments (at least 1 CFU, 8 hours):
Spectrophotometric analysis of unknown concentration samples by means of linear regression method; Spectrophotometric assay of a citric acid cycle enzyme.; Kinetic parameters determination of an enzyme in the presence and absence of a reversible inhibitor.

Development of the course and examination

Methods for assessing learning outcomes:
To value the learning the are two type of examinations, a written one and a oral one. The written one, that lasts for 60 minutes, consists of fifteen multiple choice questions and three open-ended questions. The oral one, that lasts for 15-20 minutes, consists of three open-ended questions. Getting through the written examination is necessary to gain access to the oral examination.

Criteria for assessing learning outcomes:
The questions of the written and oral examination are focused to verify the level of knowledge and comprehension of the student on the topics of the theoretical lessons and of the laboratory experiments. In the written examination, the open-ended questions are focused also to determine the ability of the student to synthesize and to explain clearly and precisely the topics.

Criteria for measuring learning outcomes:
The final mark is assigned in thirtieths. The examination is considered passed if the final mark is equal or more than 18. It is possible to assign “with a first” mark (30 cum laude).

Criteria for conferring final mark:
For the written examination, every correct answer to a multiple choice question counts as one point while every answer to the open-ended questions is valued between zero and five points, depending on its correctness and its exhaustiveness. The mark of the written examination is calculated as the sum of the points obtained in the various type of questions added of a further point. A mark of 16 points is a requisite to be admitted to the oral examination. Every answer of the oral examination is valued between zero and ten points, depending on the correctness, exhaustiveness and the ability of expounding. The marks obtained in the written and in the oral examination are averaged to obtain the final mark. The mark “with a first” (30 cum laude) can be obtained if the final mark, obtained from the average of the written and oral examination, is equal to 30 points and at the same time the student has proved to possess a thorough knowledge of the subject during the oral examination.

Recommended reading

J.M. Berg, J.L. Tymoczko e L. Stryer, “BIOCHIMICA”, 7a ed. Zanichelli.
J. L. Tymoczko, J. M. Berg, L. Stryer, “PRINCIPI DI BIOCHIMICA”, ed. Zanichelli.

BIOCHEMISTRY (M-Z)

TIZIANA BACCHETTI

Seat Scienze
A.A. 2016/2017
Credits 8
Hours 64
Period 1^ semestre

Prerequisites

Basic knowledge in inorganic and organic chemistry, mathematics and physics is desirable.The course is implemented both through classroom lectures (max 7CFU, 56 hours) as well as through laboratory practicals in the didactic laboratories (at least 1 CFU, 8 hours) . These are carried out in small groups (3-5 students), on specific topics that have been treated during the course. In support of the classroom lecture lessons, on the on line Moodle platform teaching materials, instructions and protocols of laboratory exercises are loaded:. Seminars on specific topics of particular interest may be organized in agreement with students.

Course contents

The course is implemented both through classroom lectures (max 7CFU, 56 hours) as well as through laboratory practicals in the didactic laboratories (at least 1 CFU, 8 hours) . These are carried out in small groups (3-5 students), on specific topics that have been treated during the course. In support of the classroom lecture lessons, on the on line Moodle platform teaching materials, instructions and protocols of laboratory exercises are loaded:. Seminars on specific topics of particular interest may be organized in agreement with students.

Objectives of the course

Knowledge:
At the end of the course, the student will have achieved an overall knowledge on: the structure and function of fundamental biological molecules and their role in the metabolic energy production and transformation; main biochemical pathways and their control; the general strategies that underlie life processes.

Ability to apply the knowledge:
At the end of the course, students will be able to apply the notions they have learned and understood, in the study of other areas such as molecular biology, plant physiology, pharmacology, etc., where knowledge on the main biochemical mechanisms are necessary. Moreover, the students will have achieved an overall knowledge necessary to deal complex and multidisciplinary issues.

Soft skills:
The laboratory practicals at the individual level and in groups, and the discussion and interpretation of the results obtained, will contribute to improve the decision-making skills of each student in

general, as well as the ability to communicate within a group, and the ability to reach conclusions.

Program

Programme
Contents of the lectures (theoretical lessons, up to 7 CFU, 56 hours):
Amino acid structure and properties. Structure and function of proteins. Hemoglobin and myoglobin, heme structure, saturation curves and cooperativeness. Enzymes: the enzymatic catalysis, activation energy. Enzyme kinetics: the Michaelis-Menten model, kinetic parameters, competitive and non-competitive inhibition. Regulation of enzyme activity and allosteric enzymes. Lipids: fatty acids, triglycerides, glycerophospholipids, sphingolipids and cholesterol. Biological membranes: structure and physico-chemical properties. Carbohydrates: structure and function, glycoconjugates and glycoproteins. Metabolism: basic concepts. Role of ATP and of the "high-energy" compounds in energy metabolism. Glucose metabolism. Glycolysis. Aerobic and anaerobic fate of pyruvate. Pentose phosphate pathway. Gluconeogenesis and glycogen metabolism. Cori cycle. Citric acid cycle. The electron transport chain. Oxidative phosphorylation. Malate-aspartate and glycerol 3-phosphate shuttle systems. Activation and transport of fatty acids. Degradation of fatty acids. Formation and metabolic role of ketones. Synthesis of fatty acids. Degradation of amino acids. Urea cycle. Signal transduction: general and intracellular pathways. Adrenaline and insulin transduction pathways. Protein degradation: the role of ubiquitin and proteasome 20S.

Laboratory Practicals (at least 1 CFU, 8 hours):
Spectrophotometric analysis of samples at unknown concentration by the method of linear regression; spectrophotometric assay of enzyme activity; evaluation of enzyme kinetic parameters in the absence and in the presence of an inhibitor.

Development of the course and examination

Methods for assessing learning outcomes:
The exam consists in a written examination followed by an oral one. The written one consists of fifteen multiple choice questions and three open-ended questions to be completed in one hour. The oral one, consists of three open-ended questions. Getting through the written examination is necessary to gain access to the oral examination.

Criteria for assessing learning outcomes:
The questions of the written and oral exam are aimed to assess the student knowledge on the topics of the course. In the written test, the open questions are aimed to evaluate the student's ability to summarize and to clearly and precisely describe the topics.

Criteria for measuring learning outcomes:
The final exam mark is out of 30. The exam is considered passed when the mark is greater or equal to 18. There is also the possibility of giving full marks with honors (30 cum laude).

Criteria for conferring final mark:
For the written examination, every correct answer to a multiple choice question counts as one point while every answer to the open-ended questions is valued between zero and five points, according to the correctness and exhaustiveness of the answer.The mark of the written examination is calculated as the sum of the points obtained in the various type of questions added of a further

point. A mark of 16 points is a requisite to be admitted to the oral examination. Every answer of the oral examination is valued between zero and ten points, depending on the correctness, exhaustiveness and the ability of expounding. The marks obtained in the written and in the oral examination are averaged to obtain the final mark. The honors (cum laude) is given when the mark obtained from the written tests reaches 30 and at the same time the student has proved to possess a thorough knowledge of the subject during the oral examination.

Recommended reading

Notes taken during the lectures and PowerPoint presentation handed out by the lecturer (on line Moodle platform)
Further reading:
J.M. Berg, J.L. Tymoczko e L. Stryer, “BIOCHIMICA”, 7a ed. Zanichelli.
J. L. Tymoczko, J. M. Berg, L. Stryer, “PRINCIPI DI BIOCHIMICA”, ed. Zanichelli

BIOCHEMISTRY AND BIOTECHNOLOGY OF PROTEINS

FABIO TANFANI

Seat Scienze
A.A. 2016/2017
Credits 8
Hours 64
Period 1^ semestre

Prerequisites

Gary Walsh. Proteins, Biochemistry and Biotechnology. John Wiley and Sons, LTD

Course contents

The course consists of eight credits (64 hours). The course is implemented both through classroom lectures using power point presentations (seven credits) handed out to students, as well as through seminars prepared by small groups of students on topics proposed by the teacher, and seminars on specialized topics given by the teacher and/or his colleagues (one credit).
The course aims to teach students about protein biochemistry and about strategies for the purification of soluble and membrane proteins on laboratory and industrial scale. Moreover, the course aims to teach students about the application of non-catalytic proteins and enzymes in the food, pharmaceutical, and chemical industries.

Objectives of the course

Knowledge:
At the end of the course, the students will be familiar with protein biochemistry, with factors that stabilise/destabilise proteins, and methods used to purify membrane proteins, non-catalytic proteins and enzymes on laboratory and industrial scale. Moreover, the students will be familiar with the applications of different classes of non-catalytic proteins and enzymes in the food, pharmaceutical, and chemical industries.

Ability to apply the knowledge:
The students should be able to plan purification methods for membrane proteins, non-catalytic proteins and enzymes bearing in mind the protein biochemistry, the wanted degree of purification, the costs, and the use of a specific protein in a particular field of industry. Moreover, the students should be able to ponder possible and potential applications of a specific protein in a particular industrial sector.

Soft skills:
The students should be able to communicate clearly the knowledge and the related rationale. The communication ability, the capacity to work in groups and the ability to analyse and summarise information will be experienced through seminars prepared by small groups of students on topics given by the teacher. The preparation of the seminars and their presentation in the lecture room will

encourage students to interact and communicate between themselves and with the teacher.

Program

Cells as factories for the production of proteins for biomedical, analytical and industrial applications. Globular, fibrous and membrane proteins. Post-translational modification. Importance of side-chains on structure-function of proteins. Folding, misfolding, denaturation. Destabilising factors of protein structure: detergents, organic solvents, oxidant and chaotropic agents, temperature, pH, freezing/thawing. Stabilisation and storage of proteins: stabilising agents, cooling, freeze-drying, spray drying, sterilization, preservation.
Protein sources: proteins from animals, plants, and from mesophilic and extremophile organisms; protein production from genetically engineered organisms. Screening of new enzymes.
Homogenization of tissues and cells on a laboratory and industrial scale.
Strategies for the purification of soluble proteins. Solubility and fractional precipitation with temperature and pH changes, with the addition of organic solvents, salting-out and salting-in. Main chromatographic techniques for the purification of proteins on a laboratory and industrial scale.
Methods for purification of membrane proteins and for their reconstitution into liposomes.
Purification of exocellular and endocellular proteins of industrial, biomedical, pharmaceutical and analytical interest. Scale-up of the protein extraction and purification process. Proteins as inclusion bodies: solubilisation and refolding methods. Technical and economic implications for different strategies of protein purification.
Proteins and enzymes for industrial applications: Immobilized enzymes, immobilization techniques, bioreactors. Biosensors: principles and applications. Proteases: classification and industrial uses.
Carbohydrases: applications of alpha-amylase, beta-amylase, glucoamylase, alpha-(1-6) glucosidase, and glucose isomerase. Enzymes able to hydrolyse cellulose, hemicellulose, and pectin. Lipases and their applications. Milk proteins.
Enzymes and proteins for medical, pharmacological, analytical, and food applications. Microbial, viral, and pyrogenic contaminants. Blood products, enzymes and antibodies for analytical and therapeutic applications, hormones, growth factors, cytokines, tumoral necrosis factors, interferons, interleukins.

Development of the course and examination

Methods for assessing learning outcomes:
The assessment method is an oral examination that takes 30-40 minutes.

Criteria for assessing learning outcomes:
The assessment method is an oral examination directed to evaluate the knowledge and understanding of protein biochemistry and of the other course topics necessary to solve problems related to the course objectives.

Criteria for measuring learning outcomes:
The final mark is out of 30. Successful completion of the examination will lead to grades ranging from 18 to 30, and 30 cum laude.

Criteria for conferring final mark:The final mark is attributed on the basis of the answers to three questions and on the basis of the quality of the seminars given by the students. The student seminars will contribute to the final mark for not more than two points. The laude is attributed when the student demonstrates complete mastery of the matter.

Recommended reading

Gary Walsh. Proteins, Biochemistry and Biotechnology. John Wiley and Sons, LTD;

BIOCHEMISTRY OF NUTRITION

TIZIANA BACCHETTI

Seat Scienze
A.A. 2016/2017
Credits 8
Hours 64
Period 2^ semestre

Prerequisites

Basic knowledge in Chemistry and Biochemistry is desirable.

Course contents

The course is implemented both through classroom lectures (max 7credits) as well as through laboratory practicals in the didactic laboratories (min 1 credit). These are carried out in small groups, on specific topics that have been treated during the course. In support of the classroom lecture, on the on line Moodle platform, teaching materials, instructions and protocols of laboratory exercises are loaded. Seminars on specific topics of particular interest may be organized in agreement with students.

Objectives of the course

Knowledge:
At the end of the course, the student will have achieved an overall knowledge on: the structure, function and nutritional significance of the fundamental food macronutrients and micronutrients; the reactions in which nutrients are involved during food processing and storage; the main biochemical and metabolic processes involved in food intake and nutrient utilization. Students will have the information for understanding the molecular and metabolic mechanisms involved in human diseases and disorders related to nutrition.

Ability to apply the knowledge:
At the end of the course, students will have achieved an overall knowledge and competence on the fundamental points necessary to deal the issues related to nutritional aspects and to apply this knowledge in the profession.

Soft skills:
The laboratory practicals and the discussion and interpretation of the results obtained, will contribute to improve the decision-making skills of each student in general, as well as the ability to communicate within a group, and the ability to reach conclusions.

Program

Contents of the lectures:
Food and nutrition: use of the terms and operational meaning.
Nutritional standards and dietary guidelines: body mass index and its use for the diagnosis of obesity in adults. The RDAs and adequacy of food intake.
Categories of nutrients, macronutrients and micronutrients.
Carbohydrates: definition and nutritional classification, food sources, energy value. Digestion, absorption and role of available carbohydrates in the diet, the minimum and recommended requirements. Factors affecting the bioavailability of carbohydrates. Glycemic index and glycemic load and their biochemical meaning. Dietary fiber. Sweetening power of sugar and artificial sweeteners. Prebiotics and Probiotics.
Lipids: classification and chemical composition. Food sources and energy value. Saturated, monounsaturated and polyunsaturated, trans fatty acids. Essentiality of fatty acids. Lipid requirements and pathophysiological roles of lipids. Dietary cholesterol and endogenous cholesterol. Digestion and absorption and plasma lipoproteins.
Proteins: nutritional and energy value meaning. Amino acids: nutritional and metabolic classification. Protein turnover. The nutritional value of protein. Integration and complementation of food proteins. Digestion and absorption. Daily requirement and pathophysiological roles.
Vitamins: nutritional significance. Fat-soluble and water soluble vitamins, their biochemical deficiency and toxicity, requirements, food sources and bioavailability.
Minerals: classification of main macro and micro elements. Food sources and bioavailability, requirements and deficiencies, toxicities.
Phytonutrients (polyphenols, carotenoids, glucosinolates). Food sources and their pathophysiological importance.
Major changes nutrients undergo during processing and storage of food: enzymatic and non-enzymatic browning reaction (Maillard reaction and caramelization); oxidation of lipids and the role of antioxidants; degradation and / or oxidation of proteins; loss of vitamins and phytonutrients.
Food and health: the molecular basis of diseases associated with wrong eating habits. Functional foods.

Laboratory Practicals:
Determination on normal and pathological lyophilized serum of the concentration of proteins, enzymes and metabolites routinely analysed in biomedical diagnostics, using diagnostic kits and spectrophotometric measurements. Determination of metabolites and physical examination of urine using dipsticks and diagnostic kits. Determination of antioxidant activity on different samples of white and red wine using a spectrophotometric assay based on a stable, coloured radical.

Development of the course and examination

Methods for assessing learning outcomes:
The exam consists in oral examination with questions targeted to evaluate the knowledge on the topics of the course.

Criteria for assessing learning outcomes:
The student has to demonstrate that he/she knows and has mastered all the topics of the course and to possess the information needed to deal issues related to nutrition / diet.

Criteria for measuring learning outcomes:
The final exam mark is out of 30. The exam is considered passed when the mark is greater or equal to 18. There is also the possibility of giving full marks with honors (30 cum laude).

Criteria for conferring final mark:
The final mark is given based on the ability demonstrated by the student during the exam of being competent on the topics of the course

Recommended reading

Notes taken during the lectures and powerpoint presentation handed out by the lecturer (on line Moodle platform)
Further reading:
I. COZZANI e E. DAINESE. Biochimica degli Alimenti e della Nutrizione. Piccin, Padova, 2006
A. MARIANI COSTANTINI, C. CANNELLA, G. TOMASSI, Fondamenti di Nutrizione Umana, Il Pensiero Scientifico Editore, Roma.

BIOETHICS

MASSIMILIANO MARINELLI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 2^ semestre

Prerequisites

Knowledge of the basics of biology, genetics and general ethics.

Course contents

lectures are planned (6 credits, 48 hours). At the front course is flanked teaching activity through a web platform containing inter alia: teaching materials, events, clarifications on specific aspects of the program, and the possibility of interaction between students and the teacher.

Objectives of the course

knowledge:
The course enables students to acquire the basic knowledge about the history, the development of bioethics, to learn the ethical and methodological foundations of a moral argument about the problems arising from the development of the applications of biology and genetics in the field of human and animal (fertilization assisted, stem cells, genetic engineering, CRISP-CAS, pharmacogenomics and pharmacogenetics).

Ability to apply the knowledge:
The student will also acquire the following professional skills: ability to identify ethical issues in the various fields of biology activity and critically analyze aspects of the new biotechnologies.

Soft skills:
The particular language of bioethics, that requires both biological techniques linguistic proficiency and humanities ethics and methodology of argumentation that takes place through an extensive reflection groups, help to improve the degree of independence of judgment in general, the ability to communicate that also stems from working in groups, the ability to learn independently and to draw conclusions.

Program

Content (lectures, 6 CFU, 48 hours):
Introduction to ethical reflection

The nature of ethics
The fundamental concepts of moral action
Ethical pluralism
History and principles of bioethics
Bioethics according Potter
Jonas and the principle responsibility
The currents of bioethics
The issues of bioethics
The principles of bioethics
ethical and legal considerations on the use of biotechnology
The age of biotechnology
Features of biotechnology research
Ethical issues on the use of human stem cells
therapeutic cloning
The human embryo
GM animals:
The patentability of living organisms
Animal testing
Interests or rights?
Genetic engineering and the Human Genome Project
genetic testing
pharmacogenomics Pharmacogenetics
gene therapy
CRISPR-CAS9

Development of the course and examination

Methods for assessing learning outcomes:
The exam is oral and consists of a discussion of the educational content of the course. The questions tend to test learning in each of the three areas of training course: bioethics and his arguments, ethical developments of major scientific research programs, the relationship with the animal world and their testing.

Criteria for assessing learning outcomes:
The student will demonstrate knowledge of the evolution, the reference principles of bioethics and the ethics of argumentation methods applied to biotechnology, as well as to have acquired basic knowledge on major scientific research programs and their possible developments. It must also show that they have acquired the ability to assess the extent of technological evolution ethics in biology and genetics with regard to the destiny of man and the animal world.

Criteria for measuring learning outcomes:
The final mark is awarded out of thirty. The exam is passed when the grade is greater than or equal to 18. It is expected to be awarded the highest marks with honors (30 cum laude).

Criteria for conferring final mark:
The final grade is given by adding up the feedback of the answers to the questions in the three training areas. Praise is attributed when the score obtained from the previous sum reaches 30/30, and at the same time the student has demonstrated full mastery of the subject.

Recommended reading

lecture notes, slide material present in
https://www.facebook.com/Marinellibioetica/
Reichlin M, Etica della vita, nuovi paradigmi morali, Bruno Mondadori, 2008
Viafora C., Gaiani A, (a cura di) A lezione di bioetica FrancoAngeli, 2015
Marinelli M., Trattare le malattie, curare le persone, FrancoAngeli, 2015

BIOINFORMATICS

MARCO BARUCCA

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 1^ semestre

Prerequisites

General knowledge of genetics and molecular biology.

Course contents

Lectures are provided as well as at least 3 CFU of practical exercises in the computer lab (carried out individually or in small groups).

Objectives of the course

Knowledge and understanding:
The aim of the course in bioinformatics is to provide an introduction to the knowledge and use of bioinformatic tools freely available on the World Wide Web, for the sequence analysis of nucleic acids and proteins, and more generally of the data available in biological databases.

Ability to apply the knowledge:
At the end of the course the student will be able to use the information available in biological databases and some of the most important bioinformatic tools to study nucleotide and protein sequences.

Soft skills
Individual and group exercises in the computer lab will contribute to improve the autonomy level as well as communication skills also arising from work in groups.

Program

Introduction to software for application in biology. Public biological sequence databases: history, catalog of current databases, organization of database entries, entry identification and retrieval, storage and updating, evolution to adapt to new technologies. Analysis of single nucleic acid sequences: from restriction map to gene structure prediction. Pairwise comparisons: dot plots and one-to-one alignment strategies, analysis of sequence similarities. Comparisons to databases: hardware and software strategies for generating and analysing very large numbers of pairwise alignments (BLAST). Multiple alignments: methods for detecting similarities within a family.

Development of the course and examination

Methods for assessing learning outcomes:
Written and oral examination, with registration in the own private area.

Criteria for assessing learning outcomes:
Written and Oral test: the final exam will consist in the evaluation of a written report (the analysis of a protein using the tools available on the web) and an oral test to demonstrate the ability to use advanced information tools (databases, software packages) for genetics and biology.

Criteria for measuring learning outcomes:
The final mark is assigned on the basis of written and oral exam through questions at low, medium, and high difficulty

Criteria for conferring final mark:
The final mark is assigned on the basis of the student's ability to provide answers that demonstrate mastery of the subject with clarity and with a relevant technical and scientific terminology. It will also evaluate the student's ability to link the topics covered during the course among themselves and with topics of other teachings already acquired by the student.

Recommended reading

S. Pascarella e A. Paiardini, Bioinformatica, Zanichelli, Bologna.
DE. Krane e ML Raymer, Fondamenti di Bioinformatica, Pearson
A.M. Lesk, Introduzione alla Bioinformatica, McGraw-Hill Companies
D.W. Mount, Bioinformatics: sequence and genome analysis, Cold Spring Harbor Lab. Press.
C. Gibas, and P. Jambeck, Developing bioinformatics computer skills, O´Reilly, Cambridge
Slides provided during the course.

BIOLOGICAL AND ECOLOGICAL RISK

FRANCESCO REGOLI

Seat Scienze
A.A. 2016/2017
Credits 8
Hours 64
Period 2^ semestre

Prerequisites

A good knowledge of basic chemistry, ecology, general and cell biology are important requisites for this course.

Course contents

The course is based on theoretical lessons, presentation of case-studies, and specific insights through seminars and integrative lessons given by national experts.

Objectives of the course

Knowledge
The Course Biological and Ecological Risk is aimed to prepare students on the more actual methodologies to assess, prevent, monitor and counteract various forms of biological and environmental risk. The course will prepare students on the risk of bioterrorism, focussing on differences between biological and chemical weapons, biological mechanisms and toxicological effects. The course will also prepare students on general characteristics, diffusions, environmental resistance, infection, incubation and pathogenesis, diagnosis, bio-safety procedures and management of the risk associated to other natural biological risks, including aviarian pests and pandemic risks, and biotoxins associated to specific algal blooms. Students will be trained on some toxicological emergencies which occurred in the last decades analyzing procedures and events, acute effects and long term consequences at both biological and environmental levels. Normative guidelines and models for Environmental Risk Analysis (ERA) will be discussed and applied to actual issues, like those involving removal and management options of contaminated sediments. The Course will introduce students to management and assessment of biological and ecological risks during recent environmental emergencies, including oil-spills, discharges of toxic wastes in the sea, nuclear incidents.

Ability to apply the knowledge:The student will have the capability to apply received knowledges for the planning and the management of several typologies of emergencies (bioterrorist attacks, pandemic events, biotoxins, industrial and nuclear incidents, oil spills and discharges into the sea), for the risk perception and assessment, for the identification of critical points, adequate monitoring controls, for the decisional and gestional measures.

Soft skills:
Beside the different typologies of risk analysed during the course, transversal competences include various aspects and phases related to characterization and management of risk, such as the origin and source of the risk, diffusion within environmental matrices and transfer to humans, mechanisms of action and eco-toxicological effects, possibility of diffusion and propagation of the damage, protocols of action, control and remediation, prevention

Program

Modern bioterrorism, origin and characteristics. Comparison between chemical and biological weapons. Biological weapons of type A, B, C. Main biological characteristics, diffusion, environmental resistance, infection, incubation and pathogenesis, biological mechanisms of action, clinical aspects, diagnosis and therapies, bio-safety procedures, depuration and remediation. Type A agents: anthrax, smallpox, plague, botulism, viruses of hemorrhagic fevers, tularemia. Chemical weapons, physical, chemical and toxicological characteristics. Primary and collateral biological effects, NOEL, LOEL, LOAEL, LC50 Ct, LCt50. General properties, stability, diffusion, exposure routes, biological mechanism of action and toxicological effects, antidotes and therapies of: blister agents, Blood agents, Nerve agents, Pulmonary agents, Incapacitating agents, Riot control agents. Biological risks and recent sanitary emergencies; aviarian pest and pandemic risks. Toxic algae and biotoxin during algal blooms; classification, molecular structure, toxicological effects, environmental distribution and biological risks. Toxicological, biological and ecological emergencies in developing and industrialized countries. The Bophal disaster, characteristics, acute and chronic effects, toxicological and sanitary consequences after 20 years. Risks from nuclear radiations, type of radiation, exposure sources, deterministic and stochastic effects. Biological and environmental consequences of Hiroshima and Chernobyl. Uranium decay and characteristics of isotopes. Use of enriched and depleted uranium and biological and ecological risks associated to depleted uranium in weapons. The risks of dioxins and dioxin-like compounds, dangerous substances, industries of high environmental concerns, introduction to Seveso Directives. Environmental Risk Assessment (ERA) and Weight Of Evidence (WOE) models. Dredging and remediation of polluted sites. Environmental emergencies due to oil-spills and discharge of toxic wastes; biological and ecological risks associated to use of chemical dispersants. Critical evaluation of recent incidents, Erika, Ievoli Sun, Prestige, Deep Water Horizon).

Development of the course and examination

Methods for assessing learning outcomes:
The examination is oral, based on questions and following discussion related to the main risks of biological nature, those arising from industrial or nuclear incidents, marine and maritime emergencies, ecological risk.

Criteria for assessing learning outcomes:
During the examination, it will be evaluated the capability of the student to properly answer and discuss various issues, the general competence on problematics, the use of appropriate terminology, the capability to move from a topic to another one and make transversal links.

Criteria for assessing learning outcomes:
The final assessment is made of thirty. The examination is considered as passed with a vote of 18/30 or higher. The student can decide to decline the proposed vote and give again the

examination in the following session.

Criteria for conferring final mark:
The final assessment will be given depending on the capability of the student to answer all the questions, general competence and ability to properly discuss various issues.

Recommended reading

Provided material and scientific literature suggested on specific topics.

BIOMEDICAL BACTERIOLOGY

FRANCESCA BIAVASCO

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 1^ semestre

Prerequisites

Good knowledge of General Microbiology and Molecular Biology

Course contents

The course encompasses lectures (5 credits, 40 hours) and lab practice in small working groups (1 credit, 8 hours). Course attendance is not mandatory, although lab practice is strongly recommended. Students who have not followed labs must anyway know their content and be able to describe the experimental assays (they can find detailed lecture notes on the Department web site and ask the professor for clarification).

Objectives of the course

At the end of the course students will be required to have a detailed knowledge of the structure and function of the bacterial cell parts and of bacterial pathogenicity, including the molecular bases of its origin, evolution and spread. Students will also be required to know the bases of bacterial taxonomy, the main features of bacterial genera and species involved in human (and animal) infections, their transmission routes and the main criteria for their culture, isolation and identification.

Ability to apply the knowledge:
Students will have the ability of recognizing the main pathogenic or potential pathogenic genera and species and to be able to reproduce procedures useful to their isolation, culture and identification. In specific cases student will have the ability to discriminate, within a single species, between virulent and avirulent strains.

Soft skills:
Lab practice will contribute to improve students' interpersonal skills, their independence in terms of work management and their ability to work as a part of a team and to critically discuss the results. Moreover, students will be encouraged to make connections with what learned in other courses, with particular regard to Diagnostic Microbiology.

Program

What you'll learn (theoretical training, 5 credits, 40 hours):
Pathogenicity and virulence. Adhesiveness and invasiveness, intracellular pathogens; fimbriae: structure, classification and involvement in virulence; secretion systems; main bacterial toxins; bacterial mechanisms for escaping host defenses, survival in the host cells. Evolution of bacterial pathogens. Pathogenicity and Resistance Islands. Transmission routes of bacterial diseases, zoonosis
Bacterial phylogenesis, classical and molecular taxonomy, the concept of species in bacteriology, the Bergey's manual. Bacterial identification and preservation. Main groups of bacteria involved in human pathology. Enterobacteriaceae (Escherichia coli, Salmonella, Shigella, Yersinia and others), pseudomonads and other nonfermenting bacilli, genus Vibrio and Aeromonas, Campylobacter and Helycobacter; neisseriae, yersiniae, brucellae; hemophili, bordetellae mycobacteria; staphylococci; streptococci, enterococci; listeriae; spore-forming aerobes (Bacillus anthracis and Bacillus cereus); spore-forming anaerobes (Clostridium tetani, Clostridium botulinum, Clostridium perfringens); other anaerobes; spirochetes (genus Borrelia, Treponema and Leptospira); rickettsiae, chlamydiae, mycoplasmas, legionellae.

Laboratory practice: isolation and identification of different bacterial species from biological samples.

Development of the course and examination

Methods for assessing learning outcomes:
The exam will take the form of an interview and each student will be asked three questions. Erasmus students can have a written multiple-choice test in either English or Italian including 30 questions.

Criteria for assessing learning outcomes:
Each student will be required to demonstrate an understanding of the asked topic and to be able to organize a logical and understandable answer, he should also be able to make connections with related, and entry required, disciplines. The student will be required to demonstrate his knowledge of the theoretical bases of the experimental procedures he is asked to describe.
Students who will face the written test will have to mark the correct answer.

Criteria for measuring learning outcomes:
A 30-point scale will be used to measure your performance, with 18 being the minimum score to pass the exam and 30 being the highest, considering also your ability of thinking and make connections. In the event of an outstanding performance, the professor can decide to reward the student with a 30 cum laude.

Criteria for conferring final mark:
The final mark will be awarded based on the evaluation of the answers to the three questions. Honors will be awarded when the mark is 30 and the student has demonstrated a particularly good command of the matter.

Recommended reading

Bendinelli, Chezzi, Dettori manca, Morace, Polonelli, Tufano. Microbiologia medica-Batteriologia. Ed. Monduzzi

La Placa. Principi di Microbiologia Medica. Società Editrice Esculapio.
Antonelli, Clementi, Pozzi, Rossolini. Principi di microbiologia medica. Casa Editrice Ambrosiana.
Wilson, Salyers, Whitt, Winkler. Bacterial Pathogenesis – a molecular ap-proach. ASM press; Whashington, DC
Madigan, Martinko, Stahl, Clark. Brock - Biologia dei microrganismi-vol. 3, Mi-crobiologia biomedica. Ed. Pearson Italia.
Wiley, Sherwood, Woolverton. Prescott 3 - Microbiologia medica. Ed. McGraw-Hill.
Lecture and lab practice exercises notes.

BIOMEDICAL LABORATORY SAFETY

ERNESTA PIERAGOSTINI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 1^ semestre

Prerequisites

None

Course contents

The course consists of theoretical lectures (5 credits, 40 hours) and laboratory practical work carried out individually or at small groups (1 credit, 8 hours)

Objectives of the course

Knowledge:
The course aims to develop in students a thorough knowledge of risk factors, in relation to the current regulations, in order to permit good management of health and safety in laboratories.

Ability to apply the knowledge:
At the end of the course, the students should acquire the professional ability to work safely according to the B.P.L.

Program

Contents (lectures, 5 CFU, 40 hours. Laboratory practical work 1 CFU, 8 hours)
• THE CURRENT NORMATIVE AND LEGAL ASPECTS OF THE SAFETY AND HEALTH PROTECTION IN THE WORKPLACE
• THE LABORATORY : WORKPLACE AND RELATED RISKS
• CHEMICAL RISK, REACH AND CLP
• RISK FROM CANCEROGENIC AND MUTAGENIC AGENTS
• RISK FROM BIOLOGICAL AGENTS
• RISK FROM PHYSICAL AGENTS
• CLASSIFICATION OF LABORATORIES
• OCCUPATIONAL STRESS
• MICROCLIMATE IN THE WORKPLACE
• ENVIRONMENTAL AND BIOLOGICAL MONITORING IN WORKPLACES WITH SPECIAL REGARD TO LABORATORIES

• INJURIES AND OCCUPATIONAL DISEASES IN DIAGNOSTIC AND RESEARCH LABORATORIES
• WORKPLACE SAFETY AND PREVENTION
• PREVENTION MEASURES IN LABORATORIES, INDIVIDUAL AND COLLECTIVE PROTECTION DEVICES
• HEALTH SURVEILLANCE
• LABORATORY WASTE MANAGEMENT
• BASIC FIRST AID INFORMATION FOR THE WORKER

Development of the course and examination

Methods for assessing learning outcomes:
The assessment method is a written classwork and subsequent revision/discussion of the script. 27 questions and 1 open question are provided for the examination. To each question, a score included between zero and one is assigned, to open question a score included between zero and four is assigned .The exam is passed when the final score is higher or equal to 18.

Criteria for assessing learning outcomes:
In the written classwork, the student will have to demonstrate to have acquired, autonomy and good management of health and safety in laboratories.

Criteria for measuring learning outcomes:
The final mark is attributed in thirtieths. Successful completion of the examination will lead to grades ranging from 18 to 30, and 30 with laude.

Criteria for conferring final mark:
The final mark is attributed by summing to the evaluation of the written classwork, laud is attributed when the score obtained by the previous sum exceeds the value of 30

Recommended reading

L. Alessio, P. Apostoli; Manuale di MEDICINA DEL LAVORO E IGIENE INDUSTRIALE PER TECNICI DELLA PREVENZIONE, 2009 Piccin
G. Campurra; Manuale MEDICINA DEL LAVORO, 2013 Ipsoa Indicitalia

BIOMEDICAL VIROLOGY

PATRIZIA BAGNARELLI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 1^ semestre

Prerequisites

Basic principles of cell biology and innate/adoptive mechanisms of the immune defence

Course contents

The course is organized in a number of lectures arranged into two parts. The part one deals with general virology (virus definition, morphology, classification, replication strategies, viral genetics, viral vaccines and chemotherapy); the part two deals with the specific virus families focusing on their distinctive characteristics. Every single agent, considered in the context of the viral family it belongs, is treated with special attention to the structure, biology, pathogenesis, epidemiology, diagnosis, therapy and prevention. There will be a guided tour of the virology laboratory.

Objectives of the course

Knowledge:
The principal aim of the course is to provide students with a thoroughly and complete knowledge on the viral agents involved in a number of human infectious diseases. The student must have clear what are viruses, what is meant by viral infection, what are the pathogenic mechanisms put in place by major viral pathogens.

Ability to apply the knowledge:
At the end of the course students will be able to recognize the major viral pathogens for humans, the ways of transmission, the virulence mechanisms, and resistance to antiviral drugs. Such knowledge will prove useful in any job experience within a Microbiology laboratory at the Hospital or University setting.

Soft Skills:
Knowledge of the causes of major infectious diseases in humans, understanding the etiopathogenesis of infectious diseases and the complex host-parasite-environment relationship will improve the degree of independence of judgment in general, and the ability to draw conclusions.

Program

General virology: introduction to virology, virus structure, replication, culture and genetics, mechanisms of viral pathogenesis, laboratory diagnosis of viral diseases, antiviral agents and viral vaccines.
Specific Virus Families: DNA viruses (Parvoviruses, Adenoviruses, Poxviruses, Papillomaviruses and Polyomaviruses, Human Herpesviruses); RNA viruses (Orthomyxovirus, Paramyxovirus, Rubella Virus, Flaviviruses, Rhabdoviruses, Arenaviruses, Hantaviruses, Filoviruses, Picornaviruses, Reoviruses, Coronaviruses, Retroviruses and HIV); Hepatitis Viruses.

Development of the course and examination

Methods for assessing learning outcomes:
Oral evaluation consisting of two/three questions about different topics of the program.

Criteria for assessing learning outcomes:
The student will be evaluated according to the knowledge of the topics in the program and the skill showed about them.

Criteria for measuring learning outcomes:
The final mark is awarded in thirtieths. The exam is passed when the rating is greater than or equal to 18. The highest marks with honors (30 cum laude) may be awarded.

Criteria for conferring final mark:
The final mark is given considering the completeness of exposition demonstrated in each reply. Honors are given when the student has demonstrated full mastery of the topic.

Recommended reading

Guido Antonelli e Massimo Clementi, “Principi di Virologia Medica”, Casa Editrice Ambrosiana
Patrick Murray Ken Rosenthal G. Kobayashi M. Pfaller: “Medical Microbiology” (Last Edition)

BIOTECHNOLOGY OF MICROORGANISMS

MAURIZIO CIANI

Seat Scienze
A.A. 2016/2017
Credits 7
Hours 56
Period 1^ semestre

Prerequisites

Knowledge of the issues of the following courses: General Biology, General Microbiology, Genetics

Course contents

Both theoretical lectures (6 credits, 48 hours) and laboratory practical work carried out individually or in small groups (1 credit, 8 hours) are planned. The teaching material of the lectures will be provided in the reserved area. Teaching materials for the exercises will be provided to each planned exercise and the elaborated results will be made available in the reserved area.

Objectives of the course

Knowledge:
The course will allow students to acquire knowledge of the metabolic and physiological issues of the microorganisms used in various fermentation processes. At the same time, will also allow to know the mode of growth and the use of microorganisms in biotechnological processes as well as the parameters conditioning the process. The course also provides knowledge on the main biotechnological processes.

Ability to apply the knowledge:
With the support of the lab hours student will be able to measure microbial growth parameters, and describe and control simple biotechnological processes.

Program

Introduction: general arrangement and sectors of application; microorganisms and products of industrial fermentations. Development and perspective of microbial biotechnology Microorganisms and fermentation. Taxonomic and systematic arrangement of micro-organisms of use or potential use in the fermentation processes; microbial metabolism: main pathways of carbon and nitrogen metabolism and its regulations; respiro-fermentative metabolism of yeasts; metabolic regulation. Microorganisms and biochemical cycles: Carbon cycle and nitrogen cycle. Screening and selection

of industrial cultures; genetic manipulations of industrial strains, strains improvement. Primary and secondary metabolites Fermentation technology: Raw materials and composition of substrate of fermentation. Fermentation process: batch, extended batch, batch with cell recycle, continuous process; kinetic of microbial growth and fermentation products; principal parameters of fermentation process. Molecular characterization of microorganisms. Bioreactors: design, operation and applications. Agitation and aeration technology; measurements and regulations of principal fermentation parameters; fermentation plant. Product recovery. Killer character in yeasts. Cell immobilization. Some industrial application of microorganisms: Organic acid production. Wastewater treatment: aerobic and anaerobic wastewater processes. Composting processes, recycle of biomass.
The laboratory practices (1 credit 8 hours). Isolation and counting of microorganisms from various food matrices, screening and characterization of isolated strains, growth curve and determination of the main parameters)

Development of the course and examination

Methods for assessing learning outcomes:
oral examination

Criteria for assessing learning outcomes:
learning evaluation will be performed by means of questions and taking into account the arguments put forward by the student.

Criteria for measuring learning outcomes:
The student must demonstrate that it has acquired knowledge and mastery in the use of microorganisms in biotechnological processes

Criteria for conferring final mark:
the final grade will be out of thirty. The student who does not have the reports on laboratory exercises will also be evaluated on such topics

Recommended reading

Brock Biologia dei microrganismi vol. 1 Microbiologia generale, Pearson Ed. 2012
M. Manzoni Microbiologia Industriale CEA Editrice 2006
Donadio, S., Marino, G. Biotecnologie microbiche CEA Editrice 2008

BOTANY (A-L)

CECILIA MARIA TOTTI

Seat Scienze
A.A. 2016/2017
Credits 8
Hours 64
Period 1^ semestre

Prerequisites

Basic knowledge of physics and general and organic chemistry. It is recommended to pass the course of Cytology and histology.

Course contents

Both theoretical (7 CFU, 56 hours) and practical (1 CFU, 8 hours) lessons will be provided.

Objectives of the course

Knowledge
This course allows students to acquire basic knowledges plant biology, both in the general and in systematic aspects. The course allow students to learn the structure and function of cells, tissues and organs of plant organisms. Finally, the students will know main groups of plant organisms (algae, fungi and land plants) in terms of morphological, anatomical and reproductive traits and will understand their evolutionary relationships.

Ability to apply the knowledge:
The acquisition of knowledge by students are aimed to inspire a ‘botanical culture’, which is necessary to the general preparation of a biologist and fundamental for those who will begin one's career as a teacher. Students will be able to recognize plant histological preparations, organ sections and will be able to comprehend the plant biology, reproduction end evolutionary adaptations.

Program

Theoretical lessons (7 CFU, 56 hours)
Introduction to botany. Cyanobacteria: cell structure, morphology, reproduction, distribution and ecology.
Origin of chloroplast and evolution of eukaryotes. The classification of plants in main eukaryote supergroups following the recent classification.
Algae. General characteristics, morphological and reproductive traits of main algal groups (Rhodophyta, Chlorophyta/Streptophyta, Dinophyta, Stramenopili, Euglenophyta). Notes on algal

ecology.
Land plants. Adaptations to terrestrial life. Non vascular plants: Bryophytes. General characteristics and life cycles of mosses and liverworts.
Introduction to vascular plants. Pteridophytes: morphology and life cycles of lycopods, equiseta and ferns.
Spermatophytes: Gymnosperms (Coniferophyta, Cycadophyta, Ginkgophyta); general characteristics, reproduction and life cycle. Angiosperms: (Dicotyledones and Monocotyledones) reproduction and life cycle; flowers, seeds, fruits.
Morphology and anatomy of Spermatophyta. Plant cell characteristics (cell wall, plastids, vacuole).
Tissues and organs: meristematic (primary and secondary) tissues; adult tissues (tegumental, parenchymatous, mechanical, transport, secretory). Morphological and anatomical characteristics of roots, stem and leaves.
Fungi: general characteristics and life cycles of Chytridiomycota, Zygomycota, Ascomycota, Basidiomycota. Lichenes and Micorrhizae.

Practical lessons (1 CFU, 8 hours/student)
Foe each students, for practical lessons (2 hours each) will be done.
I. Setting up of cytological and histological preparations: observation at the light microscope of plasmolysis of the onionskin, starch granules after Lugol coloration, sclereids and collenchyma.
II. Setting up of transversal section of roots of Monocots and Dicots and microscopy observations before and after coloration (Toluidine Blue).
III. Setting up of transversal section of stems of Monocots and Dicots and microscopy observations before and after coloration (Toluidine Blue).
IV. Setting up of transversal section of leaves of Monocots and Dicots and microscopy observations before and after coloration (Toluidine Blue). Observation of upper and lower epidermis.

Development of the course and examination

Methods for assessing learning outcomes:
Evaluation of learning will be effected by oral examination. Examination consists in three questions on the course topics.

Criteria for assessing learning outcomes:
The final mark is attributed in thirtieths. The examination is passed when the mark is higher or equal to 18. The maximum mark is 30 cum laude.

Criteria for measuring learning outcomes:
The final mark is given in thirtieths. The examination is passed when the mark is higher or equal to 18/30. The cum laude assignation is also possible (30 cum laude).

Criteria for conferring final mark:
The final mark is given considering the student preparation, the thorough knowledge and the exposition ability.

Recommended reading

PASQUA G., ABBATE G., FORNI C. Botanica generale e diversità vegetale. III edizione Piccin
LONGO C., MARZIANI G., 2005. Biologia delle piante. Forme e funzioni elementari. Utet

BOTANY (M-Z)

FABIO RINDI

Seat Scienze
A.A. 2016/2017
Credits 8
Hours 64
Period 1^ semestre

Prerequisites

Basic knowledge of physics and general and organic chemistry. It is recommended to pass the course of Cytology and histology.

Course contents

Both theoretical (7 CFU, 56 hours) and practical (1 CFU, 8 hours) lessons will be provided.

Objectives of the course

Knowledge:
This course allows students to acquire basic knowledges plant biology, both in the general and in systematic aspects. The course allow students to learn the structure and function of cells, tissues and organs of plant organisms. Finally, the students will know main groups of plant organisms (algae, fungi and land plants) in terms of morphological, anatomical and reproductive traits and will understand their evolutionary relationships.

Ability to apply the knowledge:
The acquisition of knowledge by students are aimed to inspire a 'botanical culture', which is necessary to the general preparation of a biologist and fundamental for those who will begin one's career as a teacher. Students will be able to recognize plant histological preparations, organ sections and will be able to comprehend the plant biology, reproduction end evolutionary adaptations.

Program

Theoretical lessons (7 CFU, 56 hours)
Introduction to botany. Cyanobacteria: cell structure, morphology, reproduction, distribution and ecology.
Origin of chloroplast and evolution of eukaryotes. The classification of plants in main eukaryote supergroups following the recent classification.
Algae. General characteristics, morphological and reproductive traits of main algal groups (Rhodophyta, Chlorophyta/Streptophyta, Dinophyta, Stramenopili, Euglenophyta). Notes on algal

ecology.
Land plants. Adaptations to terrestrial life. Non vascular plants: Bryophytes. General characteristics and life cycles of mosses and liverworts.
Introduction to vascular plants. Pteridophytes: morphology and life cycles of lycopods, equiseta and ferns.
Spermatophytes: Gymnosperms (Coniferophyta, Cycadophyta, Ginkgophyta); general characteristics, reproduction and life cycle. Angiosperms: (Dicotyledones and Monocotyledones) reproduction and life cycle; flowers, seeds, fruits.
Morphology and anatomy of Spermatophyta. Plant cell characteristics (cell wall, plastids, vacuole). Tissues and organs: meristematic (primary and secondary) tissues; adult tissues (tegumental, parenchymatous, mechanical, transport, secretory). Morphological and anatomical characteristics of roots, stem and leaves.
Fungi: general characteristics and life cycles of Chytridiomycota, Zygomycota, Ascomycota, Basidiomycota. Lichenes and Micorrhizae.

Practical lessons (1 CFU, 8 hours/student)
Foe each students, for practical lessons (2 hours each) will be done.
I. Setting up of cytological and histological preparations: observation at the light microscope of plasmolysis of the onionskin, starch granules after Lugol coloration, sclereids and collenchyma.
II. Setting up of transversal section of roots of Monocots and Dicots and microscopy observations before and after coloration (Toluidine Blue).
III. Setting up of transversal section of stems of Monocots and Dicots and microscopy observations before and after coloration (Toluidine Blue).
IV. Setting up of transversal section of leaves of Monocots and Dicots and microscopy observations before and after coloration (Toluidine Blue). Observation of upper and lower epidermis.

Development of the course and examination

Methods for assessing learning outcomes:
Evaluation of learning will be effected by oral examination. Examination consists in three questions on the course topics.

Criteria for assessing learning outcomes:
The final mark is attributed in thirtieths. The examination is passed when the mark is higher or equal to 18. The maximum mark is 30 cum laude.

Criteria for measuring learning outcomes:
The final mark is given in thirtieths. The examination is passed when the mark is higher or equal to 18/30. The cum laude assignation is also possible (30 cum laude).

Criteria for conferring final mark:
The final mark is given considering the student preparation, the thorough knowledge and the exposition ability.

Recommended reading

PASQUA G., ABBATE G., FORNI C. Botanica generale e diversità vegetale. III edizione Piccin
LONGO C., MARZIANI G., 2005. Biologia delle piante. Forme e funzioni elementari. Utet.

CELL BIOLOGY AND CYTOGENETICS (A-L)

MASSIMO GIOVANNOTTI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 2^ semestre

Prerequisites

Basic knowledge of biochemistry, cytology, genetics and molecular biology.

Course contents

The course consists of a theoretical part with lectures (4.5 ECTS*, 36 hours) based on Power Point presentations and laboratory practicals (1.5 ECTS, 12 hours). Power Point presentation are handed over to students and uploaded on a Moodle platform. Thorough this platform students will be able to book to laboratory practicals. For some topics, the lecturer indicates scientific articles published in international peer-reviewed journals that students can use to deepen some topics while studying for the final exam.
* 1 ECTS= 1 CFU

Objectives of the course

Knowledge:
The course will enable students to gain knowledge on: i) various aspects of cell biology (e.g., cell cycle, cell cycle control, chromatin organization, organization of interphase nucleus) more closely related to chromosome biology; ii) function and structure of chromosomes and their parts (centromere, telomere, neucleolar organizing region); iii) chromosomal nomenclature; structural and numerical chromosome abnormalities, their causes and consequences for human health; iv) evolutionary significance of chromosomal rearrangements and polyploidy; v) epigenetic modifications influencing gene expression of whole portion of them; vi) function and differentiation of sex chromosomes; vii) cell culture methods; viii) classic and molecular cytogenetics methods; ix) cytogenetic diagnosis methods.

Ability to apply the knowledge:
At the end of the course, the student should be able: i) to apply some classical cytogenetic techniques (such as Giemsa staining; AgNOR banding; G-banding) used in cytogenetic investigation; to recognise and classify chromosomes on the basis of their morphology; iii) to make a karyotype from metaphase pictures captured with a digital camera.

Soft skills:
Laboratory practicals will help the student to develop the abilities to learn autonomously and to work within a group. In addition, laboratory practicals will help the student to develop practical skills

needed to work autonomously and effectively in a cytogenetic laboratory. The scientific articles suggested by the lecturer to deepen some topics will help the student to develop the ability to read and understand international scientific literature: this ability will be used by the student while preparing the final thesis.

Program

Contents of the lectures (4.5 ECTS, 36 hours):
Historical perspective. The cell cycle: mitosis; meiosis; cell cycle regulation. Amount of DNA per haploid nucleus: C-value. Chemical composition and ultrastructure of eukaryotic chromosomes: euchromatin; constitutive and facultative heterochromatin; organization of chromatin and chromatin compaction levels. The eukaryotic chromosome: morphology, chromosome arms, centromeric index and chromosome classification; karyotype and chromosome number; normal human karyotype and conventional nomenclature of human chromosomes; examples of karyotypes in other vertebrates. The chromosomes in interphase: chromosome territories; nuclear matrix. Structure and function of centromere. Structure and function of telomeres. The nucleolar organizing region (NOR). Lampbrush chromosomes. Polytene chromosomes. B chromosomes. Karyology and evolution: chromosome banding; karyotypes, genomes and evolution. Sex chromosomes and sex determination; evolution of sex chromosomes; sex chromosome systems in vertebrates; dosage compensation. Genomic imprinting. Chromosome heteromorphisms. Numerical chromosome abnormalities: aneuploidy, polyploidy and the evolution of plants and animals. Structural chromosome abnormalities. Dynamic mutations. Fragile sites: fragile X syndrome. Cytogenetic mutagenesis. Elements of cancer cytogenetics. Elements of prenatal cytogenetic diagnosis. Cell cultures. Preparation of metaphase chromosomes from cell cultures. Preparation of metaphase chromosomes with the direct method. Molecular cytogenetic techniques: FISH (Fluorescence In Situ Hybridization); M-FISH (Multiplex-FISH); Chromosome Painting; CGH (Comparative Genomic Hybridization); fibre FISH; production of painting probes from flow sorted and microdissected chromosomes.

Laboratory Practicals (1.5 ECTS, 12 hours/student):
Preparation of slides with mitotic chromosomes; standard staining with Giemsa stain of chromosomes and microscope observation. AgNOR-banding to highlight nucleolar organizer region active sites. G-banding. Image capture with digital camera of metaphase chromosomes stained with Giemsa or banded.

Development of the course and examination

Methods for assessing learning outcomes:
Student learning outcomes are assessed through an oral exam. The oral assessment is based on three main questions concerning three topics among those listed in the course programme.

Criteria for assessing learning outcomes:
During the oral exam, the student will have to demonstrate a proper knowledge of the topics dealt with in the lectures and/or laboratory practicals. The student will have to able to link different topics of the course programme and to use deductive thinking. The student will have to use a proper technical-scientific terminology.

Criteria for measuring learning outcomes:

The final mark is attributed in thirtieths. Successful completion of the examination will lead to grades ranging from 18 to 30 “cum laude”.

Criteria for conferring final mark:
Depending on the answers given by the student, a score ranging from 0 to 10 will be attributed to each of the three questions on which the exam is based. A mark of 30/30 cum laude will be given to those students that will have reached the top mark (30/30) and will have also demonstrated: i) mastery of the subjects using proper technical and scientific terminology; ii) to be able to apply the knowledge to make proper links between the different subjects dealt with in the course programme

Recommended reading

Notes taken during the lectures and power point presentations handed out by the lecturer.

Further reading:
Sumner A.T. - Chromosomes: Organization and Function - Wiley-Blackwell; ISBN: 978-0-470-69522-7; Aprile 2008; 304 pages
Mandrioli M. – Principi di citogenetica – Mucchi Editore
Colombo R., Olmo E. – Biologia Cellula e Tessuti – Edi-Ermes (capitoli: 9; 10).
Hartwell, Hood, Goldberg, Reynolds, Silver, Veres – Genetica: dall’analisi formale alla genomica – McGraw-Hill (capitoli: 4; 17 (paragrafo2.5) ; 18).
Lewin B, Cassimeris L., Lingappa V.R., Plopper G., Cellule – Zanichelli (capitoli: 6; 10; 11; 13).

CELL BIOLOGY AND CYTOGENETICS (M-Z)

ANDREA SPLENDIANI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 2^ semestre

Prerequisites

Basic knowledge of biochemistry, cytology, genetics and molecular biology.

Course contents

The course consists of a theoretical part with lectures (4.5 ECTS*, 36 hours) based on Power Point presentations and laboratory practicals (1.5 ECTS, 12 hours). Power Point presentation are handed over to students and uploaded on a Moodle platform. Thorough this platform students will be able to book to laboratory practicals. For some topics, the lecturer indicates scientific articles published in international peer-reviewed journals that students can use to deepen some topics while studying for the final exam.
* 1 ECTS= 1 CFU

Objectives of the course

Knowledge:
The course will enable students to gain knowledge on: i) various aspects of cell biology (e.g., cell cycle, cell cycle control, chromatin organization, organization of interphase nucleus) more closely related to chromosome biology; ii) function and structure of chromosomes and their parts (centromere, telomere, neucleolar organizing region); iii) chromosomal nomenclature; structural and numerical chromosome abnormalities, their causes and consequences for human health; iv) evolutionary significance of chromosomal rearrangements and polyploidy; v) epigenetic modifications influencing gene expression of whole portion of them; vi) function and differentiation of sex chromosomes; vii) cell culture methods; viii) classic and molecular cytogenetics methods; ix) cytogenetic diagnosis methods.

Ability to apply the knowledge:
At the end of the course, the student should be able: i) to apply some classical cytogenetic techniques (such as Giemsa staining; AgNOR banding; G-banding) used in cytogenetic investigation; to recognise and classify chromosomes on the basis of their morphology; iii) to make a karyotype from metaphase pictures captured with a digital camera.

Soft skills:
Laboratory practicals will help the student to develop the abilities to learn autonomously and to work within a group. In addition, laboratory practicals will help the student to develop practical skills

needed to work autonomously and effectively in a cytogenetic laboratory. The scientific articles suggested by the lecturer to deepen some topics will help the student to develop the ability to read and understand international scientific literature: this ability will be used by the student while preparing the final thesis.

Program

Contents of the lectures (4.5 ECTS, 36 hours):
Historical perspective. The cell cycle: mitosis; meiosis; cell cycle regulation. Amount of DNA per haploid nucleus: C-value. Chemical composition and ultrastructure of eukaryotic chromosomes: euchromatin; constitutive and facultative heterochromatin; organization of chromatin and chromatin compaction levels. The eukaryotic chromosome: morphology, chromosome arms, centromeric index and chromosome classification; karyotype and chromosome number; normal human karyotype and conventional nomenclature of human chromosomes; examples of karyotypes in other vertebrates. The chromosomes in interphase: chromosome territories; nuclear matrix. Structure and function of centromere. Structure and function of telomeres. The nucleolar organizing region (NOR). Lampbrush chromosomes. Polytene chromosomes. B chromosomes. Karyology and evolution: chromosome banding; karyotypes, genomes and evolution. Sex chromosomes and sex determination; evolution of sex chromosomes; sex chromosome systems in vertebrates; dosage compensation. Genomic imprinting. Chromosome heteromorphisms. Numerical chromosome abnormalities: aneuploidy, polyploidy and the evolution of plants and animals. Structural chromosome abnormalities. Dynamic mutations. Fragile sites: fragile X syndrome. Cytogenetic mutagenesis. Elements of cancer cytogenetics. Elements of prenatal cytogenetic diagnosis. Cell cultures. Preparation of metaphase chromosomes from cell cultures. Preparation of metaphase chromosomes with the direct method. Molecular cytogenetic techniques: FISH (Fluorescence In Situ Hybridization); M-FISH (Multiplex-FISH); Chromosome Painting; CGH (Comparative Genomic Hybridization); fibre FISH; production of painting probes from flow sorted and microdissected chromosomes.

Laboratory Practicals (1.5 ECTS, 12 hours/student):
Preparation of slides with mitotic chromosomes; standard staining with Giemsa stain of chromosomes and microscope observation. AgNOR-banding to highlight nucleolar organizer region active sites. G-banding. Image capture with digital camera of metaphase chromosomes stained with Giemsa or banded.

Development of the course and examination

Methods for assessing learning outcomes:
Student learning outcomes are assessed through an oral exam. The oral assessment is based on three main questions concerning three topics among those listed in the course programme.

Criteria for assessing learning outcomes:
During the oral exam, the student will have to demonstrate a proper knowledge of the topics dealt with in the lectures and/or laboratory practicals. The student will have to able to link different topics of the course programme and to use deductive thinking. The student will have to use a proper technical-scientific terminology.

Criteria for measuring learning outcomes:

The final mark is attributed in thirtieths. Successful completion of the examination will lead to grades ranging from 18 to 30 “cum laude”.

Criteria for conferring final mark:
Depending on the answers given by the student, a score ranging from 0 to 10 will be attributed to each of the three questions on which the exam is based. A mark of 30/30 cum laude will be given to those students that will have reached the top mark (30/30) and will have also demonstrated: i) mastery of the subjects using proper technical and scientific terminology; ii) to be able to apply the knowledge to make proper links between the different subjects dealt with in the course programme

Recommended reading

Notes taken during the lectures and power point presentations handed out by the lecturer.

Further reading:
Sumner A.T. - Chromosomes: Organization and Function - Wiley-Blackwell; ISBN: 978-0-470-69522-7; Aprile 2008; 304 pages
Mandrioli M. – Principi di citogenetica – Mucchi Editore
Colombo R., Olmo E. – Biologia Cellula e Tessuti – Edi-Ermes (capitoli: 9; 10).
Hartwell, Hood, Goldberg, Reynolds, Silver, Veres – Genetica: dall’analisi formale alla genomica – McGraw-Hill (capitoli: 4; 17 (paragrafo2.5) ; 18).
Lewin B, Cassimeris

CELLULAR BIOTECHNOLOGY

ADRIANA CANAPA

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 1^ semestre

Prerequisites

Knowledge of the basic concepts of cytology and histology, genetics and molecular biology.

Course contents

The lectures are planned (5 CFU) as well as the preparation and presentation of scientific papers related to the topics covered during the lectures and also the laboratory practices (1 CFU).

Objectives of the course

Knowledge:
At the end of the course the student will have acquired the knowledge on basic procedures useful for in vitro growing of eukaryotic cells and on the methodologies to carry out their genetic manipulation for medical and industrial applications.

Ability to apply the knowledge:
The student will be able to design strategies for biotechnological compounds for pharmaceuticals and food, for monoclonal antibody production, and for obtaining genetically modified organisms from isolated cells or cell cultures.

Soft skills:
Through the laboratory practice and the preparation and presentation of reports on scientific articles students will acquire autonomy in judgment as well as communication skills also arising from work in groups.

Program

Objectives and instruments for cell biotechnologies. Cell and tissue cultures. Stem cells. Monoclonal antibody production. Tissue engineering and clinical applications. Recombinant DNA technology. Production of recombinant proteins in eukaryotic cells. Site-directed mutagenesis. Techniques for the production of transgenic animals. Cloning of animals by transfer of the nucleus. Gene therapy applied to human. Cell biotechnology applications in the various fields.

Development of the course and examination

Methods for assessing learning outcomes:
Oral exam after registration in the reserved area.

Criteria for assessing learning outcomes:
The oral examination is aimed at assessing the knowledge and understanding of cellular biotechnology and other subjects needed to resolve problems related to course objectives.

Criteria for measuring learning outcomes:
The final mark is assigned exclusively on the oral exam through questions at low, medium, and high difficulty.

Criteria for conferring final mark:
The final mark is assigned on the basis of the student's ability to provide answers that demonstrate mastery of the subject with clarity and with a relevant technical and scientific terminology. It will also evaluate the student's ability to link the topics covered during the course and the presentation of the scientific paper.

Recommended reading

Slides provided during the course.

CHARACTERIZATION OF INDUSTRIAL EMISSIONS

MARIA LETIZIA RUELLO

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 1^ semestre

Prerequisites

Fundamentals of chemistry and physic.

Course contents

The course will consist of lectures and assisted exercitation. The presentations used during lectures, accompanied by bibliography, will be available to students.

Objectives of the course

Knowledge:
The course will enable students to understand the basic knowledge about:
key systems for the Continuous Emission Monitoring (CEM), and characterization of industrial emissions through chemical-physical parameters.
procedure for implementing monitoring (and characterization) techniques to specific cases
how the most common analyzers work
sampling in both air and water matrices
validation of data within CEM System

Ability to apply the knowledge:
The student will also gain the following professionalising skills:
to make distinctions between the different type of CEM systems
apply national and international emission surveillance systems
analyze and evaluate data from different experiments and CEM programs, and from these results be able to describe and judge the status of the plant
use of the information derived from technical and scientific literature to solve problems and critically address the issues
critical description Case History
plan basic emission monitoring programs and field experiments

Soft skills:
The design, individual and team, helps to improve both the degree of independence of judgment in general of students, and their ability to communicate that stems also from the teamwork, and their

ability to learn independently and to draw conclusions.

Program

Program (lectures, 4 CFU, 32 hours):
Air emission monitoring programs: Fundamentals; Production lines to be continuously monitored; Parameters to detect; Chemical parameters; Alternative parameters; Standardization; Measurements; Principles and techniques of measurement: Location of measuring points; Sampling mode; Alternative measures; Instruments; Probes , Analyzers, Non-extractive systems (in situ); Extractive systems; Validation of elementary data; Data pre-processing; Validation of the hourly averages; Data processing; Plan for the submission of a CEMS draft
Industrial Wastewater Quality Monitoring: Regulatory Context; Characteristics of Industrial Wastewater; Monitoring of Industrial Wastewater; Variability; Accident Detection and Source Identification.

Exercises (2 CFU, 16 hours):
Lab exercises:
Design of a system for CEM or characterization, as low as real cases of industrial plants subject to Integrated Pollution Prevention Control (IPPC).
At the end of the exercises, the student will have to deliver a report on the designing activities carried out, presenting for the case study, objective, relevant regulations, the plant description, proposed solutions, calculations to be executed and how to evaluate/interpret the results themselves.
Field exercises:
A one-day field trip will be organized, and dedicated to visit an industrial plant and its system of emission monitoring in the different environmental matrices.

Development of the course and examination

Methods for assessing learning outcomes:
The evaluation is through written and oral tests. In the written exam, students must approach the design of an emissions monitoring system with the aid of the technologies and methods discussed in class. In the oral exam the student is asked to present the main technologies and investigative strategies, responding to questions or discussing their written paper.

Criteria for assessing learning outcomes:
In the exam tests, the student must demonstrate the ability to use autonomously and correctly the key investigation technologies and strategies for the characterization of industrial emissions discussed during class; Furthermore, the student must demonstrate sufficient capacity to judge, select, synthesize and clearly present ideas, concepts and investigative solutions related to the characterization of industrial emissions.

Criteria for measuring learning outcomes:
In the examination tests is evaluated, the autonomous capacity of the student to set up and solve the problems that are placed to her/him. It also evaluated the ability to properly and appropriately use technologies and strategies of industrial emissions characterization.

Criteria for conferring final mark:

The maximum vote, equal to thirty points cum laude, is awarded to students who demonstrate, in the two the exams full autonomy to set and solve problems and complete mastery of the technologies and strategies of the characterization of industrial emissions. The minimum voting, equal to eighteen, is assigned to students who demonstrate to be able to solve problems that are set and sufficient knowledge of technologies and strategies of industrial emissions characterization.

Recommended reading

Appunti di lezione
D.A. Skoog, D.M. West, F.J. Holler, S.R. Crouch. Fondamenti di chimica analitica, 3a ed., EdiSES, Napoli, 2015.
D.C. Harris. Chimica analitica quantitativa, Zanichelli, Bologna, 2005.
C. Baird, M. Cann. Chimica Ambientale, Zanichelli, Bologna, 2006.
S.E. Manahan. Chimica dell’Ambiente, Piccin, Padova, 2000.

CHEMICAL ANALYSYS OF FOODS

CRISTINA TRUZZI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 1^ semestre

Prerequisites

Knowledge of the topics of the courses on Physics, General Chemistry, Organic Chemistry and Instrumental Analytical Chemistry.

Course contents

The course consists of theoretical lectures (4 credits, 32 hours) and individual laboratory practical work (2 credits, 16 hours)

Objectives of the course

Knowledge:
The course enables students to acquire knowledges of the theoretical and methodological bases of the main chemical-analytical techniques for the determination of chemicals compounds responsible both of nutritional and chemical characteristic of foods and of toxicological aspects. In particular, the student acquires knowledges on control procedures of food of animal (meat, eggs, milk and dairy products, butter, flower, cheese and honey) and vegetable (cereals, oil, canned tomato) origin, and beverages (water, must and wine, vinegar, fruit juices, beer and alcoholic beverages). Contextually the student should acquire knowledges of chemical-analytical procedures for the determination of undesirable substances from environmental contamination.

Ability to apply the knowledge:
The student should acquire the following professional skills: 1) ability to perform chemical analysis of foods for the determination of substances of major nutritional interest and of general characterization (e.g nitrogen from protein and non-protein origin, carbohydrates, fat, moisture, dry residue, ashes, acidity, vitamins, antioxidants, mineral salts); 2) ability to perform the determination of undesirable substances in food.

Soft skills:
The execution of laboratory analyses performed individually or in group, and the preparation of reports on practical work carried out, help to improve the degree of judgement autonomy in general. The communicative capacity will be also stimulated by the teamwork, such as the learning capacity in autonomy, and the ability to draw conclusions from experimental data.

Program

Contents (frontal lessons, 4 CFU, 32 hours)
Generality on food sample collection and treatment. Application of classic and instrumental analytical methodologies on food analysis. Chemical analyses of main food groups both of animals (meat, eggs, milk and dairy products, butter, cheese and honey) and vegetable (cereals, oil, canned tomato) origin, and beverages (water, must and wine, vinegar, beer and alcoholic beverages). Determination of the main substances of nutritional importance and of general characterization (e.g. nitrogen from protein and non-protein origin, carbohydrates, fats, moisture, dry residue, ashes, acidity, vitamins, antioxidants, mineral salts). Determination of undesirable substances from environmental contamination, such as pesticides, heavy metals, hydrocarbons, chlorinated aromatic compounds.
Laboratory exercises (2 CFU, 16 hours/student)
Chemical analyses of the following food and beverages: flour, butter, cheese, meat, honey, canned tomato, water, milk, fruit juices, non-alcoholic beverages, wine, vinegar.
Field work
One-day school trips is expected to be carried out dedicated to field activity: sampling of spring water with analyses on filed (temperature, pH, conductivity, chloride, fluoride, iodide, nitrate), and visit to plants for mineral water bottling.

Development of the course and examination

Methods for assessing learning outcomes:
The exam takes place as oral interview related to topics of the program.

Criteria for assessing learning outcomes:
The student should demonstrate to know the topics of the program, such as chemical procedures for the determination of major substance of nutritional interest and of general characterization of foods, as well as analytical methods for the determination of undesirable substances in food.

Criteria for measuring learning outcomes:
The final mark is attributed in thirtieths. Successful completion of the examination will lead to grades ranging from 18 to 30, and 30 with laud.

Criteria for conferring final mark:
The final mark is attributed by evaluating the learning of the student on the contents of the course and by evaluating the complete mastery of the matter.

Recommended reading

Copy of slides available
P. Cabras, C.I.G. Tuberoso: Analisi dei prodotti alimentari, Piccin Nuova Libraria, Padova 2014.
D. Marini, F. Balestrieri: Metodi di analisi chimica dei prodotti alimentari, Monolite Editrice, Roma, 2005.
S. Mannino, MG Bianco: Esercitazioni di analisi chimica dei prodotti alimentari- esperimenti pratici di laboratorio, Tecnos Editrice, Milano, 1996.

CHEMISTRY I (A-L)

ROBERTA GALEAZZI

Seat Scienze
A.A. 2016/2017
Credits 9
Hours 72
Period Corso annuale

Prerequisites

Basic knowledge of mathematics and physics.

Course contents

Theoretical lectures are planned (7 credits, 56 hours) and stoichiometric and laboratory exercises in the classroom (1 credits, 8 hours). At the front course, it is flanked a teaching support with educational materials, instructions for stoichiometric and laboratory exercises and preparation of examination tasks.

Objectives of the course

Knowledge:
At the end of the course, the student will be aware of the main theoretical and experimental aspects of chemistry, with respect to both the structure of matter is its transformations with special nods to life science applications and implications. The rigorous discussion of the items will be constantly accompanied by numerical applications and laboratory in order to make clear the experimental nature of Chemistry. The student will be gradually addressed during the course, which includes numerical exercises and laboratory, to acquire the basic language and the ability to solve chemical problems through the application of the basic concepts.

Ability to apply the knowledge:
The teaching program, in particular, focuses on the relationship between the atomic structure of the elements, periodic table, and the nature and properties of their compounds, as well as on the numerical solution of chemical problems, and on the principles of 'equilibrium in aqueous solution, the acid-base properties, the pH of the solutions, foundations indispensable for the understanding of the teachings for which the general chemistry is preliminary. The information acquired from the course must therefore be applied to the normal laboratory practice, such as the preparation of a known titre solutions or dilute acid solutions, basic and buffer. The student will also be able to know how to identify the most appropriate procedure for solving some stoichiometric chemical problems that will be proposed during the course.

Program

Introduction to chemistry. Atomic theory. Atomic mass unit and mole. Introduction to quantum chemistry theory: Atomic structure and Orbitals . Electronic configuration. Periodic table of elements. Nomenclature. Chemical bond. Oxidation number. Chemical reactions. Molecular geometry. Valence bond and molecular orbitals theories. Gas phase. Solid and liquid phases. Thermodynamic and Thermochemistry. Kinetic theory. Physical equilibria. solutions. Chemical equilibria. Acids and bases. Ionic equilibria in solution. Electrochemistry.

Development of the course and examination

Methods for assessing learning outcomes:
The exam consists of a written test on the topics covered in class containing multiple choice questions including also structure of chemical compounds and nomenclature (n. 13-17) , n. 3-5 stoichiometry exercises and n. 1 open question. The exam is passed when the final grade is greater than or equal to 18.

Criteria for assessing learning outcomes:
In the written test, the student must demonstrate knowledge of principles and methods of general chemistry. In addition, a particular emphasis will be reserved to the acquisition of knowledge in the prediction of structures, molecular geometry and the equilibria in solution (acid-base and buffers). Ultimately, the student must demonstrate that they have achieved the ability to apply the knowledge acquired during the training for the purpose of simple stoichiometric problems, as well as the ability to independently prepare a test report.

Criteria for measuring learning outcomes:
The final mark is awarded out of thirty. The exam is passed when the grade is greater than or equal to 18. It is expected to be awarded the highest marks with honors (30 cum laude).

Criteria for conferring final mark:
The final grade is awarded on the basis of the written evaluation. In the case of an oral integration, a maximum of two points to the writing may be added. Praise is attributed when the score obtained by the value exceeds 30 and at the same time the student has demonstrated full mastery of the subject.

Recommended reading

M.S. Silberberg , Chimica,Ed. McGraw Hill
P.Atkins, L. Jones, Principi di Chimica, Zanichelli
R. Breschi, A. Massagli, Stechiometria, Ed. Pellegrini.
Michelin Lausarot, Vaglio, Stechiometria per la Chimica generale, Ed. PICCIN

CHEMISTRY I (M-Z)

ELISABETTA GIORGINI

Seat Scienze
A.A. 2016/2017
Credits 9
Hours 72
Period Corso annuale

Prerequisites

Basic knowledge of mathematics and physics.

Course contents

Theoretical lectures (7 credits, 56 hours) together with stoichiometric and laboratory exercises in classroom (1 credits, 8 hours) are planned. At the front course, it is flanked a teaching support with educational materials, instructions for stoichiometric and laboratory exercises and preparation of examination tasks.

Objectives of the course

Knowledge:
At the end of the course, the student will be aware of the main theoretical and experimental aspects of chemistry, with respect to both the structure of matter and its transformations with special nods to life science applications and implications. The rigorous discussion of the items will be constantly accompanied by numerical applications and laboratory in order to make clear the experimental nature of Chemistry. The student will be gradually addressed during the course, which includes numerical exercises and laboratory, to acquire the basic language and the ability to solve chemical problems through the application of the basic concepts.

Ability to apply the knowledge:
The teaching program, in particular, focuses on the relationship between the atomic structure of the elements, periodic table, and the nature and properties of their compounds, as well as on the numerical solution of chemical problems, and on the principles of equilibria in aqueous solution, the acid-base properties, the pH of the solutions, foundations indispensable for the understanding of the teachings for which the general chemistry is preliminary. The information acquired from the course must therefore be applied to the normal laboratory practice, such as the preparation of a known titrate solutions or dilute acid or basic solutions, and buffers. The student will also be able to know how to identify the most appropriate procedure for solving some stoichiometric chemical problems that will be proposed during the course.

Program

Introduction to chemistry. Atomic theory. Atomic mass unit and mole. Introduction to quantum chemistry theory: Atomic structure and Orbitals . Electronic configuration. Periodic table of elements. Nomenclature. Chemical bond. Oxidation number. Chemical reactions. Molecular geometry. Valence bond and molecular orbitals theories. Gas phase. Solid and liquid phases. Thermodynamic and Thermochemistry. Kinetic theory. Physical equilibria. solutions. Chemical equilibria. Acids and bases. Ionic equilibria in solution. Electrochemistry.

Development of the course and examination

Methods for assessing learning outcomes:
The exam consists of a written test on the topics covered in class containing multiple choice questions including also structure of chemical compounds and nomenclature (n. 13-17) , n. 3-5 stoichiometry exercises and n. 1 open question. The exam is passed when the final grade is equal or greater than 18.

Criteria for assessing learning outcomes:
In the written test, the student must demonstrate knowledge of principles and methods of general chemistry. In addition, a particular emphasis will be reserved to the acquisition of knowledge in the prediction of structures, molecular geometry and the equilibria in solution (acid-base and buffers). Ultimately, the student must demonstrate that they have achieved the ability to apply the knowledge acquired during the training for the purpose of simple stoichiometric problems, as well as the ability to independently prepare a test report.

Criteria for measuring learning outcomes:
The final mark is awarded out of thirty. The exam is passed when the grade is equal or greater than 18. It is expected to be awarded the highest marks with honors (30 cum laude).

Criteria for conferring final mark:
The final grade is awarded on the basis of the written evaluation. In the case of an oral integration, a maximum of two points to the writing may be added. Praise is attributed when the score obtained by the value exceeds 30 and at the same time the student has demonstrated full mastery of the subject.

Recommended reading

M.S. Silberberg , Chimica,Ed. McGraw Hill
P.Atkins, L. Jones, Principi di Chimica, Zanichelli
R. Breschi, A. Massagli, Stechiometria, Ed. Pellegrini.
Michelin Lausarot, Vaglio, Stechiometria per la Chimica generale, Ed. PICCIN

CHEMISTRY II (A-L)

MARIO ORENA

Seat Scienze
A.A. 2016/2017
Credits 8
Hours 64
Period 1^ semestre

Prerequisites

Knowledge of some chemistry topics including either molecular structure and types of chemical bonds. Chemical thermodynamics and kinetics arguments will be also useful.

Course contents

Lectures are planned (8 credits, 64 hours) during which questions are presented with a guided solution, concerning the most significant reaction mechanisms of organic chemistry. The lectures' educational activity is supported in e-learning mode disclosing all slides discussed in class and audio files of lectures; the final examinations texts with solutions are also given, thus allowing students to assess their level of preparation.

Objectives of the course

Knowledge:
The course enables students to acquire the basic knowledge about the transformations and interactions mechanisms of organic compounds present in biological systems, in order to understand their action in living organisms.

Ability to apply the knowledge:
The student should acquire the ability to define the reaction mechanisms underlying biological processes, so that he can apply this knowledge within other courses, in particular those dealing with biological chemistry and molecular biology.

Soft skills:
The solution of selected problems, with single and group work, can improve the student insight together with the ability to communicate stemming from teamwork.

Program

Topics (Lectures, 8 CFU, 64 hours):
1.Introduction to the structure of organic molecules. Atomic orbitals and electronic configuration. The chemical bond. The rendering of an organic structure. Functionalities and nomenclature of

organic compounds. The theory of the valence bond.
2. The theory of molecular orbital. Resonance structures. Non-covalent interactions. Relationship between non-covalent interactions and physical properties of organic compounds.
3.Conformational equilibria and static stereochemistry. Conformations of molecules with linear chain. Conformations of cyclic molecules: cyclopentane, cyclohexane and glucose.   Confurations and stereochemistry: chirality and chirality centres. Compounds displaying one chirality centre: the enantiomers. Compounds dispolaying more chirality centre: the diastereomers. Stereochemistry and reactivity. Prochirality in biological molecules.
4.Introduction to reaction mechanisms. Thermodynamics and kinetis of organic reactions. Energy graphics and reaction plots. Electrophiles and nucleophiles versus Lewis acids and bases.
5.The acid-base processes. Structure effects on acidity and basicity. Mesomeric effect. Hyperconjugative effect. Inductive effect. Acidity of phenols an basicity of nitrogen-containing compounds. The resonance on pyridine, pyrrole and imidazole. Carbon acids an enolate anions.
6.The nucleophilic substitutio to sp3 carbons. Associative nucleophilic substitution: SN2 mechanism. Dissociative nucleophilic substitution: SN1 mechanism. Steric and electronic effects acting on electrophilicity. Leaving groups and their properties. The SN1 o SN2 mechanism can be easily provided starting from structural considerations. The nucleophilic substitution of epoxides. Nucleophilic substitution in biological systems: the SAM (S-adenosylmethionine).
7.Elimination reactions leading to double bonds. E1 and E2 mechanisms. Steric and thermodynamic effects leading to formation of double bonds.
8.The   moieties as bases and nucleophiles. The electrophilic addition process. Cations as reaction intermediates and 1,2-shift. Intermediate cations stabilized by mesomeric or hyperconiugative effect. Regioselectivity and stereoselectivity of addition processes. Enantiotopic and diastereotopic re and si faces of cationic intermediates. Kinetic and/or thermodynamic control in addition to dienes. Cationic intermediates within isomerization reactions. Cationic intermediates within alkylation of aromatic substrates.
9.Transfer of phosphate groups. The cleavage of phospate esters: inter and intramolecular processes. Behaviour of molecules significant for biological systems: ATP, PEP, DHP, G6P e F6P.
10.Addition of nucleophiles to the carbonyl group. Keto-enolic tautomerism. Steric and electronic effects within the addition process. The addition process occurs as an equilibrium reaction. Kinds of nucleophiles. Nucleophiles at hydrogen, nucleophiles at nitrogen, nucleophiles at oxygen. Stereoselectivity of the addition process. Intramolecular addition in glucose leading to the anomers formation. Nucleophiles at carbon: cyanide anion and enolate anions. Enolate anions can arise under kinetic or thermodynamic control. Aldol reaction, retroaldol reaction and aldol condensation. Requirements for the E1cB reaction mechanism.
11.Addition of nucleophiles to the carbonyl group followed by removal of a leaving group. Nucleophiles at hydrogen, nucleophiles at nitrogen, nucleophiles at oxygen. Nucleophiles at carbon leading to   -dicarbonyl compounds. The reactivity of   -ketoacyl-SCoAs.Comparison between esters and thioesters reactivity.
12.Addition of nucleophiles to   -unsaturated systems. Processes occurring under kinetic and/or thermodynamic control. The conversion of fumarate into (S)-malate.
13.Redox reactions in organic chemistry.

Development of the course and examination

Methods for assessing learning outcomes:
he exam consists of a written test and oral examination with commentary of the written test results and discussion of one or more slides presented in class. In the task there are six issues concerning the reaction mechanisms. For each response is given a score between zero and five. In order to overrun the written test, the student must attain a score not less than half of the available points.

The exam is passed when after the oral test final vote is greater than or equal to 18.

Criteria for assessing learning outcomes:
In the written test, the student must demonstrate knowledge of the major organic chemical reaction mechanisms and to have acquired basic knowledge about the reactivity of the most common types of organic compounds.

Criteria for measuring learning outcomes:
The final mark is awarded out of thirty. The exam is passed when the grade is greater than or equal to 18. It is expected to be awarded the highest marks with honors (30 cum laude).

Criteria for conferring final mark:
The final grade is given by adding to the written score the evaluation of the oral interview, up to a maximum of five points. Praise is attributed when the score obtained from the previous sum exceeds the value 30, while the student has demonstrated full mastery of the subject.

Recommended reading

1. Lecture notes
2. Soderberg, Organic Chemistry with a Biological Emphasis, Lulu, 2016
3. Klein, Fondamenti di Chimica Organica, Pearson, 2016
4. Vollhardt & Smith, Chimica Organica, Zanichelli, 2016

CHEMISTRY II (M-Z)

MARIO ORENA

Seat Scienze
A.A. 2016/2017
Credits 8
Hours 64
Period 1^ semestre

Prerequisites

Knowledge of some chemistry topics including either molecular structure and types of chemical bonds. Chemical thermodynamics and kinetics arguments will be also useful.

Course contents

Lectures are planned (8 credits, 64 hours) during which questions are presented with a guided solution, concerning the most significant reaction mechanisms of organic chemistry. The lectures' educational activity is supported in e-learning mode disclosing all slides discussed in class and audio files of lectures; the final examinations texts with solutions are also given, thus allowing students to assess their level of preparation.

Objectives of the course

Knowledge:
The course enables students to acquire the basic knowledge about the transformations and interactions mechanisms of organic compounds present in biological systems, in order to understand their action in living organisms.

Ability to apply the knowledge:
The student should acquire the ability to define the reaction mechanisms underlying biological processes, so that he can apply this knowledge within other courses, in particular those dealing with biological chemistry and molecular biology.

Soft skills:
The solution of selected problems, with single and group work, can improve the student insight together with the ability to communicate stemming from teamwork.

Program

Topics (Lectures, 8 CFU, 64 hours):
1.Introduction to the structure of organic molecules. Atomic orbitals and electronic configuration. The chemical bond. The rendering of an organic structure. Functionalities and nomenclature of

organic compounds. The theory of the valence bond.
2. The theory of molecular orbital. Resonance structures. Non-covalent interactions. Relationship between non-covalent interactions and physical properties of organic compounds.
3.Conformational equilibria and static stereochemistry. Conformations of molecules with linear chain. Conformations of cyclic molecules: cyclopentane, cyclohexane and glucose. Confurations and stereochemistry: chirality and chirality centres. Compounds displaying one chirality centre: the enantiomers. Compounds dispolaying more chirality centre: the diastereomers. Stereochemistry and reactivity. Prochirality in biological molecules.
4.Introduction to reaction mechanisms. Thermodynamics and kinetis of organic reactions. Energy graphics and reaction plots. Electrophiles and nucleophiles versus Lewis acids and bases.
5.The acid-base processes. Structure effects on acidity and basicity. Mesomeric effect. Hyperconjugative effect. Inductive effect. Acidity of phenols an basicity of nitrogen-containing compounds. The resonance on pyridine, pyrrole and imidazole. Carbon acids an enolate anions.
6.The nucleophilic substitutio to sp3 carbons. Associative nucleophilic substitution: SN2 mechanism. Dissociative nucleophilic substitution: SN1 mechanism. Steric and electronic effects acting on electrophilicity. Leaving groups and their properties. The SN1 o SN2 mechanism can be easily provided starting from structural considerations. The nucleophilic substitution of epoxides. Nucleophilic substitution in biological systems: the SAM (S-adenosylmethionine).
7.Elimination reactions leading to double bonds. E1 and E2 mechanisms. Steric and thermodynamic effects leading to formation of double bonds.
8.The moieties as bases and nucleophiles. The electrophilic addition process. Cations as reaction intermediates and 1,2-shift. Intermediate cations stabilized by mesomeric or hyperconiugative effect. Regioselectivity and stereoselectivity of addition processes. Enantiotopic and diastereotopic re and si faces of cationic intermediates. Kinetic and/or thermodynamic control in addition to dienes. Cationic intermediates within isomerization reactions. Cationic intermediates within alkylation of aromatic substrates.
9.Transfer of phosphate groups. The cleavage of phospate esters: inter and intramolecular processes. Behaviour of molecules significant for biological systems: ATP, PEP, DHP, G6P e F6P.
10.Addition of nucleophiles to the carbonyl group. Keto-enolic tautomerism. Steric and electronic effects within the addition process. The addition process occurs as an equilibrium reaction. Kinds of nucleophiles. Nucleophiles at hydrogen, nucleophiles at nitrogen, nucleophiles at oxygen. Stereoselectivity of the addition process. Intramolecular addition in glucose leading to the anomers formation. Nucleophiles at carbon: cyanide anion and enolate anions. Enolate anions can arise under kinetic or thermodynamic control. Aldol reaction, retroaldol reaction and aldol condensation. Requirements for the E1cB reaction mechanism.
11.Addition of nucleophiles to the carbonyl group followed by removal of a leaving group. Nucleophiles at hydrogen, nucleophiles at nitrogen, nucleophiles at oxygen. Nucleophiles at carbon leading to -dicarbonyl compounds. The reactivity of -ketoacyl-SCoAs.Comparison between esters and thioesters reactivity.
12.Addition of nucleophiles to -unsaturated systems. Processes occurring under kinetic and/or thermodynamic control. The conversion of fumarate into (S)-malate.
13.Redox reactions in organic chemistry.

Development of the course and examination

Methods for assessing learning outcomes:
he exam consists of a written test and oral examination with commentary of the written test results and discussion of one or more slides presented in class. In the task there are six issues concerning the reaction mechanisms. For each response is given a score between zero and five. In order to overrun the written test, the student must attain a score not less than half of the available points.

The exam is passed when after the oral test final vote is greater than or equal to 18.

Criteria for assessing learning outcomes:
In the written test, the student must demonstrate knowledge of the major organic chemical reaction mechanisms and to have acquired basic knowledge about the reactivity of the most common types of organic compounds.

Criteria for measuring learning outcomes:
The final mark is awarded out of thirty. The exam is passed when the grade is greater than or equal to 18. It is expected to be awarded the highest marks with honors (30 cum laude).

Criteria for conferring final mark:
The final grade is given by adding to the written score the evaluation of the oral interview, up to a maximum of five points. Praise is attributed when the score obtained from the previous sum exceeds the value 30, while the student has demonstrated full mastery of the subject.

Recommended reading

1. Lecture notes
2. Soderberg, Organic Chemistry with a Biological Emphasis, Lulu, 2016
3. Klein, Fondamenti di Chimica Organica, Pearson, 2016
4. Vollhardt & Smith, Chimica Organica, Zanichelli, 2016

CIVIL PROTECTION ORGANIZATION

PAOLO DE BIAGI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 1^ semestre

Prerequisites

Basic knowledge of law

Course contents

Lessons (complete with attestations) and guided tours.

Objectives of the course

Knowledge
The course aims to give students the knowledge of the evolution of the civil protection system through the analysis of its historical development to its actual configuration in our country. The training activity intends to give students the acquaintance with the national and regional rules which regulate the subject and jointly with the organization of the civil protection system. This course also aims to encourage the practical approach, to give students the cognition of the various (normative, administrative, national, regional and local) levels of the system and to illustrate the organizational arrangement and the division of competence, responsability and functions.

Ability to apply the knowledge
The course aims to provide students the ability to exploit the acquired knowledge in order to apply them concretely. The analysis of the organizational system, programmatic acts and measures (orders, plannings, coordination centers, etc) will give students the ability to understand civil protection documents and to act concretely in that area.

Soft skills
The course aims to improve the knowledge of the organization of the civil protection system in our country and to promote the reflection about how the civil is set in the political and civil situation of our country and how it deals with it. At the same time the course intends to give students the necessary knowledge for the deepenings which can be developed through other studying levels.

Program

The concept of civil protection
Historical evolution of the civil protection The foundation of the civil protection national service
The administrative decentralization
The civil protection department
The management of large scale events
Civil protection and the reform of the Fifth Title of Costitution
Current structure of the civil protection national service
Law 225/1992 and its evolution
Guidelines for the civil protection operation (prevention, prevision, rescue and restoration)
Typologies of calamitous events
Civil protection units
Components and operative structures of the national service
Prefect and Mayor: evolution of these roles and their competence
Declaration of state of emergency
Civil protection orders (practical examples)
Operations centers for national, regional, provincial and local coordination
Operations rooms
National and regional operational directives and organizational models for the emergency management
National leaders of the civil protection system
National warning system
Regulations and civil protection system in the Marches
Regional structure and organizational system
Minimum requirements for the regional and national civil protection organization
Planning: the Augustus method
Analysis of a civil protection municipal plan
Voluntary work of civil protection (at national and regional levels)
Spreading the culture of the civil protection through the school system

Development of the course and examination

Methods for assessing learning outcomes:
The exam consists in an oral examination with questions aimed to assess the theoretical knowledge on the topics covered in the course

Criteria for assessing learning outcomes:
The questions of the oral exam are aimed to assess the student’s level of knowledge and comprehension on the topics of the course as well as his/her analysis and synthesis capacity.

Criteria for measuring learning outcomes:
The final exam mark is out of 30. The exam is considered passed when the mark is greater or equal to 18.

Criteria for conferring final mark:
The final mark is assigned on the basis of the student's ability to provide answers that demonstrate mastery of the subject with clarity. It will also evaluate the student's ability to link the topics covered during the course among themselves and with topics of other teachings.

Recommended reading

Lesson notes. Instalments given by the teacher

CLIMATIC RISK

PETER WADHAMS

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 2^ semestre

Prerequisites

A good knowledge of climatology and meteorology, physics and mathematics is advisable, together with some knowledge of oceanography.

Course contents

The course is based on theoretical lessons in English, presentation of case-studies, and specific insights.

Objectives of the course

Knowledge:
The Course is aimed to give a complete background on the physics of sea ice and its role in the climate system, also including ice mechanics, icebergs and the physics of oil-ice interaction.

Ability to apply the knowledge:
The students will have the capability to apply received knowledges for interpreting the climatic, atmospheric and marine phenomena that are potentially hazardous because of the trends introduced by climate change; they will also have the capability to apply basic methods of monitoring and forecasting these changes.

Soft skills:
Transversal competences include all the different aspects related to ice system in the marine environment, their links with global climate change, practical cases on effects, forecasts and possible actions.

Program

Module 1. The physics of sea ice and ice formation
Oceanographic background – Arctic and Antarctic
What happens when sea water cools
Growth of ice crystals
Brine cells and brine rejection

Salinity structure
Summer melt processes
First- and multi-year ice

2. Ice growth and decay
Thermodynamic model
Equilibrium thickness
Sensitivity of thickness to changes in forcing
Sensitivity to albedo.

3. Ice dynamics
Ice motion - driving forces
Free drift solution
Ice interaction
The dynamics of polynyas

4.The ice thickness distribution
Ridge and lead formation
Geometry of pressure ridges
The probability density of ice thickness and its evolution
Mathematical form of ridges and leads distributions

5. Ice mechanics
The ridging and rafting process
Ridge evolution and decay
Ice interaction with structures
Ice interaction with the seabed

6. The marginal ice zone
Ice floes
Waves in ice
Modelling development of floe size distribution
Eddies

7. Icebergs and ice islands
Sources
Distribution in Arctic and Antarctic
Physical properties
Dynamics
Decay and breakup
Role in the oceans and in sediment transport
Iceberg scouring – depths, incidence, seabed interaction
Mechanics of iceberg and ice island interaction with structures
Upstream detection of ice islands

8. Oil spills under ice
Scope of the under ice blowout problem
Other sources of spills under and in ice
Physical behaviour of crude oil in very cold water
Dynamics of a rising oil-infested bubble plume
Incorporation of oil in rough sea ice – containment factors
Ice growth under an oil layer

Oil penetration into brine drainage channels
Oil transport by ice
The melt process and mode of final oil release
Oil behaviour in pancake ice and the marginal ice zone

9. Two important ice regions – Greenland Sra and Beaufort Sea
East Greenland waters
Greenland Sea convection zone
South Greenland and the Storis
Baffin Bay ice conditions
Nares Strait
The Lincoln Sea and waters north of Greenland
The Beaufort Gyre and its variability
Changes in ice conditions in central Beaufort Sea
The Beaufort Sea coastal zone
The summer Beaufort Sea as a new MIZ
Methane release from seabed

10. Thinning and retreat of sea ice in response to global change
Satellite data on retreat
Parkinson - retreat in sectors, Arctic and Antarctic
What is found in Antarctic
Thinning - the submarine and other evidence
Model predictions of a future seasonal Arctic ice cover

11. Arctic feedbacks and acceleration of global change
Albedo change
Snowline retreat
Global sea level rise
Offshore methane release and its threat to climate

12. Conclusions – Ice, planet Earth and the future
Ice ages and their causes
Earlier ice-free periods
Is Man the only cause of current changes?
What will happen in the longer term?
Can geoengineering save us?
This module will include, in the afternoon, a lecture on sea ice and the history of polar exploration, to be given at the museum of the Istituto Geografico Polare “Silvio Zavatti”, Fermo.

Development of the course and examination

Methods for assessing learning outcomes:
The examination is a written test consisting of 30 questions formulated on all of the subjects of the integrated course, including geological and climatic risk and an oral discussion on the same.

Criteria for assessing learning outcomes:
During the examination, it will be evaluated the capability of the student to properly answer and discuss various issues, the general competence on problematics, the use of appropriate terminology.

Criteria for measuring learning outcomes:
The final assessment is made of thirty. The examination is considered as passed with a vote of 18/30 or higher. The student can decide to decline the proposed vote and give again the examination in the following session.

Criteria for conferring final mark:
The final assessment will be given depending on the capability of the student to answer all the questions, on the effectiveness of the learning process and communication skill of acquired concepts. Being an integrated course,

Recommended reading

The book of the course is "Ice in the Ocean" by P Wadhams (Taylor and Francis, 2000) Another very useful book which will be used in the course are "Global Warming - the Complete Briefing" by Sir John Houghton, 4th Edn (Cambridge University Press). During the course there will be specific references to material that could be pursued further in sources such as “On Sea Ice” by Willy Weeks (Univ. Alaska Press)
“The Geophysics of Sea Ice” (ed. N Untersteiner)
“The Physics of Ice-Covered Seas” (Univ Helsinki)
“The Drift of Sea Ice “ (M Lepparanta)
“Field Techniques for Sea Ice Research” (ed. H. Eicken)
“Ice Mechanics – Risks to Offshore Structures” by T J O Sanderson (Taylor and Francis)

COMBINED COURSE ALGAE IN HUMAN NUTRITION - ALGAE AND FOOD CONTAMINATION (MODULE)

STEFANO ACCORONI

Seat Scienze
A.A. 2016/2017
Credits 3
Hours 24
Period 2^ semestre

Prerequisites

Knowledge in Nutritional Biochemistry and Physiology

Course contents

Frontal lessons (5 credits, 40 hours) and practical lessons in laboratory (1 credit, 8 hours). During the lectures group discussions on scientific papers previously submitted to class as printed or electronic material, short presentations of students to explore themes that will attract particular interest, numerical exercises, instructions for laboratory practical works will be held.

Objectives of the course

Knowledge:
At the end of the Course, students will know the main algae involved in human nutrition, their biochemical composition, modern biotechnologies for the production and refining of the algal biomass for food use. Students will know also the risks of food contamination by algal biotoxins, the main seafood acting as vectors, and the prevention and control methods.

Ability to apply the knowledge:
Students will be able to propose the best use of algal biomass in food diets, and to evaluate the risk of food contamination by algal biotoxins, avoiding the risk of biointoxications.

Soft Skills:
Performing laboratory analysis, scientific paper discussion in groups and short presentation or brief insights on specific learning objectives of interest, help to improve the students' communication skills, learning and critical abilities in an autonomous and self-guided way.

Program

The algal biotoxin problem. Toxic microalgae and the most important biointoxications.
- Diarrheitc Shellfish Poisoning (DSP)
- Paralytic Shellfish Poisoning (PSP)

- Neurotoxic Shellfish Poisoning (NSP)
- Amnesic Shellfish Poisoning (ASP)
- Azaspiracids, cyclic imines
- Ciguatera Fish Poisoning (CFP)
- Palytoxins
- Cyanobacteria toxins (epatotoxins, neurotoxins, irritative toxins)

Toxic microalgae. Main vector organisms. The contamination of seafood and drinkable waters. Chemical structure of biotoxins and action mechanism. Symptoms of biointoxications. Geographical distribution. Risk evaluation. Notes on legislation: threshold values. Monitoring and prevention methods

Laboratory (both modules) - Techniques for microalgae cultivation; identification of micro and macroalgae; extraction and determination of photosynthetic pigments.

Development of the course and examination

Methods for assessing learning outcomes:
The exam consists of an oral interview with at least six questions (three each module). Each question is given a score between zero and thirty. Oral exam grade is calculated as the average of the scores. The exam is passed when the final grade is greater than or equal to 18.

Criteria for assessing learning outcomes:
The student must demonstrate to know the main algae involved in human nutrition, their biochemical composition, modern biotechnologies for the production and refining of the algal biomass for food use. Students must also demonstrate to know the risks of food contamination by algal biotoxins, the main seafood acting as vectors, and the prevention and control methods.

Criteria for measuring learning outcomes:
The final mark is awarded out of thirty. The exam is passed when the grade is greater than or equal to 18. The highest mark with honors (30 cum laude) is also expected to be awarded.

Criteria for conferring final mark:
The final mark is given by adding the oral exam grade to the grade (up to a maximum of two points) resulting from the class work done during the course. The highest honors are attributed when the score obtained from the previous sum exceeds the value of 30 e when the student has demonstrated full mastery of the subject.

Recommended reading

Bibliography cited in teaching slides and notes during the course.
Manual on Harmful Marine Algae. Hallegraeff G.M., Anderson D.M., Cembella A.D. (Eds.) 2003. UNESCO Publishing, 794 p.

COMBINED COURSE ALGAE IN HUMAN NUTRITION - ALGAE IN HUMAN NUTRITION (MODULE)

ALESSANDRA NORICI

Seat Scienze
A.A. 2016/2017
Credits 3
Hours 24
Period 2^ semestre

Prerequisites

Knowledge in Nutritional Biochemistry and Physiology

Course contents

Frontal lessons (5 credits, 40 hours) and practical lessons in laboratory (1 credit, 8 hours). During the lectures group discussions on scientific papers previously submitted to class as printed or electronic material, short presentations of students to explore themes that will attract particular interest, numerical exercises, instructions for laboratory practical works will be held.

Objectives of the course

Knowledge:
At the end of the Course, students will know the main algae involved in human nutrition, their biochemical composition, modern biotechnologies for the production and refining of the algal biomass for food use. Students will know also the risks of food contamination by algal biotoxins, the main seafood acting as vectors, and the prevention and control methods.

Ability to apply the knowledge:
Students will be able to propose the best use of algal biomass in food diets, and to evaluate the risk of food contamination by algal biotoxins, avoiding the risk of biointoxications.

Soft Skills:
Performing laboratory analysis, scientific paper discussion in groups and short presentation or brief insights on specific learning objectives of interest, help to improve the students' communication skills, learning and critical abilities in an autonomous and self-guided way.

Program

Main algae used in human nutrition: Porphyra, Laminaria, Undaria, Sprirulina. The importance of algae as food integrators. Biochemical composition and nutritional value of algae: proteins, carbohydrates, lipids and minerals (quantity, quality, metabolic regulation). Principles of resource

allocation in the organic pools. Algae in food industry: production of alginates, carrageenans and agar. Culturing techniques. Harvesting and processing of micro and macroalgae. Relationship between culture and environmental conditions and quality of algal biomass.
Laboratory (both modules) - Techniques for microalgae cultivation; identification of micro and macroalgae; extraction and determination of photosynthetic pigments.

Development of the course and examination

Methods for assessing learning outcomes:
The exam consists of an oral interview with at least six questions (three each module). Each question is given a score between zero and thirty. Oral exam grade is calculated as the average of the scores. The exam is passed when the final grade is greater than or equal to 18.

Criteria for assessing learning outcomes:
The student must demonstrate to know the main algae involved in human nutrition, their biochemical composition, modern biotechnologies for the production and refining of the algal biomass for food use. Students must also demonstrate to know the risks of food contamination by algal biotoxins, the main seafood acting as vectors, and the prevention and control methods.

Criteria for measuring learning outcomes:
The final mark is awarded out of thirty. The exam is passed when the grade is greater than or equal to 18. The highest mark with honors (30 cum laude) is also expected to be awarded.

Criteria for conferring final mark:
The final mark is given by adding the oral exam grade to the grade (up to a maximum of two points) resulting from the class work done during the course. The highest honors are attributed when the score obtained from the previous sum exceeds the value of 30 e when the student has demonstrated full mastery of the subject.

Recommended reading

Bibliography cited in teaching slides and notes during the course.
Manual on Harmful Marine Algae. Hallegraeff G.M., Anderson D.M., Cembella A.D. (Eds.) 2003. UNESCO Publishing, 794 p.

COMBINED COURSE BIODIVERSITY - ANIMAL BIODIVERSITY (MODULE)

BARBARA CALCINAI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 1^ semestre

Prerequisites

The course of Fundamentals of Biology is strongly recommended.

Course contents

Lectures (5 credits, 40 hours) and practical training (1 credit, 8 hours).
Four practical laboratory classes of 2 hours are scheduled.

Objectives of the course

Knowledge:
Students acquire good knowledge regarding the biodiversity of animals by means of detailed descriptions of their morphological organization at the cellular and anatomical level; phylogenetic relationships among phyla, reproductive strategies and ecology will be also treated for each taxon. Finally, some topics of applied zoology will be introduced.

Ability to apply knowledge:
The students can identify the main taxonomic categories thanks to the knowledge acquired on morphology and on details regarding the cell structure and internal anatomy, the life and reproductive strategies. The students know the environments in which the animals live and the phylogenetic relationships among phyla.

Soft skills:
Photo and video materials showed during lectures and museum samples discussed during laboratory activities stimulate students' capacity of observation, reasoning and drawing conclusions.

Program

Content of the lectures (7 credits, 56 hours):
Introduction: Biodiversity; ontogeny, bauplan, body cavity; principles of classification and phylogeny; unicellular eukaryotes. Metazoans; Porifera; cnidarians; ctenophores; platyhelminthes; Nemertea; Gnatiferan and Lofotrocozoa and minor groups; Mollusks; Annelids; Nematodes, Ecdysozoa; Arthropods; Echinoderms; Chordata; Craniata; Agnata, Chondrichthyes, Osteichthyes Amphibians,

Amniotes, "no bird" Reptiles; Birds, Mammals.
Laboratory practicals (1 credit, 8 hours):
Metazoan morphology and comparisons among the different taxa.

Development of the course and examination

Methods for assessing learning outcomes:
The exam consists of an oral test on the theoretical and the practical parts. The students must demonstrate that they have acquired the basic knowledge presented during the course; moreover, with regard to the practical part, the students have to be able to apply the theoretical knowledge to identify and describe one organism chooses by the lectures. The students have to be able to describe the morphology and discuss the morphological adaptations.

Criteria for assessing learning outcomes:
The level of knowledge acquired, exposed during the oral test, referring to lectures and to the practical parts, will be evaluated to assess the students' preparation.

Criteria for measuring learning outcomes
The final mark is assigned as a fraction of 30. The exam is successfully passed when the mark is equal to or higher than 18/30. The highest mark can be assigned cum laude.

Criteria for conferring the final mark:
The final mark is given considering the levels of knowledge acquired and shown during the oral test, and it is conferred considering the theoretical and practical parts.

Recommended reading

Notes taken during the lecturers and powerpoint presentations handed out by the lecturers.
Further reading:
Zoologia (16° edizione), Hickman, Jr., S. Roberts, S. L. Keen, D. J. Eisenhour, A. Larson, H. Lanson, McGraw-Hill

COMBINED COURSE BIODIVERSITY - PLANT BIODIVERSITY (MODULE)

FABIO RINDI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 1^ semestre

Prerequisites

Basic knowledge of general biology and cell biology. It is recommended to have passed the exam of Principles of Biology before to take the classes of this module.

Course contents

The course consists of both theoretical classes (5 credits, 48 hours) and practical laboratory classes (1 credit, 8 hours). In the course of the theoretical classes, plant and algal samples, both living (leaves, flowers or other types of plant material) and non-living (dried herbarium specimens), will be shown to the students.
The slides of the presentations used in the theoretical classes will be available to the students as PDF files downloadable from Dr Rindi's personal webpage in the website of the Università Politecnica delle Marche (www.univpm.it).

Objectives of the course

Knowledge:
The course will provide the students with a good general knowledge of plant and algal biology. Students will gain a good knowledge of the diversity of plants, algae and fungi, as well as detailed knowledge of the morphology, anatomy and reproduction of these organisms. Special attention will be given to the interactions of plants and algae with environment and their use as environmental indicators. At the same time, the course will also provide basic knowledge on some general environmental topics (climate change and its effect on natural communities) and the use of plants and algae for applied purposes (production of biofuels, production of metabolites with pharmaceutical properties, biofiltering).

Ability to apply the knowledge:
The students will gain: ability to identify plants and algae assigning them to the main plant and algal groups; knowledge of the cytological and anatomical features of the main plant and algal groups; knowledge of plants and algae important as environmental indicators; knowledge of plant and algal assemblages considered important as from the environmental point of view.

Program

Contents (theoretical classes, 5 credits, 40 hours):
General characteristics of plants and algae.
Photosynthetic prokaryotes: the cyanobacteria (phylum Cyanophyta).
Endosymbiosis, evolution of plastids and origin of photosynthetic eukaryotes.
General features of algae (thallus organization, cell structures specific to algae, reproduction, life histories).
The main groups of eukaryotic algae: Rhodophyta, Heterokontophyta, Dinophyta, Cryptophyta, Haptophyta, Euglenophyta. Green algae: Chlorophyta and Streptophyta; diversity and relationships with land plants.
Land plants: origin and general features. The Bryophytes (Bryopsida, Hepaticopsida, Anthoceropsida).
Vascular plants without seeds: general characteristics; the Pteridophytes (Arthrophyta, Licophyta, Psilotophyta, Pterophyta).
Characteristics of the plant cell: cell wall, plastids, vacuole.
The tissues of the vascular plants.
Structure of the root.
Structure of the stem.
Structure of the leaf.
The gymnosperms: characteristics, origin of the seed, functional adaptations; Coniferophyta, Cycadophyta, Gingkophyta, Gnetophyta.
The angiosperms: characteristics, differences between monocots and dicots, functional adaptations. Structure of the flower. Structure of the seed. Structure of the fruit and types of fruits.
The seagrasses. Structure of Posidonia oceanica; the meadows of Posidonia oceanica and their importance as environmental indicators.

Practical laboratory classes (1 credit, 8 hours/student):

The course includes four practical classes (2 hours each):

I. Microscopic examination of microalgae and seaweeds of the shore of Ancona.
II. Microscopic examination of plant tissues.
III. Preparation and microscopic observation of slides with cross sections of leaves of angiosperms and gymnosperms.
IV. Preparation and microscopic observation of slides with cross sections of stems and roots of monocot and dicot angiosperms.

Development of the course and examination

Methods for assessing learning outcomes:
The evaluation of the preparation of the student will consist of a final oral exam. The exam will consist of three main questions concerning the topics of the course. The first question will concern a group of plants or algae: the student will be expected to describe its general characteristics, its reproduction, distribution and ecological features. The second question will be based on the observation of an image depicting a plant or plant tissue, of which the student will be expected to give a detailed description and explanation. The third question will concern cytological or anatomical characteristics of plants or algae, or another topic taught during the course.

Criteria for assessing learning outcomes:
In the exam, the student will be expected to demonstrate good knowledge and understanding of the topics taught in the course. The mark will be based on the overall preparation of the student, the

depth of the knowledge of the topics taught and the capacity to present them with an appropriate language.

Criteria for measuring learning outcomes:
The final mark is assigned as a fraction of 30. The exam is successfully passed when the mark is equal to or higher than 18/30. The highest mark can be assigned cum laude.

Criteria for measuring learning outcomes:
The mark of the Integrated Course of which this module is part (together with the mark of the module of Animal Biodiversity) will be calculated as overall mark based on the marks of the two modules.

Recommended reading

PASQUA G., ABBATE G., FORNI C. Botanica generale e diversità vegetale. III edizione Piccin.
SMITH A.M., COUPLAND G., DOLAN L., HARBERD N., JONES J., MARTIN C., SABLOWSKI R., AMEY A. 2010. Plant Biology. Garland Science.

Useful online resources
Videos listed and linked in the section “LINK UTILI” of Dr Rindi’s personal webpage.
Online Botany Atlas of the University of Turin: http://www.atlantebotanica.unito.it/page.asp
Acta Plantarum - flora delle regioni italiane: http://www.actaplantarum.org/
AlgaeBase: http://www.algaebase.org/
Facebook page of the Italian Botanical Society:
https://www.facebook.com/groups/Botanici.Italiani/

COMBINED COURSE BIOINFORMATICS - BIOINFORMATICS MODULE 1

MARCO BARUCCA

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 1^ semestre

Prerequisites

General knowledge of genetics and molecular biology.

Course contents

Lectures are provided as well as at least 3 CFU of practical exercises in the computer lab (carried out individually or in small groups).

Objectives of the course

Knowledge:
The aim of the course in bioinformatics is to provide an introduction to the knowledge and use of bioinformatic tools freely available on the World Wide Web, for the sequence analysis of nucleic acids and proteins, and more generally of the data available in biological databases.

Ability to apply the knowledge:
At the end of the course the student will be able to use the information available in biological databases and some of the most important bioinformatic tools to study nucleotide and protein sequences.

Soft skills:
Individual and group exercises in the computer lab will contribute to improve the autonomy level as well as communication skills also arising from work in groups.

Program

Introduction to software for application in biology. Public biological sequence databases: history, catalog of current databases, organization of database entries, entry identification and retrieval, storage and updating, evolution to adapt to new technologies. Analysis of single nucleic acid sequences: from restriction map to gene structure prediction. Pairwise comparisons: dot plots and one-to-one alignment strategies, analysis of sequence similarities. Comparisons to databases: hardware and software strategies for generating and analysing very large numbers of pairwise alignments (BLAST). Multiple alignments: methods for detecting similarities within a family.

Development of the course and examination

Methods for assessing learning outcomes:
Oral examination, common for the I and II modules, with registration in the own private area.

Criteria for assessing learning outcomes:
The final exam consists in the evaluation of a written report prepared by the student (the analysis of a protein using the bioinformatics tools available on the web) and an oral test to demonstrate the ability to use advanced information tools (databases, software packages) for genetics and biology.

Criteria for measuring learning outcomes:
The final mark is assigned on the basis of the written report (insufficient, sufficient, good, very good) and of the oral exam through questions at low, medium, and high difficulty

Criteria for conferring final mark:
The final mark is assigned on the basis of the following 4 items:
1. the quality of the written report (efficacy, completeness, adherence to specifications, evaluation and analyses of the relevant information);
2. the understanding of all the material presented in the report,
3. the skill demonstrated in biological database interrogation and in the use of related software,
4. the demonstration of subject competences and of clarity and appropriateness of technical and scientific language used.
The final mark is also assigned considering the student's ability to link the topics covered during the course among themselves and with topics of other courses already attended by the student.

Recommended reading

S. Pascarella e A. Paiardini, Bioinformatica, Zanichelli, Bologna.
DE. Krane e ML Raymer, Fondamenti di Bioinformatica, Pearson
A.M. Lesk, Introduzione alla Bioinformatica, McGraw-Hill Companies
D.W. Mount, Bioinformatics: sequence and genome analysis, Cold Spring Harbor Lab. Press.
C. Gibas, and P. Jambeck, Developing bioinformatics computer skills, O´Reilly, Cambridge
Slides provided during the course.

COMBINED COURSE BIOINFORMATICS - BIOINFORMATICS MODULE 2

PAOLO MARIANI

Seat Scienze
A.A. 2016/2017
Credits 4
Hours 32
Period 1^ semestre

Prerequisites

General knowledge of genetics and molecular biology. Basic mathematical, chemical and physical concepts.

Course contents

Lectures are provided as well as at least 2 CFU of practical exercises in the computer lab (carried out individually or in small groups).

Objectives of the course

Knowledge:
The aim of the course in bioinformatics is to provide an introduction to the knowledge and use of bioinformatics tools freely available on the World Wide Web, and useful for the analysis of nucleic acid and protein sequences and more generally for the evaluation of data available in biological databases.

Ability to apply the knowledge:
At the end of the course, the student will be able to examine the information available in biological databases and to use some of the most important bioinformatics tools to study nucleotide and protein sequences.

Soft skills
Individual and group exercises in the "Informatics Lab" contribute to improving the degree of autonomy of the student and his ability to work in teams and communicate with others. Moreover, practice exercises contribute to improving student computer skills.

Program

Principles of protein structure (secondary, tertiary and quaternary structure); Protein sequence databases; Sequence motif databases; Protein structure databases (PDB); Protein structure representation and view; Structure alignment; Searching 3D Databases; Classifying 3D shapes; Protein secondary structure analysis: defining a secondary structure element, methods for predicting secondary structure; Experimental methods for protein structure determination: X-ray crystallography and nuclear magnetic resonance NMR; Protein tertiary structure modeling: Basic concepts, Protein folding and dynamic simulation, Modeling protein side-chains, Homology modeling, Folding recognition, Threading, Ab initio modeling.

Development of the course and examination

Methods for assessing learning outcomes:
Oral examination, common for the I and II modules, with registration in the own private area.

Criteria for assessing learning outcomes:
The final exam consists in the evaluation of a written report prepared by the student (the analysis of a protein using the bioinformatics tools available on the web) and an oral test to demonstrate the ability to use advanced information tools (databases, software packages) for genetics and biology.

Criteria for assessing learning outcomes:
The final mark is assigned on the basis of the written report (insufficient, sufficient, good, very good) and of the oral exam through questions at low, medium, and high difficulty

Criteria for conferring final mark:
The final mark is assigned on the basis of the following 4 items:
1. the quality of the written report (efficacy, completeness, adherence to specifications, evaluation and analyses of the relevant information);
2. the understanding of all the material presented in the report,
3. the skill demonstrated in biological database interrogation and in the use of related software,
4. the demonstration of subject competences and of clarity and appropriateness of technical and scientific language used.
The final mark is also assigned considering the student's ability to link the topics covered during the course among themselves and with topics of other courses already attended by the student.

Recommended reading

S. Pascarella e A. Paiardini, Bioinformatica, Zanichelli, Bologna.
DE. Krane e ML Raymer, Fondamenti di Bioinformatica, Pearson
A.M. Lesk, Introduzione alla Bioinformatica, McGraw-Hill Companies
D.W. Mount, Bioinformatics: sequence and genome analysis, Cold Spring Harbor Lab. Press.
C. Gibas, and P. Jambeck, Developing bioinformatics computer skills, O´Reilly, Cambridge
Slides provided during the course.

COMBINED COURSE CHEMISTRY - GENERAL CHEMISTRY (MODULE)

ELISABETTA GIORGINI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 1^ semestre

Prerequisites

Basic knowledge of mathematics and physics.

Course contents

Theoretical lectures are planned (5 credits, 40 hours) and stoichiometric and laboratory exercises in the classroom (1 credits, 8 hours). At the front course, it is flanked a teaching support with educational materials, instructions for stoichiometric and laboratory exercises and preparation of examination tasks.

Objectives of the course

Knowledge:
At the end of the course, the student will be aware of the main theoretical and experimental aspects of chemistry, with respect to both the structure of matter and its transformations with a special focus environmental applications and implications. The rigorous discussion of the items will be constantly accompanied by numerical applications in order to make clear the experimental nature of Chemistry. The student will be gradually addressed during the course, which includes numerical exercises, to acquire the basic language and the ability to solve chemical problems through the application of the basic concepts.

Ability to apply the knowledge:
The teaching program, in particular, focuses on the relationship between the atomic structure of the elements, periodic table, and the nature and properties of elements, as well as on the numerical solution of chemical problems, and on the principles of equilibria in aqueous solution, the acid-base properties, the pH of the solutions, foundations indispensable for the understanding of the teachings for which the general chemistry is preliminary. The information acquired from the course must therefore be applied to the normal laboratory practice, such as the preparation of a known titrate solutions or dilute acid or basic solutions, and buffers. The student will also be able to know how to identify the most appropriate procedure for solving some stoichiometric chemical problems that will be proposed during the course.

Program

Introduction to chemistry. Atomic theory. Atomic mass unit and mole. Introduction to quantum chemistry theory: Atomic structure and Orbitals . Electronic configuration. Periodic table of elements. Nomenclature. Chemical bond. Oxidation number. Chemical reactions. Molecular geometry. Valence bond and molecular orbitals theories. Gas phase. Solid and liquid phases. Thermodynamic and Thermochemistry. Kinetic theory. Physical equilibria. solutions. Chemical equilibria. Acids and bases. Ionic equilibria in solution. Electrochemistry.

Development of the course and examination

Methods for assessing learning outcomes:
The evaluation consists of a written test on the topics covered in class containing multiple choice questions including also structure of chemical compounds and nomenclature (n. 13-17) and n. 3-5 stoichiometry exercises. The written test is passed when the final grade is equal or greater than 18.

Criteria for assessing learning outcomes:
In the written test, the student must demonstrate knowledge of principles and methods of general chemistry. In addition, a particular emphasis will be reserved to the acquisition of knowledge in the prediction of structures, molecular geometry and the equilibria in solution (acid-base and buffers). Ultimately, the student must demonstrate that they have achieved the ability to apply the knowledge acquired during the training for the purpose of simple stoichiometric problems, as well as the ability to independently prepare a test report.

Criteria for measuring learning outcomes:
The final mark is awarded out of thirty. The written text is passed when the grade is equal or greater than 18. It is expected to be awarded the highest marks with honors (30 cum laude).

Criteria for conferring final mark:
The final grade is awarded on the basis of the results reported in the two written tests of the Integrated Course. In the case of an oral integration, a maximum of two points may be added. Praise is attributed when the score obtained exceeds 30 and at the same time the student has demonstrated full mastery of the subject.

Recommended reading

M.S. Silberberg , Chimica,Ed. McGraw Hill
P.Atkins, L. Jones, Principi di Chimica, Zanichelli
R. Breschi, A. Massagli, Stechiometria, Ed. Pellegrini.
Michelin Lausarot, Vaglio, Stechiometria per la Chimica generale, Ed. PICCIN

COMBINED COURSE CHEMISTRY - ORGANIC CHEMISTRY (MODULE)

GIOVANNA MOBBILI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 2^ semestre

Prerequisites

A Basic knowledge in Mathematics, Physics and General Chemistry is propaedeutic to the teaching.

Course contents

The course consists of a balance of theoretical lectures (4 ECTS, 32 hours) supported by presentations and video, and other activities, such as classroom practicals (2 ECTS, 16 hours). An e-learning course is available in parallel with the lectures. It includes: the educational material organised in learning units, the materials and instructions for the classroom practicals, self-evaluation tests and results, information, videos of laboratory experiments or supporting theoretic explanations.

Objectives of the course

Knowledge:
At the end of the course, students will have achieved an adequate knowledge and understanding:
(a) of principles and fundamentals of the experimental sciences;
(b) of scientific and methodological basis of organic chemistry;
(c) of the main classes of organic compounds, of their characteristics functional groups, and of their reactivity;
(d) of the main organic reactions that disturb the preservation of the environment, or create environmental emergencies.

Ability to apply the knowledge:
At the end of the course, students will have achieved, as professional skills, the ability to interpret chemical phenomena associated with any environmental emergencies.

Soft skills
Students will obtain independent judgment for the analysis and understanding of the various chemical phenomena related to environmental management. It must also acquire the communication skills so they can clearly transfer information, ideas, problem’s solutions and techniques to specialists representative of the various and specific areas involved in environmental management.

Program

Contents of the lectures (4 ECTS, 32 hours):
Nucleophilicity & Basicity, Acid-Base Catalysis, The functional groups. Alkanes, Nomenclature, Constitutional Isomers, Conformational Isomers, Combustion, Substitution (of H by halogen), Cycloalkanes, Configurational Isomers, Stereoisomers, Stereochemistry, Chirality & Symmetry, Optical Activity, Configurational Nomenclature, Compounds with Several Stereogenic Centers, Fischer Projection Formulas, Achiral Diastereomers, Summary of Isomerism, Alkenes & Alkynes, Nomenclature, Geometric Isomers, Carbocations, Electrophilic Additions, Electrophilic Halogen Reagents, Other Electrophilic Reagents, Reduction, Oxidation, Hydrogenation, Acidity of Terminal Alkynes (Substitution of H), Benzene & Derivatives, Nomenclature, Resonance, Electrophilic Substitution, Reactions of Substituted Benzenes, Reaction Characteristics, Alkyl Halides, Nomenclature, General Reactivity, Substitution(of X), SN2 Mechanism, SN1 Mechanism, Elimination (of HX). Alcohols, Nomenclature, Reactions of Alcohols, Substitution of the Hydroxyl H, Substitution of the Hydroxyl Group, Elimination of Water, Oxidation of Alcohols, Reactions of Phenols, Acidity of Phenols, Oxidation to Quinones, Antioxidant activity, Ethers, Nomenclature, Reactions of Ethers, Acid Cleavage, Epoxide Reactions, Thiols & Sulfides, Sulfur Analogs of Alcohols & Ethers. Amines, Nomenclature, Properties of Amines, Basicity of Nitrogen Compounds, Reagent Bases, Reactions of Amines. Aldehydes & Ketones, Nomenclature, Occurrence of Aldehydes & Ketones, Properties of Aldehydes & Ketones, Reversible Addition Reactions, Hydration & Hemiacetal Formation, Acetal Formation, Imine Formation, Enamine Formation, Organometallic Reagents Additions, The Aldol Reaction, Ambident Enolate Anions, Carboxylic Acids, Nomenclature, Related Derivatives, Acidity, Salt Formation, Substitution of Hydroxyl Hydrogen, Substitution of the Hydroxyl Group, Reduction & Oxidation, Carboxylic Derivatives, Nomenclature, Reactions of Carboxylic Acid Derivatives, Acylic nucleophilic Substitution, Mechanism, Acidity of C–H, The Claisen Condensation.
Practicals: (2 ECTS, 16 hours):
Chemical language – Chemical Reactions – Reactions mechanisms.

Development of the course and examination

Methods for assessing learning outcomes:
The exam consists of a written exam and a following discussion of the elaborate. The test contains ten/thirteen multiple-choice questions and four more complex exercises on nomenclature, stereochemistry and reaction mechanisms. A score of one is assigned to each question; to every exercise, depending on the complexity, a maximum score between 5 and 7 will be assigned in order to reach the 33 potentially acquirable points. The test mark has to be of at least 16 points, in this case two more points may be added during the discussion of the written exam. The exam is passed when the final grade is greater than or equal to 18. During the course of lectures the students have the possibility to take part to "in itinere" written tests.

Criteria for assessing learning outcomes:
The student will have to demonstrate to possess a sound knowledge (theoretical and applied to exercises) of the nomenclature, the structure, the physical and chemical properties and the reactivity of organic compounds.

Criteria for measuring learning outcomes:
The final mark is attributed in thirtieths. Successful completion of the examination will lead to grades

ranging from 18 to 30, and 30 with laud.

Criteria for conferring final mark:
The final mark is attributed by summing the scores obtained in the written exam. The test mark has to be of at least 16 points, in this case two more points may be added during the discussion of the written exam to reach a final grade of 18. The laud is attributed when the score obtained by the previous sum exceeds the value of 30.

Recommended reading

Gorzynski Smith Fondamenti di chimica organica 2/ed • ISBN: 978-88-386-6825-8 McGraw-Hill Education, Milano, (2014) € 59,00.
All other educational material is available on the e-learning web platform

COMBINED COURSE: ANALYTICAL AND ENVIRONMENTAL CHEMISTRY - APPLIED CHEMISTRY FOR ENVIRONMENTAL PROTECTION (MODULE)

CRISTINA TRUZZI

Seat Scienze
A.A. 2016/2017
Credits 7
Hours 56
Period 2^ semestre

Prerequisites

Knowledge of the topics of the courses on Mathematics, Physics, General Chemistry, Organic Chemistry.

Course contents

The course consists of theoretical lectures (5 credits, 40 hours) and individual laboratory practical work and exercises on field (2 credits, 16 hours)

Objectives of the course

Knowledge:
The course enable students to acquire the basic knowledges and concepts of environmental pollution (air and water), essential for environmental protection, prevention and reduction of environmental pollution. In particular, the student acquires knowledge about environmental legislation and major environmental contaminants, their sources, their fate in atmosphere and in the water, and their effects on environment. Contextually the course deals with the main techniques of pollutants monitoring, and principal methods of reduction of pollutants and particulate air pollution. Moreover, the course presents some advanced analytical techniques (atomic absorption spectroscopy AAS, atomic emission spectroscopy ICP-MS, voltammetric in-situ techniques).

Ability to apply the knowledge:
The student will acquire the following professional skills: 1) ability to sampling environmental matrices (on field) and to carry out physical and chemical analyses; 2) ability to perform simple physical and chemical analyses (such as determination of water hardness, total solids and alkalinity of water) and advanced analysis in atomic absorption spectrometry; 3) ability to made interconversion between mass units for air pollutants (ppm, mg/m3, mol/L); 4) ability to evaluate analytical data obtained according to law limits, provided by national and international institutions; 5) ability to discuss case-studies of environments monitoring extracts from scientific literature.

Soft skills:
The execution of individual laboratory analyses, and the preparation of reports on practical work carried out, help student to improve the degree of judgement autonomy in general, because the student will learn to compare experimental data with the corresponding limit laws, encouraging a

discussion above. The communicative capacity will be stimulated during lessons by discussing with the teacher some scientific report or papers (even in English language) on environmental monitoring of air and/or water: these capabilities will be encouraged by attendance to some seminar on environmental topic, carried out by managers of the sector. In addition, the execution of field analyses contribute to improve the degree of judgement autonomy in general, the communicative capacity, the learning capacity in autonomy, and the ability to draw conclusions from experimental data.

Program

Knowledge:
The course enable students to acquire the basic knowledges and concepts of environmental pollution (air and water), essential for environmental protection, prevention and reduction of environmental pollution. In particular, the student acquires knowledge about environmental legislation and major environmental contaminants, their sources, their fate in atmosphere and in the water, and their effects on environment. Contextually the course deals with the main techniques of pollutants monitoring, and principal methods of reduction of pollutants and particulate air pollution. Moreover, the course presents some advanced analytical techniques (atomic absorption spectroscopy AAS, atomic emission spectroscopy ICP-MS, voltammetric in-situ techniques).

Ability to apply the knowledge:
The student will acquire the following professional skills: 1) ability to sampling environmental matrices (on field) and to carry out physical and chemical analyses; 2) ability to perform simple physical and chemical analyses (such as determination of water hardness, total solids and alkalinity of water) and advanced analysis in atomic absorption spectrometry; 3) ability to made interconversion between mass units for air pollutants (ppm, mg/m3, mol/L); 4) ability to evaluate analytical data obtained according to law limits, provided by national and international institutions; 5) ability to discuss case-studies of environments monitoring extracts from scientific literature.

Soft skills:
The execution of individual laboratory analyses, and the preparation of reports on practical work carried out, help student to improve the degree of judgement autonomy in general, because the student will learn to compare experimental data with the corresponding limit laws, encouraging a discussion above. The communicative capacity will be stimulated during lessons by discussing with the teacher some scientific report or papers (even in English language) on environmental monitoring of air and/or water: these capabilities will be encouraged by attendance to some seminar on environmental topic, carried out by managers of the sector. In addition, the execution of field analyses contribute to improve the degree of judgement autonomy in general, the communicative capacity, the learning capacity in autonomy, and the ability to draw conclusions from experimental data.

Development of the course and examination

Methods for assessing learning outcomes:
The exam takes place as oral interview related to topics of the program.

Criteria for assessing learning outcomes:
Student should demonstrate to know the topics of the program, such as fundamental concepts of

environmental pollution (air and water), which are essential for environmental protection, prevention and reduction of environmental pollution.

Criteria for measuring learning outcomes:
The final mark is attributed in thirtieths. Successful completion of the examination will lead to grades ranging from 18 to 30, and 30 with laud.

Criteria for conferring final mark:
The final mark is attributed by evaluating the learning of the student on the contents of the course and by evaluating the complete mastery of the matter. The vote of the Combined Course of which this course is part (together with the course of Analytical chemistry for environment and safety) is attributed evaluating the results of the two modules.

Recommended reading

Copy of slides available
Chimica Ambientale, C. Baird, M. Cann., 2th Ed., 2006, Zanichelli. Bologna.
J. H. Seinfeld: Atmospheric Chemistry and Physics of Air Pollution. John Wiley and Sons, 2012
C. Stern, R. W Bonbel, D.F. Fox: Fundamentals of Air Pollution (II Ed.) Academic Press,1984

COMBINED COURSE: ANALYTICAL AND ENVIRONMENTAL CHEMISTRY - SAFETY AND ENVIRONMENTAL ANALYTICAL CHEMISTRY (MODULE)

GIUSEPPE SCARPONI

Seat Scienze
A.A. 2016/2017
Credits 7
Hours 56
Period 1^ semestre

Prerequisites

Knowledge of the topics of the courses on Mathematics, Physics, General and Organic Chemistry.

Course contents

The course consists of theoretical lectures (6 credits, 48 hours) and laboratory practical work carried out individually or at small groups (1 credit, 16 hours) and fieldwork. An e-learning didactic activity is available in parallel to the normal frontal course. It includes: the didactic material, the self-evaluation tests, numerical exercises, instructions for the laboratory exercises, booking for the laboratory exercises, a section for the upload of laboratory reports from the students, information and booking for the field work, attendances to lectures and laboratory exercises, results of examinations.

Objectives of the course

Knowledge:
The course enables students to acquire the fundamental knowledge of the theoretical and methodological basis of main techniques for chemical analysis (gravimetry, volumetry, potentiometry, conductimetry, UV-Vis spectrophotometry), and their applications in environmental field (spring waters, river waters, snow, atmospheric aerosol). At the same time, the course allows also students to acquire the basic concepts on some environmental issues referring to global changes (climatic changes, greenhouse effect, ozone hole, heavy metal pollution) and on local pollution (photochemical smog, acid rains).

Ability to apply the knowledge:
At the end of the course, the student should also acquire the following professional skills: ability to carry out basic laboratory chemical analyses (gravimetric, volumetric, potentiometric, conductimetric, UV-Vis spectrophotometric) devoted to the analytical control of environmental matrices included the step of field sampling.

Soft skills:
The execution of laboratory analyses (alone or in-group), as well as the drafting and editing of reports on the exercises carried out, contribute to improve for the student the degree of judgement autonomy in general, the communicative capacity (which derives also from the teamwork), the learning capacity in autonomy, and the ability to draw conclusions from experimental data.

Program

Content (lectures, 6 CFU, 48 hours). Fundamentals of chemical analysis. Phases of the analytical process. Stoichiometric calculations of analytical chemistry. Quality of analytical data. Errors. Precision. Accuracy. Certified reference materials. Basic equipment for quantitative chemical analysis. Analytical balance and calibration control. Volumetric glassware and its calibration. Classical analytical methods of gravimetry and volumetry. Some instrumental analytical techniques: electrochemical (potentiometry, conductimetry) and spectrochemical (UV-Vis), with environmental applications. Global changes: greenhouse effect, stratospheric ozone depletion, heavy metal pollution. Local chemical pollution: atmospheric pollution and photochemical smog, acid rains.

Laboratory exercises (1 credit, 16 hours/student). Volumetric determination of HCl by strong acic-strong base titration and using acid/base indicators. Determination of acidity of rain or snow by potentiomentric titration. Conductimetric titration of HCl with NaOH. Determination of chlorides in river water by conductimetric precipitation titration. Determination of iodides, fluorides and chlorides in river water and hot spring water by direct potentiometry (calibration curve method). Spectrophotometric determination of nitrites in river water (calibration curve method). Spectrophotometric determination of Fe(III) in river water (standard addition method). At the end of the exercises, the student will have to consign (electronically) a report on the laboratory activity showing, for each experiment: the data obtained, the calculations performed, the analytical results computed (expressed with the correct number of significant figures), and their discussion and interpretation.

Field work (two one-day school trips). Two one-day school trips are expected to be carried out (one in winter, one in summer) dedicated to field activity: sampling of snow and spring water with analyses on site (pH, conductivity, chloride, fluoride, iodide, nitrate), and visit to plants for bottling of mineral water.

Development of the course and examination

Methods for assessing learning outcomes:
The student consigns (on line) his own laboratory reports. The assessment method is a written classwork (open questions) and subsequent revision/discussion of the script. Thirty open questions are provided for the examination, which include also numerical exercises on stoichiometric calculations involved on gravimetric and volumetric analyses. To each question, a score included between zero and one is assigned. Passing of the written exam is bonded to the acquisition, on the stoichiometric calculations, of a score of at least half of the maximum obtainable. To the sum obtained other two points are added to obtain the final result of the written classwork. Moreover, for the final grade, up to two points maximum will be assigned with reference to the reports of laboratory exercises. The exam is passed when the final score is higher or equal to 18. During the course of lectures it is also foregone the possibility of participating to “in itinere” written classwork (1st and 2nd partial test). The result of a partial test may be mediated with the other provided the obtained score be at least 15, with the constraint referred above. In case of negative or unsatisfactory result in one of the two partial tests, it can be retrieved in the immediately following examination session.

Criteria for assessing learning outcomes:
In the written classwork, the student will have to demonstrate to have acquired a sound knowledge

of basics and methods (theory and practice) of the chemical analytical methodologies of gravimetry, titrimetry, potentiometry, conductimetry, spectrophotometry (UV-Vis), as well as to have acquired the basic knowledge of main global environmental changes and local chemical pollution. In the laboratory reports, the student will have to demonstrate of having achieved the capacity to apply the acquired knowledge during the course to the execution of simple laboratory analyses and the capacity to write critically, in autonomy and/or in-group, a test report.

Criteria for measuring learning outcomes:
The final mark is attributed in thirtieths. Successful completion of the examination will lead to grades ranging from 18 to 30, and 30 with laude.

Criteria for conferring final mark:
The final mark is attributed by summing to the evaluation of the written classwork that of the laboratory report, the latter up to two points. The laud is attributed when the score obtained by the previous sum exceeds the value of 30 and contemporaneously the student demonstrates complete mastery of the matter. The vote of the Combined Course of which this course is part (together with the course of Applied chemistry for environmental protection) is attributed evaluating the results of the two modules.

Recommended reading

Lecture notes
D.A. Skoog, D.M. West, F.J. Holler, S.R. Crouch. Fondamenti di chimica analitica, 3rd edn., EdiSES, Napoli, 2015.
D.C. Harris. Chimica analitica quantitativa, Zanichelli, Bologna, 2005.
C. Baird, M. Cann. Chimica Ambientale, Zanichelli, Bologna, 2006.
S.E. Manahan. Chimica dell’Ambiente, Piccin, Padova, 2000.

COMBINED COURSE: BIOLOGY LABORATORY AND EXPERIMENTAL STATISTICS - BIOLOGY LABORATORY (MODULO) (A-L)

MAURA BENEDETTI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 2^ semestre

Prerequisites

Knowledge of cellular biology, histology, physics and inorganic chemistry

Course contents

The course includes lectures (4 credits, 32 hours) and laboratory practical activities (2 credits, 16 hours) in which students will learn to make laboratory experiments and to organize the experimental data. Through an online access, students can obtain didactic material and instructions for the laboratory activities.

Objectives of the course

Knowledge:
The course enables students to acquire the fundamental knowledge of the theoretical and methodological basis of main techniques used in a biological laboratory (Centrifugation, spectrophotometric and spectrofluorimetric method, histological and immuno-histochemical analyses, electrophoretic techniques).

Ability to apply the knowledge:
At the end of the course, the student should also acquire the following professional skills: ability to carry out biological laboratory techniques for biochemical, cytological, histological and molecular analyses.

Soft skills:
Individual and group laboratory experience improve the student autonomy and the communication capacity for sharing experimental problems. In addition, the use of laboratory equipment provides to the student also transversal skills in biochemistry, cell and molecular biology.

Program

INTRODUCTION TO THE LABORATORY OF BIOLOGY. Codes of conduct and safety precautions in the laboratory, individual protection devices (DPI), use of pipettes and micropipettes equipment

usually founded in a laboratory of biology.
PREPARATION OF SOLUTIONS AND BIOLOGICAL BUFFERS. the meaning of the solution concentration, pH definition, preparation and use of the buffer solutions.
SPECTROSCOPIC TECNIQUES. Spectrophotometric and spectrofluorimetric techniques. Components of a Spectrophotometer Spectrum of absorption and analysis of protein concentration by the Lowry method. Enzymatic activities: practical use of spectrophotometric methods to measure the enzyme activities. Uses of fluorophores in biological applications.
OMOGENIZATION, CENTRIFUGATION AND CELL FRACTIONATING. Physical and mechanical methods to homogenate cells and biological tissues. Component of a centrifuge and parameters of a centrifuge run.
LIGHT AND FLUORESCENCE MICROSCOPY TECNIQUES. Light microscope, fluorescence microscope, Transmission electron microscopy (TEM), , Confocal Laser Scanning Microscope (CLSM) Scanning Electron Microscope (SEM). Histological sample preparation for light and electron microscopy. Histochemical and I reactions on micro-tissue sections and staining for the visualization of cellular components
IMMUNOLOGICAL TECHNIQUES. Antibodies production and use in biological application. ELISA-Enzyme Linked Immunosorbent Assay, western blot, immunohistochemical and immunofluorescence techniques.
ELECTROPHORESIS: loading and running the gel for DNA and protein separation; separating protein with SDS-PAGE, 2D-PAGE; separation of DNA molecules with agarose gels.
PRACTICAL ACTIVITY 1. Solutions and biological buffer preparation.
PRACTICAL ACTIVITY 2. Dissection of digestive gland in mussel Mytilus galloprovincialis; homogenization, centrifugation and preparation of cytosolic fractions.
PRACTICAL ACTIVITY 3. Lowry method: colorimetric assay for protein concentration analysis.
PRACTICAL ACTIVITY 4. H&E staining of   and lipofuscin staining of cryostat section of digestive gland.
PRACTICAL ACTIVITY 5. DNA gel electrophoresis.

Development of the course and examination

Methods for assessing learning outcomes:
Oral examination in which the students have to answer to the questions (almost 3) concerning the issues of the lectures and the practical activities.

Criteria for assessing learning outcomes:
During the oral exam, the students must demonstrate that they have acquired basic knowledge about the main issues concerning the lessons and practical activities.

Criteria for measuring learning outcomes:
The final mark is assigned in a scale of thirty. The exam is passed when the score is equal or greater than 18. It is expected to be awarded the highest marks with honors (30 cum laude).

Criteria for conferring final mark:
The final score is based on the result of the oral examination of the module of Biology Laboratory A-L and the (written reviewed with public discussion) examination of the module Statistics for Experimental Sciences A-L.

Recommended reading

Lecture Notes and slides https://servizi.scienze.univpm.it/moodle
«Biochimica Applicata» M. Stoppini, V. Bellotti EdiSES.

COMBINED COURSE: BIOLOGY LABORATORY AND EXPERIMENTAL STATISTICS - BIOLOGY LABORATORY (MODULO) (M-Z)

STEFANIA GORBI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 2^ semestre

Prerequisites

Knowledge of cellular biology, histology, physics and inorganic chemistry

Course contents

The course includes lectures (4 credits, 32 hours) and laboratory practical activities (2 credits, 16 hours) in which students will learn to make laboratory experiments and to organize the experimental data. Through an online access, students can obtain didactic material and instructions for the laboratory activities.

Objectives of the course

Knowledge:
The course enables students to acquire the fundamental knowledge of the theoretical and methodological basis of main techniques used in a biological laboratory (Centrifugation, spectrophotometric and spectrofluorimetric method, histological and immuno-histochemical analyses, electrophoretic techniques).

Ability to apply the knowledge:
At the end of the course, the student should also acquire the following professional skills: ability to carry out biological laboratory tecniques for biochemical, cytological, histological and molecular analyses.

Program

INTRODUCTION TO THE LABORATORY OF BIOLOGY. Codes of conduct and safety precautions in the laboratory, individual protection devices (DPI), use of pipettes and micropipettes equipment usually founded in a laboratory of biology.

PREPARATION OF SOLUTIONS AND BIOLOGICAL BUFFERS. the meaning of the solution concentration, pH definition, preparation and use of the buffer solutions.

SPECTROSCOPIC TECNIQUES. Spectrophotometric and spectrofluorimetric techniques. Components of a Spectrophotometer Spectrum of absorption and analysis of protein concentration by the Lowry method. Enzymatic activities: practical use of spectrophotometric methods to measure the enzyme activities. Uses of fluorophores in biological applications.

OMOGENIZATION, CENTRIFUGATION AND CELL FRACTIONATING. Physical and mechanical methods to homogenate cells and biological tissues. Component of a centrifuge and parameters of a centrifuge run.

LIGHT AND FLUORESCENCE MICROSCOPY TECNIQUES. Light microscope, fluorescence microscope, Transmission electron microscopy (TEM), , Confocal Laser Scanning Microscope (CLSM) Scanning Electron Microscope (SEM). Histological sample preparation for light and electron microscopy. Histochemical and I reactions on micro-tissue sections and staining for the visualization of cellular components

IMMUNOLOGICAL TECHNIQUES. Antibodies production and use in biological application. ELISA-Enzyme Linked Immunosorbent Assay, western blot, immunohistochemical and immunofluorescence techniques.

ELECTROPHORESIS: loading and running the gel for DNA and protein separation; separating protein with SDS-PAGE, 2D-PAGE; separation of DNA molecules with agarose gels.

PRACTICAL ACTIVITY 1. Solutions and biological buffer preparation.
PRACTICAL ACTIVITY 2. Dissection of digestive gland in mussel Mytilus galloprovincialis; homogenization, centrifugation and preparation of cytosolic fractions.
PRACTICAL ACTIVITY 3. Lowry method: colorimetric assay for protein concentration analysis.
PRACTICAL ACTIVITY 4. H&E staining of haemocytes and lipofuscin staining of cryostat section of digestive gland.
PRACTICAL ACTIVITY 5. DNA gel electrophoresis.

Development of the course and examination

Methods for assessing learning outcomes
Oral examination in which the students have to answer to the questions (almost 3) concerning the issues of the lectures and the practical activities.

Criteria for assessing learning outcomes:
During the oral exam, the students must demonstrate that they have acquired basic knowledge about the main issues concerning the lessons and practical activities.

Criteria for measuring learning outcomes:
The final mark is assigned in a scale of thirty. The exam is passed when the score is equal or greater than 18. It is expected to be awarded the highest marks with honors (30 cum laude).

Criteria for conferring final mark:
The final score is based on the result of the oral examination of the module of Biology Laboratory M-Z and the written examination of the module Statistics for Experimental Sciences M-Z.

Recommended reading

Lecture Notes and slides https://servizi.scienze.univpm.it/moodle
«Biochimica Applicata» M. Stoppini, V. Bellotti EdiSES.

COMBINED COURSE: BIOLOGY LABORATORY AND EXPERIMENTAL STATISTICS: STATISTICS FOR EXPERIMENTAL SCIENCES (MODULE) (A-L)

GIUSEPPE SCARPONI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 1^ semestre

Prerequisites

Knowledge of the topics of the courses on Mathematics and Informatics.

Course contents

The course consists of theoretical lectures (5 credits, 40 hours) and computer laboratory pratical work carried out at small groups of 2-3 students. An e-learning didactic activity is available in parallel to the normal frontal course. It includes: the didactic material, the self-assessment tests, data and instructions for the experimental exercises, booking for the experimental exercises in the computer laboratory, attendances to lectures and laboratory exercises, results of examinations.

Objectives of the course

Knowledge:
The course enables students to acquire the theoretical and methodological fundamentals of univariate and multivariate statistical analysis as applied to the study of experimental sciences. In particular, the student should know the fundamentals of statistics, the hypothesis testing, and the procedures of cluster analysis, principal component analysis, nearest neighbour rule, canonical variate analysis (discriminant analysis).

Ability to apply the knowledge:
At the end of the course, the student should have acquired the ability of performing the computer procedures required for data statistical analysis using commercial statistical packages, as well as to interpret correctly the results obtained.

Soft skills:
The execution of experimental exercises in-group and the discussion of the results obtained, contribute to improve, for the student, the degree of judgement autonomy in general, the communicative capacity (which derives also from the teamwork), and the ability to draw conclusions from experimental data.

Program

Content (lectures, 5 CFU, 40 hours). Theoretical and methodological fundamentals of the main techniques of univariate and multivariate statistical analysis as applied to the study of experimental sciences. Data and data distribution. Descriptive statistics. Normal distribution. Inference. Confidence interval. Hypothesis testing. Analysis of variance. Linear regression. Multivariate data and information. Ungrouped data analysis: cluster analysis, principal component analysis (PCA). Grouped data analysis: k nearest neighbour rule (KNN), canonical variate analysis (CVA), discrimination and classification. Examples of case studies referred to biological, archaeological (paleobiological) and chemical problems. Computer laboratory activity for the study of a few real cases considered during the course.

Laboratory exercises (1 CFU, 8 hours/student). Exercise n. 1: Histograms, Frequency tables, Summary statistics, Confidence interval, Hypothesis testing. Ex. n. 2: Cluster analysis I. Ex. n. 3: Cluster analysis II, Method of k nearest neighbour rule (KNN). Ex. n. 4: Principal component analysis (PCA). Ex. n. 5: Canonical variate analysis (CVA) (or Discriminant analysis). Exercises are carried out in small groups (2-3 students/computer). Used statistical packages: Unistat, SIMCA, S-Plus, Parvus, Statgraphics. No written reports of the conducted activity are required.

Development of the course and examination

Methods for assessing learning outcomes:
The assessment method is a written classwork (open questions) and subsequent revision/discussion of the script. Thirty open questions are provided for the examination. These include also exercises on hypothesis tests and questions on the interpretation of results obtained from the analysis of a case study obtained using one of the statistical packages used during the course. To each question a score included between zero and one is assigned. To the sum obtained other two points are added to obtain the final result of the written classwork. The exam is passed when the final score is higher or equal to 18. During the course of lectures it is also foregone the possibility of participating to “in itinere” written classwork (1st and 2nd partial test). The result of a partial test may be mediated with the other provided the obtained score be at least 15. In case of negative or unsatisfactory result in one of the two partial tests, it can be retrieved in the immediately following session.

Criteria for assessing learning outcomes:
In the written classwork, the student will have to demonstrate to have acquired a sound knowledge of basics and methods of the univariate statistics (data distributions, inference, hypothesis testing) and multivariate statistics (cluster analysis, principal component analysis, k nearest neighbour rule, canonical variate analysis). The capacity to apply the acquired knowledge is assessed also through the written answers to the questions related to the exercises on the hypothesis tests and on the case study presented in the “practical” part of the written classwork.

Criteria for measuring learning outcomes:
The final mark is attributed in thirtieths. Successful completion of the examination will lead to grades ranging from 18 to 30, and 30 with laud.

Criteria for conferring final mark:
The final mark is attributed by summing the scores obtained on the 30 questions of the written classwork (after its public revision/discussion) and adding two points to the sum. The laud is attributed when the score obtained by the previous sum exceeds the value 30 and contemporaneously the student demonstrates complete mastery of the matter. The vote of the Integrated Course of which this course is part (together with the course of Laboratory of Biology) is

attributed evaluating the results of the two modules.

Recommended reading

Lecture notes
O. Vitali. Statistica per le Scienze Applicate. Vol. 2. Cacucci Editore, Bari, 1993.
O. Vitali. Principi di Statistica. Cacucci Editore, Bari, 2003.
M.C. Whitlock, D. Schluter. Analisi statistica dei dati biologici. Zanichelli, Bologna, 2010.
W.W. Daniel. Biostatistica. Edises, Napoli, 1996.
R.R. Sokal, F.J. Rohlf. Biometry. The Principles and Practice of Statistics in Biological Research, W.H. Freeman, San Francisco, 1995.
G. Norman, D. Steiner. Biostatistica. Seconda ediz., Casa Editrice Ambrosiana, Milano, 2015.
W.J. Krzanowski. Principles of Multivariate Analysis. A User’s Perspective, Second edition, Oxford University Press, 2000.
I.T. Jolliffe. Principal Component Analysis, Second edition, Springer-Verlag, New York, 2002.

COMBINED COURSE: BIOLOGY LABORATORY AND EXPERIMENTAL STATISTICS: STATISTICS FOR EXPERIMENTAL SCIENCES (MODULE) (M-Z)

FRANCESCA BEOLCHINI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 1^ semestre

Prerequisites

Basic mathematics.

Course contents

The course is given through lectures and numerical exercises, in some cases using the Microsoft Excel software and other statistical softwares.

Objectives of the course

Knowledge:
At the end of the course the student will have basic statistics skills to support the experimental activity of a biologist.

Ability to apply the knowledge:
At the end of the course the student will be able to apply basic statistics concepts to experimental data .

Soft skills:
Numerical applications stimulate the critical thinking of each student, together with communication skills.

Program

SAMPLES AND DESCRIPTIVE STATISTICS.
STATISTICAL INFERENCE.
INTRODUCTION TO FACTORIAL EXPERIMENTS AND VARIANCE ANALYSIS
LINEAR REGRESSION ANALYSIS
MULTIVARIATE ANALYSIS: CLUSTER ANALYSIS AND PRINCIPAL COMPONENT ANALYSIS

Development of the course and examination

Methods for assessing learning outcomes:
Written exam.

Criteria for assessing learning outcomes:
The student has to show knowledge of subject matter and ability to apply it to simple practical cases.

Criteria for measuring learning outcomes:
The score is given by a number, out of 30 points. The minimum score required for passing the exam is 18.

Criteria for conferring final mark:
The final score is based on the result of the oral examination of the module of Biology Laboratory M-Z and the written examination of the module Statistics for Experimental Sciences M-Z.

Recommended reading

Geoffrey R. Norman, David L. Streiner, G. Capelli. Biostatistica. Tutto quello che avreste voluto sapere. Casa Editrice Ambrosiana (2015).

COMBINED COURSE: BIOMOLECULAR TECHNOLOGIES - ADVANCED MOLECULAR BIOLOGY (MODULE)

ANNA LA TEANA

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 2^ semestre

Prerequisites

Knowledge of Biological Chemistry, Molecular Biology and Genetics is required.

Course contents

The Advanced Molecular Biology module is organized in lectures (5 CFU, 40 hours) and laboratories (1 CFU, 8 hours). Handouts of the lectures, protocols for the laboratories and booking forms for the laboratories are loaded on the Moodle platform of DiSVA website.

Objectives of the course

Knowledge:
Students will acquire knowledge concerning molecular mechanisms involved in the regulation of gene expression at the different levels with a special interest in all post-transcriptional events as well as the most important and most widely experimental approaches used for gene expression analysis.

Ability to apply the knowledge:
Students will be able to apply the acquired knowledge to understand and critically evaluate data in the scientific literature and to perform same of the basic technique for gene expression analysis.

Soft skills:
The practical experience during the laboratories together with the discussions on the experimental results will improve student's autonomy and ability to evaluate critically scientific data. Furthermore, the organization of the laboratories in small groups will facilitate the coordination and communication abilities. The preparation of a Power-point presentation for the final exam will advance the student's ability to present and discuss scientific literature.

Program

Content (lectures 5 CFU, 40 hours):
Methods for gene expression analysis: northern blotting, RT-PCR, RNase protection. Real-time

PCR. DNA microarrays. RNA-Seq. Next-generation sequencing techniques. Reporter genes. Western blotting, proteomic analysis, mass spectrometry, SILAC.
Analysis of DNA and RNA-protein interaction: DNaseI footprinting, chemical probing, cross-linking, ChIP-Seq. Analysis of protein-protein interactions: two-hybrid and three-hybrid systems, GST-pull down. Analysis of translation: cell-free systems, toe-printing, polysomal profiling, Ribo-Seq.
Site-directed mutagenesis. Knock.out and knock-down. CRISPS-Cas system.
The different levels of regulation of gene expression.
Epigenetic modifications: DNA methylation, histone methylation and chromatin remodelling.
Regulation at the post-transcriptional level: RNA binding proteins and RNA binding motifs, mRNA maturation, polyA tail addition, splicing and alternative splicing, mRNA transport, the "post-transcriptional operon" hypothesis, translation, mRNA decay, nonsense-mediated decay, miRNA and siRNA.
Regulation at the post-translational level: protein stability and processing.

Laboratories (1 CFU, 8 hours):
Extraction of RNA from cultured cells; purification of RNA by affinity chromatography and determination of its concentration by spectrophotometric analysis; retro-transcription followed by PCR with primers designed to amplify alternative splicing products; separation of the different amplicons by agarose gel electrophoresis; data analysis.

Development of the course and examination

Methods for assessing learning outcomes:
Evaluation for Advanced Molecular Biology module is performed trough an oral exam that consists of a Power point presentation based on a research article dealing with one of the topics of the program and two questions. In addition, students should present a written report of the laboratory experience.

Criteria for assessing learning outcomes:
Questions aim at verifying the level of knowledge acquired by the students. Power point presentation will show the ability of the student to present and critically discuss the scientific literature and to evaluate experimental data. The laboratory report will show the capacity of the student to understand and perform experiments.

Criteria for measuring learning outcomes:
The level of knowledge acquired by the students is measured with a mark between 0 and 30. In order to pass the exam the final mark must be between 18 and 30. The highest possible mark is 30/30 cum laude.

Criteria for conferring final mark:
Being an integrated course, the final grade is attributed upon evaluation of the overall results obtained in the single modules. Concerning the Advanced Molecular Biology module, the Power-point presentation is evaluated with a mark included between 0 and 24, the answer to the two questions and the laboratory report are evaluated overall with a mark between 0 and 6. 30/30 cum laude is attributed to students particularly able to discuss critically and with great competence about the different topics of both modules.

Recommended reading

Biologia molecolare del gene. J.D. Watson, T.A. Baker, S.P. Bell, A. Gann, M. Levine, R. Losick. Casa Editrice Zanichelli. VII edizione. 2015.
Biologia Molecolare. F. Amaldi, P. Benedetti, G. Pesole, P. Plevani. Casa Editrice Ambrosiana. II edizione. 2014.
In addition, review articles from specialized Molecular Biology journals on specific topics are provided during the course.

COMBINED COURSE: BIOMOLECULAR TECHNOLOGIES - GENETIC ENGINEERING

TIZIANA CACCIAMANI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 2^ semestre

Prerequisites

The course provides a multidisciplinary approach, therefore good background in Molecular Biology, Microbiology, Genetics, Biochemistry and Bioinformatics are suggested.

Course contents

The course will comprise 6 credits: frontal lectures are planned for a total of 4 credits (32 hours) and practical exercises carried out in groups for a total of 2 credits (16 hours). The exercises will included the in silico design of a cloning experiment (carried out in class) and practical laboratory work . The course material related to the lectures, instructions for exercises and laboratory schedule will be available on Moodle platform in the web site of the Department of Life and Environmental Science dedicated to teaching activity.

Objectives of the course

Knowledge
The course provides students with:
the theoretical and methodological bases used to produce recombinant DNA in different organisms; (b) know how to draw information from genetic, protein and medical databases for applications design in various biotechnological fields; (c) basic information on the current safety rules required to use genetically modified organisms.

Ability to apply the knowledge:
Students will gain the ability:
to perform basic manipulations for cloning, expression, and analysis of genes, following the safety rules; (b) to consult the databases to design the cloning, expression and modifications of a gene in different organisms, according to special applications in the medical, industrial, food and environmental fields; (c) to assess the benefits and risks associated with genetically modified organisms produced.

Soft skills
The exercises directed to the in silico design of a cloning experiment for a particular application will help the students to develop the ability to analyze and synthesize information from different fields, making judgments on autonomy, solve problems, work in groups and improve their communication skills.

Program

Content (lectures, 4 ECTS, 32 hours + tutorials, 2 credits, 16 hours):
Fundamentals of Molecular Biotechnology
prokaryotic and eukaryotic organisms used in molecular biotechnology, restriction enzymes and enzymes necessary for the manipulation of DNA and RNA, sequencing and DNA amplification, site directed mutagenesis for the manipulation of proteins, use of databases and programs for the analysis of DNA sequences.
Prokaryotic systems
Plasmid vectors for cloning and expression, transformation and selection methods, vectors based on bacteriophages, construction of gene libraries, large-scale production of recombinant proteins.
Eukaryotic systems
Expression vectors, transfection and selection methods used in yeast, insect and mammalian cells, production of recombinant proteins in eukaryotic systems, main vectors used for gene therapy based on DNA or RNA molecules.
Biotechnological applications
Examples: production of therapeutic agents based on recombinant nucleic acids and proteins; synthesis of recombinant proteins useful for industrial processes, transgenic animals.
Exercises:
Gene cloning and expression "in silico".
Cloning a DNA fragment in plasmid vector and analysis of the clones.

Development of the course and examination

Methods for assessing learning outcomes:
The exam will consist of an interview with at least three questions on different topics and a discussion of the laboratory reports submitted.
The student submits (online) their lab reports at least one week before the exam session.

Criteria for assessing learning outcomes:
During the oral examination the three questions will be used to evaluate:
(a) the theoretical and practical knowledge acquired by the students, (b) the ability to present a topic in a clear and appropriate way and (c)the degree of independent judgment reached at the end of the course.
In lab reports, student should demonstrates that he/she has achieved the ability to apply the knowledge acquired during the course to design a simple protocol for recombinant protein production and he/she is able to properly evaluate the results obtained.

Criteria for measuring learning outcomes:
The higher grade will be express by 30/30 and if the student's performance will be excellent, it is expected to be awarded (lode).
For each oral question is provided a score from 0 to 8.
The reports will be evaluated from 1 to 6 points.

Criteria for conferring final mark:
Being an integrated course, the final grade is attributed upon evaluation of the overall results obtained in each single module. Concerning the Genetic Engineering module, the grade it is given by adding the scores of oral responses and reports evaluation. The higher grade is 30/30 and the

student must achieve a minimum score of 18/30 to pass the exam. The grade 30/30 cum laude will be used for student able to discuss properly, critically and with great competence about the different topics from both modules.

Recommended reading

S. Primrose, RD. Twyman, B.Old - Genetic Engineering, Principles and features- Zanichelli, 2004.
B.R. Glick, J.J. Pasternak - Molecular Biotechnology, principles and applications of DNA ricombinante- Zanichelli, 1999.
Some topics will be integrated with technical manuals, articles and reviews suggested by the teacher as PDF format in the course website

COMBINED COURSE: ENVIRONMENTAL AD ENERGETIC SUSTAINABILITY - ENVIRONMENTAL SUSTAINABILITY

ANTONIO DELL'ANNO

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 2^ semestre

Prerequisites

Basic knowledge of Ecology

Course contents

The course is articulated in theoretical lectures integrated with the analysis of case studies and numerical exercises

Objectives of the course

Knowledge:
The course provides the basic principles and the most recent approaches for managing complex and inter-disciplinary issues needed to answer environmental sustainability objectives.

Ability to apply the knowledge:
The student will acquire the following professional skills: ability to plan strategies for the management and conservation of environmental quality and its resources; propose actions and measures for the reduction and mitigation of human pressure on ecosystems.

Soft skills:
The student will acquire skills useful for interfacing with agencies and institutional bodies involved in the management of the environment and its resources

Program

Basic concepts and definitions: Environmental sustainability, ecological sustainability and sustainable development. Models of sustainable development. Indicators of human wellbeing. The concept of carrying capacity. Goods and services provided by ecosystems. Assessment of the value of the natural capital. The key ecological paradigms (resistance, resilience, emerging properties and ecosystem borders) for the eco-sustainable management of the environment.
Global change and global ecology: Human ecology. Human populations and urban growth. Analysis of the growing anthropogenic impact. Major causes responsible for the transformation and

degradation of ecosystems and of the landscape: consequences on the provisioning of ecosystem's goods and services for human wellbeing. Climate changes, ecological feedbacks, adaptation and mitigation strategies.
Strategic approach to the use of the natural resources: analysis of multiple impacts in the multiple environmental dimensions. Driving forces, Pressures and Environmental health. Approaches for the sustainable management of the natural resources. Use of non-renewable resources. Strategies for the mitigation of the impact due to the excessive use of resources. Network analysis: comparison between natural and man-made systems. Ecological Footprint and Biocapacity. Emergy.
Environmental policy and quality of life: Impact of economical transformation and globalization on ecosystems. Cost-benefit analysis. Perspectives for the 2050. The problem of disparities. Competitions and conflicts. Ecological priorities and prognosis.
Case studies: Agriculture and sustainable yields. Sustainability of biofuels.
Sustainability of fisheries and aquaculture. The aesthetic and recreational value of the environment: the case of coral reefs. Biodiversity of terrestrial and aquatic ecosystems and the production of goods and services for humans. Criteria for sustainable management of forest resources.
Exercises: application of network analysis tools to natural and anthropogenic systems, examples of ecological footprint assessment.

Development of the course and examination

Methods for assessing learning outcomes:
The student will demonstrate his/her expertise by an oral examination on at least three questions.

Criteria for assessing learning outcomes:
Students must demonstrate that they have acquired the knowledge on: the main models and indicators of sustainable development and environmental sustainability, indicators of human well-being, goods and services provided by ecosystems, the main causes of transformation and degradation of ecosystems, assessment of the economic value of the natural capital, the main approaches for the sustainable management of renewable resources, the strategies for reducing human impact due to the consumption of resources. The questions will allow assessing the student's ability to communicate clearly the information gained during the course.

Criteria for measuring learning outcomes:
The final vote is awarded out of thirty. The exam is passed when the vote is greater than or equal to 18. It is expected to attribute the highest score with honors (30 cum laude).

Criteria for conferring final mark:Being an integrated course the final vote is attributed jointly following the oral exam of the Environmental Sustainability module and the Energetic Resources and Alternative Energies module. Praise is given if the student demonstrates full mastery of the subject.

Recommended reading

Lecture notes
Lemons J., L. Westra & R. Goodland (1998) Ecological sustainability and integrity: concepts and approaches. Environmental Science and Technology Library, Kluwer academic Publishers.
Bologna G. (2005) Manuale della sostenibilità. Idee, concetti, nuove discipline capaci di futuro. Edizioni Ambiente S.r.L..

Southwick C.H. (1996) Global ecology in human perspective. Oxford University Press.
Chambers N., C. Simmons & M. Wackernagel (2000) Sharing nature's interest. Ecological footprints as an indicator of sustainability. Earthscan, London and Sterlin, VA.
Wackernagel M. & W.E. Rees (2000) L'impronta ecologica: come ridurre l'impatto dell'uomo sulla terra. Edizione italiana a cura di Bologna G. & P. lombardi, Edizioni Ambiente S.r.L..

COMBINED COURSE: ENVIRONMENTAL AND ENERGETIC SUSTAINABILITY - ENERGETIC RESOURCES AND ALTERNATIVE ENERGIES

PAOLO PRINCIPI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 1^ semestre

Prerequisites

taken the exam of Environmental Technical Physic

Course contents

The course is developed through series of lectures, divided into blocks on specific topics and at the end of each phase of exercises designed to introduce students to the written test exam. As part of the course students can access the course materials in electronic form on the university website consists of: as pdf files on the slides shown during the lectures, the file in pdf related to numerical exercises carried out in previous academic years and the current one, the pdf's related to the tests of previous years and the work already undertaken in the current academic session, the results of the examinations.

Objectives of the course

Knowledge
Renewable energy is becoming one of the fastest growing industries in the face of the current environmental crisis, resulting from dependence on fossil fuels and unprecedented global rate of development. To the end of the instruction the student will have to know the functioning of all types of renewable energies technologies. The Renewable Energy Program gives the student a solid foundation in the fundamental design, installation techniques required to work with renewable technologies.

Ability to apply the knowledge
The student will also acquire the following professional skills: ability to make simple energy analysis, for example, the fuel used to cool the buildings on the territory in order to make strategies for the reduction of energy consumption and sending in the gas atmosphere greenhouse. Do anyway energy issue advice to the decision-maker with the aim of producing strategies to pursue environmental sustainability, reduce the consumption of fossil fuels and reduce the phenomenon of climate change.

Soft skills
The exercises, performed by students in a collaborative way, but also independently, allow to learn, as well as the examination procedures also wrote the cooperation mechanisms in the development

of energy strategies for environmental sustainability. These practices allow to acquire independent judgment, ability to learn and draw conclusions independently, but also to develop communication skills, enhanced by teamwork.

Program

FOSSIL FUELS AND ENVIRONMENTAL ASPECTS OF THEIR USE
Pollution and correlated effects: emission due to the human activities. Greenhouse effect, greenhouse gases, climate change, action for emission limitation.
Energy consumption in human activities, sustainable management of natural and environmental resources.
ENERGY POLICY
International policy and energy actions:
European policy and energy actions, italian policy and energy actions, regional policy and energy actions, local energy actions

RENEWABLE ENERGIES
Introduction to renewable energies. Definitions, classification and diffusion of renewable energy technologies. Principles and practices.
Solar Energy
Assessment of solar energy availability, thermal power (solar collectors and high-temperature solar thermal power systems) and electric power technologies (photovoltaic), environmental impacts

Solar thermal electric power
High-temperature Solar thermal power systems (concentrating solar power), Concentration of sunlight: parabolic trough collector, linear Fresnel collector, central receiver system with dish collector and central receiver system with distributed reflectors, concentrated solar thermal trough power plant with thermal storage, Solar Thermal Tower Power Plants, Dish-Stirling Systems. Examples in the word.
Solar thermal
Collector types, flat plate and the evacuated tube solar thermal systems, heat pipe evacuated tube, solar thermal air collector. Types of absorber, selective surfaces, Efficiency, storage tanks. Environmental benefits.
Solar pond
Basic system principles, advantages, disadvantages, efficiency, thermal and electricity generation, desalination, applications in developing countries.
Photovoltaic
Photovoltaic effect, Photovoltaic (PV) materials: crystalline silicon, thin-film materials such as cadmium telluride, copper indium diselenide, and amorphous silicon.
Polymer. Devices convert sunlight into electrical energy, PV cells, technologies of cells combined into modules, modules assembled into PV arrays, components, stand alone and grid connected systems. Concentrated PV. The international and national programs.
Hydropower
Assessment of hydropower availability, overview of hydropower technologies.: impoundment, diversion, and pumped storage. Sizes of hydroelettric power plant. Types of hydro turbines: impulse and reaction.
Energy from the seaAssessment of tidal and wave power availability, Wave power, oceanic currents, deep currents, tidal currents, horizontal axis turbine, vertical axis turbine, oscillating hydrofoil, attenuator, point adsorber, oscillating water column, overtopping, thermal gradient, OTEC. Examples in the word.

Wind power
Assessment of wind power availability, technologies for electricity generation, wind turbine, components of wind turbine, main parts to a wind turbine: the base, tower, nacelle, and blades., wind farms, onshore and offshore, Italian and European examples.
Geothermal
Assessment of available geothermal energy, technologies for thermal and electric power generation, geothermal power plants: dry steam, flash steam, and binary cycle, environmental impacts.Geothermal direct use by heat pump,
Biomass
assessment of biomass availability, technologies for electric production. Combustion and gasification. Aerobic and anaerobic digestion processes. Biofuel, biopower

ENERGY CONSERVATION AND ENERGY EFFICIENCY IN BUILDINGS
City heat island effect and green roofs, passive solar buildings, Reduction in consumption of heat in building.
Nuclear power

Development of the course and examination

Methods for assessing learning outcomes:
Oral examination

Criteria for assessing learning outcomes:
In the oral examination, students must demonstrate that they have acquired knowledge of national and international energy scenarios, regulations and strategies to reduce the consumption of fossil fuels and reduce the resulting environmental impact. The student will learn about alternative sources of energy and technologies intended for their exploitation

Criteria for measuring learning outcomes:
Oral exam will be given at the end of course at scheduled time. At the end of the oral test is given the vote of thirty. It confirms the exam when the vote is greater than or equal to 18. It is expected to be awarded the highest marks (30 cum laude).

Criteria for conferring final mark:Being an integrated course the final vote is attributed jointly following the oral exam of the Environmental Sustainability module and the Energetic Resources and Alternative Energies module. Praise is given if the student demonstrates full mastery of the subject.

Recommended reading

download pdf files from web pages teacher
handouts for specific topics

COMBINED COURSE: OCEANOGRAPHY AND SEDIMENTARY ENVIRONMENT - MARINE SEDIMENTARY ENVIRONMENT (MODULE)

ANNA SABBATINI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 2^ semestre

Prerequisites

Basic knowledge on Geology and Stratigraphy topics.

Course contents

The course will include both theoretical lessons (5 credits, 40 hours) and laboratory practical works carried out individually or in small classes and field trip exercises (1 credits, 8 hours). During the course the educational activity will be supported also by the e-learning platform (Moodle platform) containing: teaching materials, numerical exercises, instructions for laboratory exercises, reservation for laboratory exercises, restricted area for insertion of lab reports, attendance in class and in the laboratory, the test results.

Objectives of the course

Knowledge:
The course will concern significant aspects of sedimentology in the marine environment with particular attention to the description of marine sedimentary environments, the abiotic factors controlling the dynamics of the sediments and the most important organisms forming with their biomass part of the sediments and participating in biogeochemical cycles of the planet. The course enables students to acquire the basic knowledge on the sediment classification according to their texture and sedimentary process that generated them.
Simultaneously it provides students with the knowledge of some global environmental topics in relation to climate change and its influence on past and modern environments and regional topics relating to coastal erosion and its environmental and social impact.

Ability to apply the knowledge:
The student must acquire the following professional skills: ability to perform basic sedimentological laboratory analysis (grain size analysis of sediments, recognizing types of principal sediments, preparation of sediment samples by washing) in the context of an environmental monitoring or ecological research, including the phase of field sampling.

Soft skills:
The execution of individual and group laboratory analysis and the relative report on the experience that students have to produce, will help them to improve both their independence and their ability to

communicate and work in a team such as the ability to learn independently and resume the principal topics of the course.

Program

Contents
-Main topics on stratigraphy and geology.
-Types of sediments and their regime: the siliciclastic sediments and sedimentary process that generated them; chemical sediments.
-The sedimentary environments: marine and transitional sedimentary environments; coastal dynamics.
-Major biogeochemical processes in marine sediments.
-Marine sediments and organisms that constitute them.
-Sampling methods and the sediment in the legislative framework.
-Applications: the study of past sediments as a function of climate and environmental changes; the sediment dynamics on the coastal erosion; sediment in environmental monitoring.

Lab practice
Preparation of the sediment sample. Grain size analysis of a sediment sample. Preparation and processing of the dataset for the grain size distribution analysis. Calculation of the main statistical parameters. Recognition of a sediment sample using a stereomicroscope. Recognition of benthic calcareous meiofauna. At the end of the practical lessons, the student will compile a report relating to the laboratory activities and, presenting, for each experience, the obtained data and the calculated analytical results and discussion / interpretation of the same.
Field/Practical trip on Monte Conero.

Development of the course and examination

Methods for assessing learning outcomes:
The exam consists of a written questionnaire and the subsequent review/discussion of the questions. There will be 30 questions divided between open questions and multiple choice. Each question has a score between zero and one. There will be also the possibility of an oral exam covering all the topics of the course. The exam is passed when the final score is greater than or equal to 18.

Criteria for assessing learning outcomes:
In the written test (and possibly oral), students should demonstrate to know the main subjects of the course as well as their applications in environmental and marine biology. They must also demonstrate to know the scientific language of the study matter and to achieve the ability to apply the knowledge acquired during the training and the ability to draw critically, independently and/or in group, a test report.

Criteria for measuring learning outcomes:
The final score is in thirtieth. The exam is passed when the score is greater than or equal to 18. Worthy students can be awarded with the maximum score (30 cum laude).

Criteria for conferring final mark:
The final score is given by adding the evaluation of the written questionnaire to the oral procedure (if

necessary maximum two points).
Being an integrated course, the finale score is assigned by evaluating the results of both modules
Praise is attributed when the score obtained from the previous sum exceeds the value of 30 and the student has demonstrated fully master of both modules.

Recommended reading

Notes and Books
- Sedimentologia, volume 1 e volume 3di Ricci Lucchi Franco. 1980, 548 p., ill. CLUEB Editore
- I ritmi del Mare. Sedimenti e dinamica delle acque di Ricci Lucchi Franco. 1992, 256 ill. Carocci Editore.
- Capire la Terra di Frank Press, Raymond Siever, John Grotzinger, Thomas H Jordan
Seconda edizione italiana condotta sulla quarta edizione americana. Trad. di P. Fredi, revisione di E. Lupia Palmieri e M. Parotto. 2006, 451 ill. Zanichelli Editore

COMBINED COURSE: OCEANOGRAPHY AND SEDIMENTARY ENVIRONMENT - OCEANOGRAPHY (MODULE)

PIERPAOLO FALCO

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 1^ semestre

Prerequisites

Knowledge about Math and Physic courses topics

Course contents

The course consists in 48 hours of frontal lessons equivalent to 6 credits

Objectives of the course

Knowledge:
This course allows the students to acquire the fundamental knowledge regarding the ocean structure and dynamics. The students will learn all the elements necessary to understand and describe: the ocean vertical structure, the air-sea interactions, the processes governing the water masses formation and transformation and eventually how the ocean circulation influences the climate system. Some details will be given regarding the oceanography of the polar regions, the cryosphere and the role it plays both at local and large scale. The Mediterranean Sea will be also studied. In particular, it will be pointed out the characteristic processes that drive its tri-dimensional dynamics and the variability observed in the last decades.

Ability to apply the knowledge:
The student will acquire the knowledge: 1) regarding the main ad more updated instruments used to measure the main physical oceanographic parameters, 2) to understand the ocean vertical water column structure from experimental data and to described the processes that determine the stability, the mixing and re-distribution of the water mass characteristics.

Soft skills:
During the course will be treated arguments extremely important in the climatological context. These topics will allow the student to acquire basic knowledge regarding the climate changes, the natural climate variability and also regarding how some mechanism (feedback mechanisms) can contribute to amplify or dampening the global warming effects.

Program

Contents of the lectures (frontal lessons, 6 credits, 48 hours) :
Basic concepts:
Definition of the main physical oceanographic parameters and their distribution in the ocean both in the vertical and horizontal plane. T/S diagrams and how they are used in oceanography. E-(P+R) budget. Volume and Salt conservation in semi-enclosed basin.
Ocean dynamics:
Equation of motion. Friction and turbulence in the ocean. Dynamics without friction: inertial motion and geostrophic balance. The equation of motion with viscosity: Eddy viscosity. Wind driven circulation. Deep circulation. Periodic motions. Coastal processes.
Descriptive oceanography
Instruments and measurement methods. Global ocean climatology. TheMediterranean Sea: process variability at different space and time scales.

Development of the course and examination

Methods for assessing learning outcomes:
In order to evaluate the student level of understanding and learning, during the course two written tests will be done. Each test consists in 20 questions. Some of them will be multiple-choice questions, while in other questions, the student will be ask to solve a specific problems or to describe a course topic. In this way it will be evident if the student is able to synthesize an argument as well as to apply some practical analysis methods that will be explained during the lessons.

Criteria for assessing learning outcomes:
The students will have two hours to complete the test and the outcome is sufficient if the test score is greater or equal to 8/30. The two test scores can be added together to obtain the total score that the student can or cannot accept as final vote of the exam. The test score will be computed assigning: one point for a correct answer, ½ point for a partially correct answer and 0 point for a wrong answer thus any penality will be attribute for a wrong answer. The score of each test will be scaled to obtain 15/30 as maximun score.

Criteria for measuring learning outcomes:
The grades are on scale of thirty. The exam is passed if the grade is greater or equal to 18/30. The highest grade is 30/30 cum laude.

Criteria for conferring final mark:
In general, the exam will be oral. The students attending the course can take advantage of the aforementioned tests. Based on student request, the grades of the two tests can be added and the total (on scale of thirty) will provide the final score for this module of the integrate course. Also, the grade obtained can be risen up to three more points if the student will answer correctly to an oral question but this part is not mandatory. The laude will be conferred if the student will answer correctly to all the test questions without any errors or if the oral exam is excellent.
Because of this course is one of the two modules of which the integrate course is made, the final grade for the integrate course is conferred evaluating the outcomes of both the modules. The laude is conferred when the student showed fully comprehension of the programme arguments of both the modules.

Recommended reading

Notes taken during the lectures and PowerPoint presentation handed out by the lecturer.

Further reading:

-R.H. Stewart, “Introduction To Physical Oceanography”, Texas A & M University, free download from the web
-Open University Course Team, “Ocean Circulation”, Butterworth-Heinemann.
-L.D. Talley, G.L. Pickard, W. J. Emery, J. H. Swift, "Descriptive Physical Oceanography: An Introduction", Academic Press-Elsevier

COMMUNICATION SKILLS

MARCO ARISTIDE GIUSEPPE CASTELLAZZI

Seat Scienze
A.A. 2016/2017
Credits 2
Hours 16
Period 2^ semestre

Prerequisites

No specific prerequisite is required.

Course contents

The course is based on theoretical lessons, presentation of case-studies, and specific insights through appropriate exercitations.

Objectives of the course

Knowledges:
The course enables students to acquire knowledge of the most modern and current Public Scientific Communication techniques used to effectively transfer scientific information to a general public, and how to make information understandable and memorable.

Ability to apply the knowledge:
Students will be able to apply their acquired knowledge in different ways of Public Scientific Communication: how to capture the audience's attention, the "wow effect", how to maintain a high level of attention, reiteration of information through different way of communication, the usage of media (TV, radio, network, popular article, etc), feedback and evaluation of the reception and understanding of the information transmitted.

Soft skills:
Beside the different typologies of models and methodologies of Public Scientific Communication treated during the course, transversal competences also cover the relations between researchers from different disciplines (e.g. biologists studying environment, engineers realizing a monitoring network, IT experts releasing a specific software) that outside of their specific matters react as a generalist audience when they have to deal with alien subjects; the relationships between researchers and scientific mediators (e.g. journalists) and relations with civil society (administrators, financiers, support and interest groups)

Program

- Basics of Communication Theory
- Historical notes on popular science
- Introduction to Sociology of science
- Relationships between science and society
- Relations between academia and Public Scientific Communication
- Communication of environmental risks
- Degree of scientific literacy of the audience
- Media used in Public Scientific Communication
- Communication Models
- Difference between Scientific Communication and Public Scientific Communication
- Public Scientific Communication Techniques
- Case studies

Development of the course and examination

Methods for assessing learning outcomes:
The examination is oral, based on questions and following discussion related to Public Scientific Communication and its application in different practical contexts.

Methods for assessing learning outcomes:
During the examination, it will be evaluated the capability of the student to properly answer and discuss various issues, the general competence on problematics, the use of appropriate terminology, the capability to move from a topic to another one and make transversal links.

Criteria for measuring learning outcomes:
The final assessment is made of thirty. The examination is considered as passed with a vote of 18/30 or higher. The student can decide to decline the proposed vote and give again the examination in the following session.

Criteria for conferring final mark:
The final assessment will be given depending on the capability of the student to answer all the questions, general competence and ability to properly discuss various issues.

Recommended reading

Provided material and scientific literature suggested on specific topics.

COMPARATIVE ANATOMY

VINCENZO CAPUTO BARUCCHI

Seat Scienze
A.A. 2016/2017
Credits 8
Hours 64
Period 1^ semestre

Prerequisites

A basic knowledge of animal cytology, histology and embryology of chordates is required.

Course contents

The course takes place during the first semester of the third year (First Level degree course in Biological science).

Objectives of the course

Knowledge:
The aim of the course is to depict a general scenario of the evolutionary radiation of vertebrates through the comparative analysis of body plans and organ systems in the different taxonomic group, aquatic and terrestrial, of this cordate subphylum. After a synthetic introduction concerning the earth history and the geological chronology, the vertebrate evolution is explained, with particular emphasis about some “key phases” of their evolutionary-adaptive route (transitions agnates/gnathostomes, bony fish/amphibians, anamniotes/amniotes, and ectotherms/endotherms). The anatomy of the apparatuses is analyzed in the light of their morpho-functional adaptations to different habitats in the different vertebrate groups.

Ability to apply the knowledge:
At the end of the course, graduates will be able i) to apply the knowledge acquired in the recognition of macroscopic and microscopic anatomical preparations, and ii) to explain the different morphological specializations in terms of performed functions; they will also iii) recognize and correctly classify the most representative species of the major taxonomic groups of vertebrates (agnathans, cartilaginous and bony fishes, amphibians, reptiles, birds and mammals).

Soft skills:
At the end of the course, students should know the basics of the anatomy of vertebrates and be able to evaluate the phyletic relations with protochordates and hemichordates and among the different classes of vertebrates thanks to the comparison of the body plans of different taxa. They must also explain the different morphological specializations in terms of performed functions.

Program

Contents (lectures, 7 CFU, 56 hours):
Systematics and evolution of vertebrates; plate tectonics; ecological crisis and mass extinctions; chronology of the geological eras and periods. The binomial system of the Linnean classification; nomenclature rules; evolutionary systematics and the significance of hierarchical classifications; definition and examples of taxonomic characters; concepts of homology, analogy, convergence, divergence, adaptive radiation and natural selection. The biological species concept and the mechanisms of reproductive isolation. Classification and evolution of the chordates (ascidians, amphioxus and vertebrates or craniotes); evolutionary affinity with calcichordates and hemichordates; early phases of vertebrate evolution. Classification and evolution of the agnathans: extinct armoured forms (pteraspids and cephalaspids) and hypothesis about the bone origin; the living agnathans (lampreys and hagfishes). The rise of jaws and paired fins and the aquatic gnathostome radiation; classification of placoderms, acanthodians, cartilaginous and bony fishes. The land “conquest”: the amphibian radiation; classification and evolution of amphibians (“Labyrinthodontia” and Lissamphibia). The full independence from water: the amniote radiation; classification and evolution of reptiles. The air “conquest”: from feathered dinosaurs to Archaeopteryx; classification and evolution of birds. The mammals and evolution of endothermy; classification and evolution of mammals and mammal-like reptiles (pelycosaurs e therapsids). Classification and evolution of primates and man.
Anatomy. History of the Comparative anatomy. An outline of organogenesis. Tegumentary system; skeletal system; muscular system; nervous system and sense organs; endocrine system; uro-genital system; circulatory system; respiratory system; digestive apparatus.
Lab practice (1 CFU, 8 hours). Identification and description of macroscopic and microscopic anatomical preparations.

Development of the course and examination

Methods for assessing learning outcomes:
The exam is oral.

Criteria for assessing learning outcomes:
Will be based on the student's level of competence (acquired knowledge and capacity in exposing the subject).

Criteria for measuring learning outcomes:
The learning measurement criteria will be expressed by a scale of thirty.

Criteria for conferring final mark:
Considering enough the score 18/30, giving praise to students who have distinguished themselves for the sake of clarity and full knowledge for the matter.

Recommended reading

Appunti di lezione
Stingo V. et al., 2016. Anatomia Comparata. Edi.Ermes, Milano.
Liem K. F., et al., 2012. Anatomia comparata dei Vertebrati: una visione funzionale ed evolutiva. EDISES (seconda edizione italiana).

Pough F. H., et al., 2014 Zoologia dei Vertebrati. Pearson.
Kardong K. V., 2005. Vertebrati. Anatomia comparata, funzione, evoluzione. McGraw-Hill.
Hickman C. P., et al., 2004. Diversità animale. McGraw-Hill.

CONSERVATION OF NATURE AND ITS RESOURCES

CARLO CERRANO

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 2^ semestre

Prerequisites

Basic knowledge of Botany, Zoology, Ecology and Marine Biology

Course contents

The course consists of both theoretical classes (4 credits, 32 hours) and practical laboratory classes (2 credit, 16 hours).

Objectives of the course

Knowledge
The course will provide the students with the necessary information to work in environmental management and in biodiversity conservation.

Ability to apply the knowledge:
The students have to apply the theoretical knowledge acquired during specific case studies, evaluating processes, phenomena, and environmental episodes, related to conservation and management of both coastal and off-shore marine environment.

Soft skills:
During the theoretical classes scientific papers will be discussed, stimulating their understanding abilities and emphasising the high interdisciplinary required to develop conservation projects.

Program

Contents (theoretical classes, 4 credits, practical activities 2 credits, 48 hours):
Theoretical classes. Introduction to protection issues, nature conservation and managment.
Biodiversity and its conservation. Threats to marine biodiversity: loss of biodiversity, vulnerability, extinction, biological invasions. Species and habitat protection: endangered, vulnerable, rare, endemic and priority species. Convention and Directive for conservation. Marine protected areas, reserve effect. Introduction and reintroduction. Restoration project.
Practical activities. Visit to an MPA and other protected areas to discuss with managers the main issues of managment at local scale.

Development of the course and examination

Methods for assessing learning outcomes:
Oral. The evaluation of the preparation of the student will be made by a final oral exam. Questions will be addressed to the main conservation theories, to biodiversity conservation, to national and international laws on biodiversity conservation. The problem solving skills will be tested by the analysis of case studies.

Criteria for assessing learning outcomes:
The level of knowledge acquired, exposed during the oral test, referring to lectures and to the practical parts, will be evaluated to assess the students' preparation.

Criteria for measuring learning outcomes:
The final mark is assigned as a fraction of 30. The exam is successfully passed when the mark is equal to or higher than 18/30. The highest mark can be assigned cum laude.

Criteria for conferring final mark:
The final mark is given considering the levels of knowledge acquired and shown during the oral test, and it is conferred considering the theoretical and practical parts.

Recommended reading

Lecture notes (Power Point)
Cattaneo-Vietti R., L. Tunesi, 2007. Le aree marine protette in Italia: problemi e prospettive. Ed. Aracne, Roma. 1-249
Primack R.B., Carotenuto L. - Conservazione della Natura, Zanichelli, 2013

CONSERVATION OF NATURE AND ITS RESOURCES

CARLO CERRANO

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 2^ semestre

Prerequisites

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Program

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Theoretical classes. Introduction to protection issues, nature conservation and managment.
Biodiversity and its conservation. Threats to marine biodiversity: loss of biodiversity, vulnerability, extinction, biological invasions. Species and habitat protection: endangered, vulnerable, rare, endemic and priority species. Convention and Directive for conservation. Marine protected areas, reserve effect. Introduction and reintroduction. Restoration project.
Practical activities. Visit to an MPA and other protected areas to discuss with managers the main issues of managment at local scale.

Development of the course and examination

Methods for assessing learning outcomes:
Oral. The evaluation of the preparation of the student will be made by a final oral exam. Questions will be addressed to the main conservation theories, to biodiversity conservation, to national and international laws on biodiversity conservation. The problem solving skills will be tested by the analysis of case studies.

Criteria for assessing learning outcomes:
The level of knowledge acquired, exposed during the oral test, referring to lectures and to the practical parts, will be evaluated to assess the students' preparation.

Criteria for measuring learning outcomes:
The final mark is assigned as a fraction of 30. The exam is successfully passed when the mark is equal to or higher than 18/30. The highest mark can be assigned cum laude.

Criteria for conferring final mark:
The final mark is given considering the levels of knowledge acquired and shown during the oral test, and it is conferred considering the theoretical and practical parts.

Recommended reading

Appunti di lezione (Power Point)
Cattaneo-Vietti R., L. Tunesi, 2007. Le aree marine protette in Italia: problemi e prospettive. Ed. Aracne, Roma. 1-249
Primack R.B., Carotenuto L. - Conservazione della Natura, Zanichelli, 2013

CYTOLOGY AND HISTOLOGY (A-L)

ADRIANA CANAPA

Seat Scienze
A.A. 2016/2017
Credits 8
Hours 64
Period 1^ semestre

Prerequisites

Basic knowledge of chemistry, physics, cell and tissue biology acquired at high school.

Course contents

The lectures are planned (7 CFU) as well as laboratory practices (1 CFU).

Objectives of the course

Knowledge:
The course aims to provide a complete and updated knowledge of cytology and histology. The student will acquire detailed knowledge of the various morphological and functional components of the cell, the mechanisms that regulate their proper functioning, the cell cycle, the various types of division, and the differences between the various animal tissues, with particular reference to those of human. Some topics presented in class will be examined in a series of laboratory practical exercises during which students can test their knowledge.

Ability to apply the knowledge:
At the end of the course, students will be able to:
Apply knowledge about the various subcellular structures to specific functional processes in an integrated and comprehensive view;
Apply theoretical and operational skills with reference to the morphological/functional aspects of the single cell and the biological tissues.

Soft skills:
Through laboratory practices students will acquire autonomy in judgment as well as communication skills also arising from work in groups.

Program

Cytology: General properties of living organisms; the level of organization of living organisms : virus, prokaryotes, eukaryotes; chemistry of the cells; cellular membranes; plasma membrane and its function; differentiations of the cell surface (microvilli, cilia and flagella, cell junctions); cytoskeleton;

ribosomes and protein synthesis; smooth and rough endoplasmic reticulum; Golgi apparatus and exocytosis; lysosomes and endocytosis; mitochondrion and energetic cycle; chloroplast and photosynthesis, nuclear envelope and nucleo-cytoplasmic exchanges; chromatin (euchromatin and heterochromatin) structure and composition; nucleoskeleton; metaphasic chromosomes; diploid and aploid chromosome set; RNA transcription; DNA duplication; mitosis; meiosis.

Histology: Tissue concept and generalities. Epithelial tissue (the lining and glandular); tissues of mesenchymal origin (cells and fundamental substance; connectives; cartilage; bone, blood, hematopoiesis and immunity) smooth, striated skeletal, and cardiac muscle tissue; nervous tissue and neuroglia. Laboratory practices include: observation by light microscopy of human blood smear, observation by light microscopy of metaphase chromosomes and preparation of a karyogram, the study by light microscopy of histological tissues described during the lectures.

Development of the course and examination

Methods for assessing learning outcomes:
The student will be evaluated with an oral exam that will be able to sustain only after passing a written test. This examination will take place at the computer room and includes twenty multiple choice questions. If the test will be passed the student will access the oral examination. Registration for the written test will be achieved through the Moodle platform while the oral exam registration will be carried out through its own reserved area.

Criteria for assessing learning outcomes:
The oral examination is aimed at assessing the knowledge and understanding of the topics needed to resolve problems related to course objectives.

Criteria for measuring learning outcomes:
The final mark is assigned exclusively on the oral exam in which the knowledge will be tested through questions at low, medium, and high difficulty.

Criteria for conferring final mark:
The final mark is assigned on the basis of the student's ability to provide answers that demonstrate mastery of the subject with clarity and with a relevant technical and scientific terminology. It will also evaluate the student's ability to link together the topics covered during the course.

Recommended reading

Biologia - Cellula e Tessuti (2a edizione). Roberto Colombo e Ettore Olmo (Eds). Edi-ermes, Milano. ISBN 9788870514001

CYTOLOGY AND HISTOLOGY (M-Z)

MARIA ASSUNTA BISCOTTI

Seat Scienze
A.A. 2016/2017
Credits 8
Hours 64
Period 1^ semestre

Prerequisites

Basic knowledge of chemistry, physics, cell and tissue biology acquired at high school.

Course contents

The lectures are planned (7 CFU) as well as laboratory practices (1 CFU).

Objectives of the course

Knowledge:
The course aims to provide a complete and updated knowledge of cytology and histology. The student will acquire detailed knowledge of the various morphological and functional components of the cell, the mechanisms that regulate their proper functioning, the cell cycle, the various types of division, and the differences between the various animal tissues, with particular reference to those of human. Some topics presented in class will be examined in a series of laboratory practical exercises during which students can test their knowledge.

Ability to apply the knowledge:
At the end of the course, students will be able to:
Apply knowledge about the various subcellular structures to specific functional processes in an integrated and comprehensive view;
Apply theoretical and operational skills with reference to the morphological/functional aspects of the single cell and the biological tissues.

Soft skills:
Through laboratory practices students will acquire autonomy in judgment as well as communication skills also arising from work in groups.

Program

Cytology: General properties of living organisms; the level of organization of living organisms : virus, prokaryotes, eukaryotes; chemistry of the cells; cellular membranes; plasma membrane and its function; differentiations of the cell surface (microvilli, cilia and flagella, cell junctions); cytoskeleton;

ribosomes and protein synthesis; smooth and rough endoplasmic reticulum; Golgi apparatus and exocytosis; lysosomes and endocytosis; mitochondrion and energetic cycle; chloroplast and photosynthesis, nuclear envelope and nucleo-cytoplasmic exchanges; chromatin (euchromatin and heterochromatin) structure and composition; nucleoskeleton; metaphasic chromosomes; diploid and aploid chromosome set; RNA transcription; DNA duplication; mitosis; meiosis.

Histology: Tissue concept and generalities. Epithelial tissue (the lining and glandular); tissues of mesenchymal origin (cells and fundamental substance; connectives; cartilage; bone, blood, hematopoiesis and immunity) smooth, striated skeletal, and cardiac muscle tissue; nervous tissue and neuroglia. Laboratory practices include: observation by light microscopy of human blood smear, observation by light microscopy of metaphase chromosomes and preparation of a karyogram, the study by light microscopy of histological tissues described during the lectures.

Development of the course and examination

Methods for assessing learning outcomes:
The student will be evaluated with an oral exam that will be able to sustain only after passing a written test. This test will take place at the computer room and includes twenty multiple choice questions. If the test will be passed the student will access to the oral exam. Registration for the exam will be achieved through the own reserved area. The deadline for registration, indicated for each exam, is established several days before the oral exam in order to arrange for the written test and publish the list of students who passed it. The list of groups and the results of the written exam will be available on Moodle of Science by consulting Cytology and Histology M-Z.

Criteria for assessing learning outcomes:
The oral examination is aimed at assessing the knowledge and understanding of the topics needed to resolve problems related to course objectives.

Criteria for measuring learning outcomes:
The final mark is assigned exclusively on the oral exam in which the knowledge will be tested through questions at low, medium, and high difficulty.

Criteria for conferring final mark:
The final mark is assigned on the basis of the student's ability to provide answers that demonstrate mastery of the subject with clarity and with a relevant technical and scientific terminology. It will also evaluate the student's ability to link together the topics covered during the course.

Recommended reading

Biologia - Cellula e Tessuti (2a edizione). Roberto Colombo e Ettore Olmo (Eds). Edi-ermes, Milano. ISBN 9788870514001

DEVELOPMENTAL BIOLOGY (A-L)

OLIANA CARNEVALI

Seat Scienze
A.A. 2016/2017
Credits 8
Hours 64
Period 1^ semestre

Prerequisites

Basic Knowledge of Cytology, Histology, Cell Biology, Biochemistry, Molecular Biology.

Course contents

Lectures (7 credits, 56 hours) and practical laboratory work with small groups of students are planned (1 credit, 8 hours). Lectures and practical activities are supported in e-learning mode that contains: teaching materials, instructions for laboratory practice, reservation for laboratory exercises.

Objectives of the course

Knowledge:
he student will acquire knowledge on the molecular basis of gametes differentiation and the mechanisms that regulate their interactions during fertilization in different experimental models with external fertilization (fish and amphibians) and those with internal fertilization (mammals). The course will enable students to acquire knowledge on the differentiation process of a wide variety of cell types, tissues and organs starting from a single cell, the fertilized egg. Students will be aware of the mechanisms at the basis of harmonic interaction among tissues and with the environment during embryonic development until the construction of characteristic adult structure. The study will focus on embryonic development in some model organisms: Drosophila, Sea urchin, Fish, Frog, Chicken and Mammal. Particular attention will be paid to the correlation existing between embryonic developmental stages and gene expression. In addition, particular focus will be addressed to: a) the transition from single-celled organism to multicellular organism, the role of cytoplasmic determinants at segmentation, formation of the body axis in Drosophila and vertebrates embryos. The role of Hox genes in the specification of the segments / somites. b) gastrulation movements and cellular interactions in the realization of the three germ layers (endoderm, mesoderm and ectoderm) and gonad differentiation. c) the origin and destiny of nervous cells and of neural crest cells in vertebrates. d) Regulation of metamorphosis and regeneration. e) Regulation of cell death

Ability to apply the knowledge:
The contents presented in the class will be tested in a series of practical laboratory in which the students will test the acquired knowledge regarding the first developmental stage of different experimental models

Soft skills:
The execution of laboratory observations of the student contributes to improve the overall vision of the process, sharpen communication skills that comes from teamwork, and enhance learning ability in autonomy and to improve the ability to draw conclusions.

Program

Knowledge:
he student will acquire knowledge on the molecular basis of gametes differentiation and the mechanisms that regulate their interactions during fertilization in different experimental models with external fertilization (fish and amphibians) and those with internal fertilization (mammals). The course will enable students to acquire knowledge on the differentiation process of a wide variety of cell types, tissues and organs starting from a single cell, the fertilized egg. Students will be aware of the mechanisms at the basis of harmonic interaction among tissues and with the environment during embryonic development until the construction of characteristic adult structure. The study will focus on embryonic development in some model organisms: Drosophila, Sea urchin, Fish, Frog, Chicken and Mammal. Particular attention will be paid to the correlation existing between embryonic developmental stages and gene expression. In addition, particular focus will be addressed to: a) the transition from single-celled organism to multicellular organism, the role of cytoplasmic determinants at segmentation, formation of the body axis in Drosophila and vertebrates embryos. The role of Hox genes in the specification of the segments / somites. b) gastrulation movements and cellular interactions in the realization of the three germ layers (endoderm, mesoderm and ectoderm) and gonad differentiation. c) the origin and destiny of nervous cells and of neural crest cells in vertebrates. d) Regulation of metamorphosis and regeneration. e) Regulation of cell death

Ability to apply the knowledge:
The contents presented in the class will be tested in a series of practical laboratory in which the students will test the acquired knowledge regarding the first developmental stage of different experimental models

Soft skills:
The execution of laboratory observations of the student contributes to improve the overall vision of the process, sharpen communication skills that comes from teamwork, and enhance learning ability in autonomy and to improve the ability to draw conclusions.

Development of the course and examination

Methods for assessing learning outcomes:
Oral examination
The final grade is given asking questions to the student on at least three different topics of the program.

Criteria for assessing learning outcomes:
In the oral exam, the student must demonstrate knowledge on the molecular mechanisms at the basis of adhesion, movement and cell differentiation as well as of the acquirement of basic knowledge on the regulation of the timing and maintenance of development. During examination, students must demonstrate the acquirement of specific knowledge on the general aspects of the development and on the development of different organism models.

Criteria for measuring learning outcomes:
The final mark is awarded out of thirty. The exam is passed when the grade is greater than or equal to 18. It is expected to be awarded the highest marks with honors (30 cum laude).

Criteria for conferring final mark:
The rating is made up of the sum of the score reported in the individual questions that will take into account the understanding of the subjects (40%), the ability to link the different processes that occur during development (40%) and the appropriateness of the technical language (20%). Praise is attributed when the score exceeds the value 30, and at the same time, the student has demonstrated full mastery of the subject.

Recommended reading

Developmental biology, Andreuccetti et al., 2009, Ed. McGraw-Hill
Developmental biology Gilbert 4th Ed Zanichelli
Slides on the Moodle platform

DEVELOPMENTAL BIOLOGY (M-Z)

FRANCESCA MARADONNA

Seat Scienze
A.A. 2016/2017
Credits 8
Hours 64
Period 1^ semestre

Prerequisites

Basic Knowledge of Cytology, Histology, Cell Biology, Biochemistry, Molecular Biology.

Course contents

Lectures (7 credits, 56 hours) and practical laboratory work with small groups of students are planned (1 credit, 8 hours). Lectures and practical activities are supported in e-learning mode that contains: teaching materials, instructions for laboratory practice, reservation for laboratory exercises.

Objectives of the course

Knowledge:
he student will acquire knowledge on the molecular basis of gametes differentiation and the mechanisms that regulate their interactions during fertilization in different experimental models with external fertilization (fish and amphibians) and those with internal fertilization (mammals). The course will enable students to acquire knowledge on the differentiation process of a wide variety of cell types, tissues and organs starting from a single cell, the fertilized egg. Students will be aware of the mechanisms at the basis of harmonic interaction among tissues and with the environment during embryonic development until the construction of characteristic adult structure. The study will focus on embryonic development in some model organisms: Drosophila, Sea urchin, Fish, Frog, Chicken and Mammal. Particular attention will be paid to the correlation existing between embryonic developmental stages and gene expression. In addition, particular focus will be addressed to: a) the transition from single-celled organism to multicellular organism, the role of cytoplasmic determinants at segmentation, formation of the body axis in Drosophila and vertebrates embryos. The role of Hox genes in the specification of the segments / somites. b) gastrulation movements and cellular interactions in the realization of the three germ layers (endoderm, mesoderm and ectoderm) and gonad differentiation. c) the origin and destiny of nervous cells and of neural crest cells in vertebrates. d) Regulation of metamorphosis and regeneration. e) Regulation of cell death

Ability to apply the knowledge:
The contents presented in the class will be tested in a series of practical laboratory in which the students will test the acquired knowledge regarding the first developmental stage of different experimental models

Soft skills:
The execution of laboratory observations of the student contributes to improve the overall vision of the process, sharpen communication skills that comes from teamwork, and enhance learning ability in autonomy and to improve the ability to draw conclusions.

Program

Content (lectures, 7CFU, 56 hours):
Introduction to Developmental Biology: history and concepts
Cell adhesion and Migration
Gametogenesis: primordial germ cells development; function structure and development of eggs and sperm.
Fertilization and egg activation, block to polyspermy
Cleavage patterns of representative Animals and blastula formation,
Gastrulation and formation of the three germ layers
Cell fate, potency and determination
Neural tube formation and its differentiation. Neural crest.
Sex determination: genetic, environmental and cytoplasmic control
Epigenetic processes and development, inactivation of the X chromosome
Body axis determination: polarization of body axis at oogenesis. Maternal genes predisposing the body axes; zygotic and embryonic pattern genes.
Pattern formation in Drosophila embryo : role of Gap, Pair rule and polarity genes;
Specification of segments by homeotic selector genes in Drosophila.
Homeotic selector Genes in Mammals
Apoptosis: programmed cell death. the genetic control mechanisms during development, Ced 4-3-4-9 in C. elegans and analogs (Bcl2, Apaf-1 and caspase 9) in mammals.Mitochondria-mediated apoptosis Receptor-mediated apoptosis. Autophagy
Metamorphosis: the hormones as mediators of development in amphibians and insects

Development of the course and examination

Methods for assessing learning outcomes:
Oral examination
The final grade is given asking questions to the student on at least three different topics of the program.

Criteria for assessing learning outcomes:
In the oral exam, the student must demonstrate knowledge on the molecular mechanisms at the basis of adhesion, movement and cell differentiation as well as of the acquirement of basic knowledge on the regulation of the timing and maintenance of development. During examination, students must demonstrate the acquirement of specific knowledge on the general aspects of the development and on the development of different organism models.

Criteria for measuring learning outcomes:
The final mark is awarded out of thirty. The exam is passed when the grade is greater than or equal to 18. It is expected to be awarded the highest marks with honors (30 cum laude).

Criteria for conferring final mark:

The rating is made up of the sum of the score reported in the individual questions that will take into account the understanding of the subjects (40%), the ability to link the different processes that occur during development (40%) and the appropriateness of the technical language (20%). Praise is attributed when the score exceeds the value 30, and at the same time, the student has demonstrated full mastery of the subject.

Recommended reading

Developmental biology, Andreuccetti et al., 2009, Ed. McGraw-Hill
Developmental biology Gilbert 4th Ed Zanichelli
Slides on the Moodle platform

DIAGNOSTIC MICROBIOLOGY

ELEONORA GIOVANETTI

Seat Scienze
A.A. 2016/2017
Credits 7
Hours 56
Period 1^ semestre

Prerequisites

Basic knowledge of General Microbiology and Bacteriologyy.

Course contents

Lectures (6 credits, 48 hours) and lab practice carried out individually or in small groups (1 credit, 8 hours).

Objectives of the course

Knowledge:
In this course you will learn the basics of both classical and molecular techniques used in the diagnosis of major diseases caused by microorganisms. You will also discover the principles underlying the request and the interpretation of the microbiological analysis results.

Ability to apply the knowledge:
Each student will have to develop the ability of formulating an etiological diagnosis based on infection site and clinical material examined (blood, cerebrospinal fluid, urine, sputum, faeces, etc.).

Soft skills:
Lab practice will contribute to improve students' interpersonal skills and ability to work as part of a team. A practical approach to the subject will also develop students' independence in terms of work management, initiative, flexibility and general behaviours.

Program

What you'll learn (theoretical training, 6 credits, 48 ore):
Definition and objectives of diagnostic microbiology. Laboratory diagnosis of infection: general methodology; direct and indirect diagnosis; choice, sampling and transport of clinical specimens for microbiological examination; diagnosis based on site of infection and clinical material (blood, CSF, urine, sputum, etc.). Major techniques for demonstrating and isolating microbial agents (viruses, bacteria, fungi, protozoa) from clinical specimens. Principles and practice of molecular diagnosis of infection. Principles and practice of in vitro susceptibility testing of microorganisms to antibiotics.

Reactions and techniques of diagnostic serology.
The laboratory of diagnostic microbiology and particular infectious types: community- and hospital-acquired infections, perinatal infections, sexually transmitted infections, infections of the immunocompromised host. Laboratory diagnosis of infections related to the development of microbial biofilms. Laboratory diagnosis of hepatitis and HIV infections. Laboratory diagnosis of prion diseases.
Lab practice (1 credit, 8 hours):
Microbiological examination of a throat swab.
Execution and interpretation of a blood culture.
Execution and interpretation of a urine culture. Antibiogram and antimicrobial susceptibility tests.

Development of the course and examination

Methods for assessing learning outcomes:
The exam will take the form of an interview and each student will be asked three questions.

Criteria for assessing learning outcomes:
Each student will be required to demonstrate an understanding of conventional and molecular methods in the diagnosis of major diseases caused by microorganisms. Each student will also be expected to describe the methods used based on examined clinical specimen, to recognise expected microorganisms, and interpret final results.

Criteria for measuring learning outcomes:
A 30-points scale will be used to measure your performance, with 18 being the minimum score to pass the exam and 30 being the highest. In the event of an outstanding performance, the professor can decide to reward the student with a 30 cum laude.

Criteria for conferring final mark:
The final mark will be awarded based on the evaluations of the answers to the three questions. Honours will be awarded when the mark is 30 and the student has demonstrated particularly good command of the matter.

Recommended reading

Useful resources suggested by the course professor to study and prepare for final exam.
J. Keith Struthers, Roger P. Westran. Clinical Bacteriology. ASM Press, 2003
R. Cevenini, Microbiologia Clinica, Piccin, 2010

DISASTER RISK REDUCTION

FAUSTO MARINCIONI

Seat Scienze
A.A. 2016/2017
Credits 7
Hours 56
Period 1^ semestre

Prerequisites

Knowledge of extreme natural phenomena, natural hazards, vulnerability and risk. Knowledge of basic principles and methodologies of emergency planning. Notions of environmental and civil protection legislation.

Course contents

The course consists of frontal lectures (about 3/5) and critical reading activities of scientific articles on disaster risk reduction. The course also includes a few seminars and supplementary modules, taught by professionals from the field. These extra activities are aimed at providing students an applied perspective on the theoretical topics covered in class. Finally, the course includes a 2 or 3 day field trip (depending on financial availability) to either visit places hit by past disasters or vulnerable to future impacts, or to attend civil protection exercises. Students are also requires to develop an independent study on the subject of vulnerability and resilience to disasters. The strong interactive nature of this course (critical thinking, seminars and independent studies) requires students to be highly proactive in class, therefore attendance and participation in classroom activities is very important.

Objectives of the course

Knowledge:
The course provide students a multifaceted perspective on hazard and risk. The main objective is to help students develop their capacity to identify the unsustainable uses of the Earth that create risk and vulnerability. The awareness that the source of risk and disaster lies in the interaction between natural and anthropogenic processes is achieved by students through the synthesis of their knowledge of environmental processes and new socio-anthropological perspectives provided in the course. Disaster risk reduction is obtained lowering on the one hand the conditions of vulnerability, while improving on the other human adaptation to natural processes, namely increasing societal resilience to natural hazards.

Ability to apply the knowledge:
The critical readings and classroom discussions will compel students to develop both analytical and communication skills. The monographic research to be presented in class at the end of the course is also designed to help the individual to synthesize and take advantage of the personal characteristics and the knowledge acquired on the subject of sustainable development and disaster

risk reduction of risk. Following are some of the skills that the course seeks to nurture in students: acquire and effectively interpret information, interpersonal, intercultural, social and civic competence, problem solving, pinpoint links and correlations. Ultimately, the course aims at providing both the technical and scientific understanding on the concepts of risk, vulnerability and resilience, and to stimulate the individual to imagine and propose alternative development and land use models. The goal is to prepare students to face future professional challenges, giving them capacity of synthesis and interdisciplinary dialogue, pivotal skill to addressed environmental planning and management issues.

Soft skills:
Understanding the surrounding environment and learn how to survive and adapt to it requires skills deriving from the various spheres of theoretical knowledge and practical experience. Reducing risk conditions means among many other things, being able to integrate multidisciplinary information and distill new knowledge exploring the interface of traditional disciplines. It also requires the ability to maximize teamwork and make the most out of the available resources. Students of this course will develop the ability to proficiently communicate and exchange knowledge with the different professional cultures composing the realm of civil protection and disaster risk reductions.

Program

The course covers methods and techniques of disaster risk reduction including the fundamentals of emergency planning. Starting with the discussion of the historical evolution of emergency management and civil protection, lectures will move to the political and cultural dimensions of risks and disasters (political ecology). The complementarity relationship of risk and safety is explored along with approaches and strategies to build disaster resilient communities. Following is a list of the principal topics discussed in class. Basic principles of emergency planning. Design of an emergency plan and its activation within the regulatory and organizational references of the national civil protection systems. Available cartographic and analytical methods. Principles of disaster mitigation and prevention through the analysis and systematic management of the causal factors of risk (e.g. reducing exposure and vulnerability of people and property, sustainable land use and management, or developing adaptive capacity to extreme natural events of local communities). Different needs and strategies in the different time phases of the disaster cycle. Models and scenarios for emergency simulation. Early warning and evacuation protocols. Search and rescue procedures. Recovery and reconstruction approaches. Special attention will be given to emergency communications and the role of information technology in civil protection. The course finishes discussing the growing issue of emerging risks and complex emergencies.

Development of the course and examination

Methods for assessing learning outcomes:
The final examination is oral and there are no written tests. However, during class activities, students are asked to critically discuss readings and other scientific material. An active participation of the student in these class discussions is among the learning evaluation methods. Similarly, the presentation in class of a monographic study helps the learning assessment and contribute to the course final grade.

Criteria for assessing learning outcomes:
During the oral exam the student must demonstrate knowledge of the topics of disaster risk

reduction. The exam questions will cover the various thematic areas discussed in class by the teacher, those contained in the readings assigned for the classroom discussions, and presented in the seminars and additional course modules. Questions can cover also address the subjects learned and directly experienced in the field trips. Student must demonstrate that they have achieved the ability to apply the knowledge gained with this course in terms of both critical analysis and capacity to formulate of comprehensive strategies for disaster risk reduction.

Criteria for measuring learning outcomes:
The course final grade is expressed in thirtieth with a threshold of 18/30. Students showing thorough preparation and insightful analysis will be awarded the highest grade with honors (30 cum laude).

Criteria for conferring final mark:
The final grade is computed by adding the evaluation of the answers to the questions posed during the oral exam, the degree of participation in the reading and critical discussion activities, and the quality of the independent study presented in class at the end of the course. Honors (30 cum laude) will awarded to the students who demonstrates to have fully mastered the subject and shows the ability to apply the acquired knowledge in different policy scenarios.

Recommended reading

Notes and teaching materials provided in class and made available online.
Alexander, D. E., 2000. Confronting Catastrophe: new perspectives on natural disasters. Oxford University Press, 282 pp.
Alexander, D. E., 2002. Principles of Emergency Planning and Management. Oxford University Press, 340 pp.
Blaikie, P., Cannon, T., Davis, I. and Wisner, B., 2014. At risk: natural hazards, people's vulnerability and disasters. Routledge, 496 pp.

ECOLOGY (A-L)

SILVIA BIANCHELLI

Seat Scienze
A.A. 2016/2017
Credits 8
Hours 64
Period 2^ semestre

Prerequisites

The student must possess the rudiments of mathematics, physics and chemistry

Course contents

Lectures (7 credits, 56 hours) are given using textual, iconographic and graphical aids. Students are offered diagrams, data and conceptual maps that describe the basic ecological processes, starting from the structure of an ecosystem to the relationships between organisms and their environment and the relationships between man and the environment. Part of the course is devoted to provide the students with basics of experimental design (using examples) and the multifactorial analysis of ecological data.

Objectives of the course

Knowledge:
The course provides the student with the necessary background and terminology of of basic ecology including the structure and functioning of ecosystems, the mechanisms of interaction between organisms, between organisms and their environment, and between man and the environment. The ultimate goal is to equip the student of the ecological principles that regulate the functioning of the biosphere and how these mechanisms can be influenced by human activities.

Ability to apply the knowledge:
The student will have to take possession of the methodological principles of ecological investigation, the formal principles of experimental design and analysis of ecological hypotheses. At the end of the course the student should be able to outline a complex experimental design about ecological topics.

Soft skills:
The acquisition of the notional principles of ecology together with the basics of formal ecological experimental design and statistical analysis of multifactorial approaches will equip the student of experimental competence, thus allowing him to deal with multifactorial experiments or complex environmental investigations.

Program

Contenuti (lezioni frontali, 7 CFU, 56 ore):
Definition of "ecosystem" and emergent properties of ecological systems; the flow of energy in ecosystems; food chains and webs; ecological efficiency; ecological valence; abiotic factors; resources and consumers; definition of population and meta-population; ecological demography: life tables, recruitment, growth of a population in a non-limited environment; density-dependent and density non-dependent factors; the density effects on the growth of a population; the logistic curve; carrying capacity; r and K life strategies; the intraspecific and interspecific competition; predation; parasitism; the Lotka and Volterra model for competition and predation; the Rosenzweig and McArthur model for the competition between two species for more resources; the concept of R *; the concept of habitat and habitat selection; ecological niche; succession; biodiversity; the biogeographic theory of islands; relationships between diversity and ecosystem functioning. Basics of formal experimental design and analysis of multivariate data.

Development of the course and examination

Methods for assessing learning outcomes:
The exam consists of a test that includes multiple-choice queries and open-ended questions. The test consists of 16 questions, of which 14 are multiple choice (one, two, all right, none right) and 2 open-ended questions. The exam duration is fixed at 60 minutes.

Criteria for assessing learning outcomes:
The test includes a question for each of the main topics covered by the course. The use of the scores as outlined below constitutes therefore an integrated tool able to assess, on a rigorous quantitative basis, the level and quality of the preparation in terms of appropriateness, correctness and consistency of:
a) the knowledge gained
b) the application of the acquired knowledge
c) the self-assessment ability

Criteria for measuring learning outcomes:
The final judgment, conferred in thirtieth, is meant as a degree of measuring students' learning based on the following levels:

a) Sufficient (18 to 20/30)
The candidate demonstrates little knowledge acquired, superficial level, many gaps; basic skills in the fitting the elementary level topics; poor textual and / or graphical expression capacity.

b) Fair (21 to 23/30)
The candidate demonstrates discrete acquisition of knowledge, lack of depth, and few gaps; textual/graphic expression capacity sufficient; acceptable mastery of scientific language; logic skills and ability in the fitting of moderately complex topics.

c) Good (24 to 26)
The candidate demonstrates a rather broad wealth of notions, moderate depth, with small gaps; satisfactory expressive capabilities and significant mastery of scientific language; textual/graphical expression ability more than acceptable.

d) Outstanding (27 to 29)
The candidate demonstrates a wealth of very extensive in-depth knowledge, with marginal gaps; considerable textual and graphical expressive skills and high mastery of scientific language.

e) Excellent (30)
The candidate demonstrates a wealth of very extensive, in-depth knowledge, irrelevant, if any, gaps; high capacity of textual/graphical expression and high mastery of scientific language

The praise is attributed to candidates clearly above average, and whose eventual notional and expressive limits result, overall, entirely irrelevant.

Criteria for conferring final mark:
At each question (including open-ended ones) corresponds a maximum score of 2 points. The maximum score for each question is only achieved by giving all the right answers. If only a subset of right answers is given the grade is down-scaled proportionally. For every wrong answer (among those proposed as multiple-choice questions) 0.4 points will be subtracted. If, for each multiple choice question, the number of wrong answers exceeds the number of right answers, it will be ranked as 0. The final score is rounded to the nearest integer, and, at the discretion of the teacher, based on the correctness of answers to open-ended questions, will be given up to a further point.

Recommended reading

Eugene P. Odum, ECOLOGIA, un ponte tra scienza e società, PICCIN, Padova, 2001
M. Begon, J.L. Harper, C.R. Townsend, ECOLOGIA, Individui, Popolazioni, Comunità, Zanichelli, Bologna, 2000
G. Chelazzi, A. Provini, G. Santini, Ecologia dagli organismi agli ecosistemi, Casa Editrice Ambrosiana, Milano, 2004.
R.R. Ricklefs, ECOLOGIA, Zanichelli, Bologna, 1997

ECOLOGY (M-Z)

EMANUELA FANELLI

Seat Scienze
A.A. 2016/2017
Credits 8
Hours 64
Period 2^ semestre

Prerequisites

None

Course contents

The course will be composed by lectures (7 CFU, 56 hours) and practical exercises to be conducted individually or in small groups (1 credit, 8 hours). The lectures are supported by additional material (such as scientific papers) in e-learning mode.

Objectives of the course

Knowledge:
Students will learn about the structure and functions of the ecosystem, its abiotic and biotic components, the transformation processes of inorganic-organic matter mediated by living organisms, the relationships between organisms and environment and the relationships among organisms themselves, with specific reference to the ecological role of competition and predation. Students will learn about the concept of biodiversity and understand the ecological significance and application of relationships between biodiversity and ecosystem functioning. Students will be required to learn the main methodologies in ecological survey, including how to create an experimental design.

Ability to apply the knowledge:
After completing the course, students will be able to apply their knowledge to face the analysis of the structure and functions of an ecosystem and its components, and to
collect and process the data in order to analyze one or more scientific ecological hypotheses.

Soft skills:
Ability to test a scientific hypothesis, to develop an experimental design, to plan collection and processing of data.

Program

Contents (lectures, 7 CFU, 56 ore):
The concept and characteristics of an “ecosystem”. Ecosystems properties; the energy flux; food chains and webs, ecological efficiency; fitness and adaptation; abiotic factors controlling ecosystems. Resources and consumers; population ecology principles; life tables; recruitment. Population growth in limited and non-limited environment; density-dependent control of population size; carrying capacity; r and K dichotomy. Competition and predation; basic mathematical models of competition and predation (Lotka-Volterra and Ronzweig-McArthur models). Ecological niche; successions; biodiversity; theory of island biogeography; biodiversity-ecosystem functioning relationships.

Development of the course and examination

Methods of assessment of learning outcomes:
Written exam based on multiple choice test and open questions.

Criteria for assessing learning outcomes
Students will face a written exam based on multiple choice test and open questions. They have to demonstrate their knowledge on all the themes of the course.

Criteria for measuring learning outcomes
The test consists of 16 questions, of which 14 multiple choice questions and two open questions. The exam lasts for 60 minutes. Each question (including the open ones) corresponds to a maximum score of 2 points. In case of only partially right answers, the score corresponds the score will be fractioned. For each wrong answer (from those available in each multiple-choice questions) will be subtracted 0.4 points. If, for each question, the number of wrong answers exceeds the number of right ones, will be awarded the score 0. In each question, if the student gives the right answer and additionally also 2 wrong ones, the score will be 0.

Criteria for conferring final mark
The final score will be rounded to the nearest integer, and, depending on the teacher’s opinion and on the correctness of the open responses, it will be given another additionally point.

Recommended reading

Eugene P. Odum, ECOLOGIA, un ponte tra scienza e società, PICCIN, Padova, 2001
M. Begon, J.L. Harper, C.R. Townsend, ECOLOGIA, Individui, Popolazioni, Comunità, Zanichelli, Bologna, 2000
G. Chelazzi, A. Provini, G. Santini, Ecologia dagli organismi agli ecosistemi, Casa Editrice Ambrosiana, Milano, 2004
R.R. Ricklefs, ECOLOGIA, Zanichelli, Bologna, 1997

ECOTOXICOLOGY AND ENVIRONMENTAL IMPACT ASSESSMENT (Benedetti)

MAURA BENEDETTI

Seat Scienze
A.A. 2016/2017
Credits 3
Hours 24
Period 2^ semestre

Prerequisites

Knowledge of general and organic chemistry, general and cell biology is important requisites for this course.

Course contents

The course will include 64 hours of lectures (8 CFU), of which 40 hours (5 CFU) of Ecotoxicology (3 CFU and 2 CFU explained by Prof. Maura Benedetti and Prof Francesco Regoli, respectively) and 24 hours (3CFU) of Environmental Impact Assessment (Prof. Stefania Gorbi). The teaching activity includes both lectures and practical lessons in didactic and computer laboratories.

Objectives of the course

Knowledge.
Students will learn to use the main toxicity tests for the characterization of the quality of the various environmental matrices, including soils, sediments and water. They learn the meaning of the use of bioindicators and biomarkers.

Ability to apply knowledge.
Students must be able to apply an ecotoxicological approach in environmental monitoring, also from the practical point of view, thanks to practice exercises performed in the laboratory. In addition, students will be able to apply correctly the main toxicity tests using appropriate test species and to correctly interpret the results obtained from the different endpoints analyzed.
Soft skills.
At the end of the course and laboratory activities the students will be able to demonstrate an independent judgment on the interpretation of analytical data resulting from ecotoxicological approach; in addition the increase in communication skills is also resulting from the group's activities done during laboratory attendance.

Program

Contents:
Environmental toxicology; importance of toxicological studies, definition of dose and dose-effect

relationships; definition of LC50, EC50, NOEL, NOAEL, LOAL; main features of toxicity tests and bioassays, choice of test species, biological end-points and applications.Use of organisms as bioindicators in environmental monitoring contamination and definition of biomarkers at the molecular, biochemical and cellular levels.

Laboratory exercises:
During practical lessons we will apply the main analytical methods used in ecotoxicology field.

Development of the course and examination

Methods for assessing learning outcomes:
The final exam consists of an oral examination in which 3 questions are provided. Each question is given a score between 0 and 10.

Criteria for assessing learning outcomes:
During the oral exam, the students must demonstrate that they have acquired basic knowledge about the main issues concerning the ecotoxicology and environmental impact assessment.

Criteria for measuring learning outcomes:
The final mark is assigned in a scale of thirty. The exam is passed when the score is equal or greater than 18. It is expected to be awarded the highest marks with honors (30 cum laude).

Criteria for conferring final mark:
The final grade is awarded according to the answers adequacy to the questions proposed by the examining committee.
The honors (cum laude) will be given when the students will demonstrate full mastery of the subject, the correct use of terminology and the ability to make connections, where it is possible, between the various topics.

Recommended reading

Lecture notes
Slides and scientific literature suggested during the course.
Manuals and Guidelines ISPRA 67/2011: “Batterie di saggi ecotossicologici per sedimenti di acque salate e salmastre”
Manuals and Guidelines ISPRA 88/2013: “Batterie di saggi ecotossicologici per sedimenti e acque interne.

ECOTOXICOLOGY AND ENVIRONMENTAL IMPACT ASSESSMENT (Gorbi)

STEFANIA GORBI

Seat Scienze
A.A. 2016/2017
Credits 3
Hours 24
Period 2^ semestre

Prerequisites

Knowledge of general and organic chemistry, general and cell biology is important requisites for this course.

Course contents

The course will include 64 hours of lectures (8 CFU), of which 40 hours (5 CFU) of Ecotoxicology (3 CFU and 2 CFU explained by Prof. Maura Benedetti and Prof Francesco Regoli, respectively) and 24 hours (3CFU) of Environmental Impact Assessment (Prof. Stefania Gorbi). The teaching activity includes both lectures and practical lessons in didactic and computer laboratories.

Objectives of the course

Knowledge:
The course enables students to acquire the fundamental knowledge of the theoretical and methodological basis for the environmental standard quality assessment, to define the complexity between development of productive activities and environmental protection, management options and environmental impact assessment

Ability to apply the knowledge:
At the end of the course, the student will be able to apply criteria for the Environmental Impact Assessment procedures and to realize an Environmental Impact Study.

Soft Skills:
At the end of the course and laboratory activities the students will be able to demonstrate an independent judgment on the interpretation of analytical data resulting from ecotoxicological approach; in addition the increase in communication skills is also resulting from the group's activities done during laboratory attendance.

Program

Main European legislation concerning the prevention and control of environmental pollution. REACH regulation: Registration, Evaluation, Authorization and Restriction of Chemical substances.

Environmental Impact Assessment (EIA): main normative guidelines, administrative and technical procedures. The Environmental Impact Study (EIS): main normative guidelines, definition of an environmental impact study, alternatives and mitigations. IPPC: Integrated Pollution Prevention and Control Directive and procedure for the Environmental Authorization (EA).

Practical activity
Practical activity will carried out in the computer lab where students will use the main web sites concerning the Environmental Impact Assessment; they will learn to consult all the information on the EIA procedures and EIS.

Development of the course and examination

Methods for assessing learning outcomes:
Oral examination in which the students have to answer to the questions (almost 3).
Each question is given a score between 0 and 10.

Criteria for assessing learning outcomes:
During the oral exam, the students must demonstrate that they have acquired basic knowledge about the main issues concerning the ecotoxicology and the environmental impact assessment.

Criteria for measuring learning outcomes:
The final mark is assigned in a scale of thirty. The exam is passed when the score is equal or greater than 18. It is expected to be awarded the highest marks with honors (30 cum laude).

Criteria for conferring final mark:
The final grade is awarded according to the answers adequacy to the questions proposed by the examining committee.
The honors (cum laude) will be given when the students will demonstrate full mastery of the subject, the correct use of terminology and the ability to make connections, where it is possible, between the various topics.

Recommended reading

Lecture notes
Slides and scientific literature suggested during the course.
Manuals and Guidelines ISPRA 67/2011: “Batterie di saggi ecotossicologici per sedimenti di acque salate e salmastre”
Manuals and Guidelines ISPRA 88/2013: “Batterie di saggi ecotossicologici per sedimenti e acque interne.

ECOTOXICOLOGY AND ENVIRONMENTAL IMPACT ASSESSMENT (Regoli)

LAMBERTO RE

Seat Scienze
A.A. 2016/2017
Credits 2
Hours 16
Period 2^ semestre

Prerequisites

Knowledge of general and organic chemistry, general and cell biology is important requisites for this course.

Course contents

The course will include 64 hours of lectures (8 CFU), of which 40 hours (5 CFU) of Ecotoxicology (3 CFU and 2 CFU explained by Prof. Maura Benedetti and Prof Francesco. Regoli respectively) and 24 hours (3CFU) of Environmental Impact Assessment (Prof. Stefania Gorbi). The teaching activity includes both lectures and practical lessons in didactic and computer laboratories.

Objectives of the course

Knowledge:
The course will allow students to learn about the major classes of environmental contaminants in terms of chemical/physical characteristics, distribution in environmental matrices, bioaccumulation, bioavailability and biomagnification; furthermore the course will enable students to acquire the knowledge on the application of analytical models of ecological risk.

Ability to apply the knowledge:
Students will be able to apply the acquired knowledge through the use of appropriate models of ecological risk analysis, involving on the weighted integration of chemical and biological parameters.

Soft skills:
At the end of the course and laboratory activities the students will be able to demonstrate an independent judgment on the interpretation of analytical data resulting from ecotoxicological approach; in addition the increase in communication skills is also resulting from the group’s activities done during laboratory attendance.

Program

Contents:
Main classes of chemical contaminants of ecotoxicological interest and their distribution in the

environmental matrices, including persistent pollutants and their global spread. Factors affecting bioavailability and toxicity of chemical contaminants. Bioconcentration, bioaccumulation and biomagnification.
Ecological risk assessment (ERA); models of risk analysis, integrated Weight of Evidence approaches (WOE): case studies.

Laboratory exercises:
In the computer laboratory we will be presented and applied some examples of ecological risk analysis.

Development of the course and examination

Methods for assessing learning outcomes:
The final exam consists of an oral examination in which 3 questions are provided. Each question is given a score between 0 and 10.

Criteria for assessing learning outcomes:
During the oral exam, the students must demonstrate that they have acquired basic knowledge about the main issues concerning the ecotoxicology and environmental impact assessment.

Criteria for measuring learning outcomes:
The final mark is assigned in a scale of thirty. The exam is passed when the score is equal or greater than 18. It is expected to be awarded the highest marks with honors (30 cum laude).

Criteria for conferring final mark:
The final grade is awarded according to the answers adequacy to the questions proposed by the examining committee.
The honors (cum laude) will be given when the students will demonstrate full mastery of the subject, the correct use of terminology and the ability to make connections, where it is possible, between the various topics.

Recommended reading

Lecture notes
Slides and scientific literature suggested during the course.
Manuals and Guidelines ISPRA 67/2011: “Batterie di saggi ecotossicologici per sedimenti di acque salate e salmastre”
Manuals and Guidelines ISPRA 88/2013: “Batterie di saggi ecotossicologici per sedimenti e acque interne.

ECOTOXICOLOGY AND ENVIRONMENTAL IMPACT ASSESSMENT (Regoli)

MAURA BENEDETTI

Seat Scienze
A.A. 2016/2017
Credits 8
Hours 64
Period 2^ semestre

Prerequisites

Knowledge of general and organic chemistry, general and cell biology, biodiversity is important requisites for this course.

Course contents

The course will include theoretical lectures (7 credits, 56 hours) and laboratory practical exercises in small groups (1 credit, 8 hours). The course is supported by didactic materials in electronic format for both the lectures and practical lessons

Objectives of the course

Knowledge:
At the end of the course the students will have to acquire: the knowledge of the main classes of environmental contaminants in terms of chemical/physical characteristics, distribution in environmental matrices, bioaccumulation, bioavailability, biomagnification, their metabolism/ detoxification and toxicity in organisms; knowledge of bioassay importance and their application to test various environmental matrices; the knowledge of the main biological responses (biomarkers) in bioindicator organisms including the metabolism/detoxification mechanisms of organic contaminants, heavy metals, pesticides and organohalogenated compounds, the alterations of antioxidant defenses, the onset of oxidative stress, the alterations of the lysosomal membranes and damages to important biological macromolecules including lipids and DNA; the knowledge of environmental economics aspects and legislation concerning the assessment of environmental impact.

Ability to apply the knowledge. At the end of the course the students must be able to apply an "ecotoxicological" approach in environmental monitoring, consisting of chemical and biological analysis integration, also from the practical point of view, thanks to practice exercises performed in the laboratory. In addition, students will be able to apply correctly the regulation on environmental impact assessment.

Soft skills. At the end of the course and laboratory activities the students will be able to demonstrate an independent judgment on the interpretation of analytical data resulting from "ecotoxicological" approach; in addition the increase in communication skills is also resulting from the groups activities done during laboratory attendance.

Program

Theoretical lessons (7 CFU, 56 h) will cover the following topics:
Introduction and definition of ecotoxicology, distribution of chemicals in the environment and factors which affect their toxicity (bioavailability, biomagnification). Toxicity Tests: general procedures, interpretation and applicability of results, examples of most commonly used tests for waters and sediments.
Ecotoxicological approach in the environment; biomonitoring, biological resources and impact assessment. Choice of bioindicator organisms. Biological effects of chemicals, biomarkers at molecular, biochemical and cellular levels. Biotransformation and toxicity of aromatic xenobiotics. Detoxification and toxicity of trace metals. Role of lysosomes in detoxification and in pollutant-mediated pathologies. Antioxidant defences and oxidative stress induced by pollutants. Environmental genotoxicity and DNA damages as biomarkers. Immunotoxicity in invertebrates and fish. Endocrine disruptors and Emerging pollutants (pharmaceuticals and microplastics). Liver pathology and chemical carcinogenesis. Biological and environmental factors which influence responses of biomarkers, basal levels, species sensitivity, adaptation mechanisms. Atmospheric and soil pollution. Elements of pollution economy, assessment, management and legislation of environmental pollution. Main tools for the implementation of the EU environmental policies. REACH regulation: Registration, Evaluation, Authorisation and Restriction of Chemical substances. Definition and design of an environmental impact assessment, main normative guidelines for VIA and VAS (environmental and strategic impact assessment). The Environmental Impact Statement (EIS). Summary of Directive 2010/75/EU on industrial emissions (integrated pollution prevention and control) (IPPC). Marine Strategy Framework Directive 2008/56/CE for a Good Marine Environmental Status

Laboratory activities (1 CFU 8 h):
During the practical exercitations, students will plan a presentation of the main analytical methods and sample preparation; evaluation of some biomarkers and analysis of the obtained results.

Development of the course and examination

Methods for assessing learning outcomes:
Oral examination in which the students must respond adequately to the questions of the exam Committee.

Criteria for assessing learning outcomes:
During the oral exam, the students must demonstrate that they have acquired basic knowledge about the main issues concerning the ecotoxicology and environmental impact assessment.

Criteria for assessing learning outcomes:
The final mark is assigned in a scale of thirty. The exam is passed when the score is equal or greater than 18. It is expected to be awarded the highest marks with honors (30 cum laude).

Criteria for assessing learning outcomes:
The final grade is awarded according to the answers adequacy to the questions proposed by the examining committee.
The honors (cum laude) will be given when the students will demonstrate full mastery of the subject, the correct use of terminology and the ability to make connections, where it is possible, between the

various topics.

Recommended reading

Lecture notes
Slides on the topics carried out
Scientific literature suggested at the beginning of the course
M.C. Newman. Fundamentals of Ecotoxicology, The Science of Pollution. 4th Edition. CRC Press, Taylor & Francis Group, 2015.
Proceedings of the study day “Indagini ecotossicologiche negli ambienti marini costieri in riferimento al D.L. 152/99” Biologia Marina Mediterranea 2001 ISSN 112-4245
Legislative decree 3 april 2006, n. 152 “Norme in materia ambientale” published in Gazzetta Ufficiale n. 88 14 aprile 2006- Ordinary supplement n. 96, updated with the Law 6 august 2015, Gazzetta Ufficiale n. 188 14 august 2015

EMERGENCIES IN THE MARINE ENVIRONMENT

FABIO SARTI

Seat Scienze
A.A. 2016/2017
Credits 2
Hours 16
Period 2^ semestre

Prerequisites

Knowledge of the topics of the courses on General Chemistry, organic chemistry and basic notions about the organizational structure of civil protection.

Course contents

Only lectures are planned.

Objectives of the course

Knowledge:
The course enables students to acquire the basic knowledge about operating procedures for combating marine pollution caused by emergency events, with particular reference to the ability to identify the correct procedures following the prediction of the behavior of oil at sea. The course provides a comprehensive framework for the operational organization and institutional organization, for combating marine pollution, also illustrating the set of resources available to the competent authorities.

Ability to apply the knowledge:
The student will also acquire the following professional skills: ability to frame an event properly identifying the appropriate decision-making levels and the reference framework.

Program

a) Istitutional bodies
I.M.O. like specialized agency of the United Nations with particular reference to the Committees Maritime Safety and Marine Environment Protection. UNEP (United Nations Environment Programme) and REMPEC (Regional Marine Pollution Emergency Response Centre for the Mediterranean Sea).The European Union and the role of Community institutions in the field of safety of navigation, marine environmental protection and emergency pollution by hydrocarbons or dangerous substances. European strategy in the environmental sector with particular reference to the role of EMSA (European Maritime Safety Agency).

b) the main international conventions
The Barcelona Convention with particular reference to the Emergency Protocol.
The Marpol 73/78 Convention and UNCLOS such additional sources of rules on combating pollution.
The London Convention 1990 (OPRC) and its NHS protocol.
The Intervention Convention 1969/1973.

c) The European and national legislation
The Erika rules and the implementation at national level, the Legislative Decree 196/2005.
The obligations of the state flag, the Legislative Decree 164/2011.
The Port State Control, the Legislative Decree 53/2011.
National legislation to protect the marine environment, with particular reference to Law 979/82 and the Legislative decree 156/2006.

d) The national organization to combat the marine pollution.
The National Civil Protection Plan and operational planning of the second and third level. National resources for combating pollution at sea.

Development of the course and examination

Methods for assessing learning outcomes:
The exam consists of an interview on the program's arguments. Each candidate shall be given at least one question about the international and national legislation, on the behavior of the main contaminants in the sea and on anti-pollution techniques and operational procedures approved by the competent bodies. The exam is successfully passed when the final grade is greater than or equal to 18.

Criteria for assessing learning outcomes:
In the exam, the student must demonstrate knowledge of the international regulations governing the intervention of civil protection in the sea by the coastal State or on the high seas against the foreign flag vessels beyond its jurisdiction and has acquired adequate knowledge about the behavior of hydrocarbons and other harmful substances at sea and preventing pollution techniques, as well as the current operating procedures.

Criteria for measuring learning outcomes:
The final grade is given thirty. The exam is successfully passed when the grade is greater than or equal to 18. It can be given the highest marks with honors (30 cum laude).

Criteria for conferring final mark:
Final grade is given by evaluating the outcome of the interview. Praise is attributed when the score exceeds the value 30, and at the same time the student has demonstrated full mastery of the Study subjects.

Recommended reading

Lecture Notes

EMERGENCY MANAGEMENT

SUSANNA BALDUCCI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 2^ semestre

Prerequisites

Knowledge of topics of the Civil Protection Legislation

Course contents

There will be provided lectures (6 credits, 48 hours) and participation in exercises/events in the field of civil protection. Some lectures are prepared and presented with the support of civil protection experts. Each year the students, organized in small groups or individually, will prepare reports on civil protection issues.

Objectives of the course

Knowledge:
The course enables students to acquire the basic knowledge on the theory and methodology of intervention on which the system of civil protection bases its actions in emergency management, with particular reference to the characterizing features of the different rescue components and to the preliminary emergency planning activities.
It allows also students knowledge about: the main issues related to the different risk scenarios, natural and anthropogenic (seismic, geological, industrial, CBRN / nuclear, biological, chemical, radiological, fire fighting forest fires, and transport, ...), the most significant and characteristic activities of civil protection (such as information to the people, the resilience, the procedures for alerting, education and training) and the Civil Protection European Mechanism.

Ability to apply the knowledge:
The student must acquire the following professional skills: ability to perform analysis of emergency events, to understand what types of activities actually put in place during the emergency phase, on the basis of the knowledge acquired, and taking into account that every emergency manifests its own magnitude and different characteristics.

Soft skills:
The comparison with civil protection experts and the activity of reporting help the student to improve both the learning capacity and judgment independently, both the communication skills that also stems from teamwork.

Program

Content (6 CFU, 48 hours):
Historical evolution of the concept of emergency management.
The emergency phase: from planning to operations.
Types of emergency.
The “Augustus Method”.
Intervention models.
Simulations and updating of emergency plans.
The phases of alarm. The first aid and the emergency response. The centers of the emergency.
The Mayor, civil protection authority.
Use of the Operational Centers and the management of communications and information.
Information to the population before, during and after the emergency.
Damage assessment. Implementation of administrative and financial management of the emergency.
Telecommunication systems and logistics in an emergency.
The phases of the recovery and the assistance: the restoration of normality.
Ordinary and special emergency management.
The European Civil Protection Mechanism.
Emergency in the countries adhering to the European Mechanism and in third countries.
Examples of emergency management.
Exercises:
There is provided the participation in a regional civil protection exercise, finalized to the updating of a municipal emergency plan and to the activation of the regional system of civil protection.
Lectures by experts in the field of "forest fire fighting" and of the training projects for civil protection.
Visit the SOUP (Operations Room Unified Permanent) of the Marche Region.

Development of the course and examination

Methods for assessing learning outcomes:
the student exposes during class, individually and/or in small groups, agreed annually reports.
The examination is conducted in oral form, designed both to verify the knowledge of the student of the activities characterizing the models of intervention of the civil protection system and the other to the analysis of emergency events to identify the steps to be implemented in phase of emergency management.

Criteria for assessing learning outcomes:
In the oral exam the student must demonstrate knowledge of principles and methods of emergency civil protection activities, as well as to have acquired basic knowledge about the main issues related to different risk scenarios.

Criteria for measuring learning outcomes:
The rating is assigned thirty. The exam is passed when the grade is greater than or equal to 18. It is expected to be awarded the highest marks with honors (30 cum laude).

Criteria for conferring final mark:
The rating is given by summing the evaluation of the oral test and the relations (the latter up to a maximum of two points). Praise is attributed when the score obtained from the previous sum

exceeds the value 30 and meanwhile the student has demonstrated full mastery of the subject.

Recommended reading

- Lecture notes.
- “La nuova protezione civile”, 1a edition 2013, Maggioli Editore

ENGLISH LANGUAGE - FIRST LEVEL DEGREE

FRANCESCO SPINOZZI

Seat Scienze
A.A. 2016/2017
Credits 4
Hours 00
Period Corso annuale

Prerequisites

Students enrolled on the first year of the degree course must take an English Language Placement Test, organized by the University Language Centre (CSAL). This will be held at the start of the academic year and is useful for assessing the students' current level of English. Any students who get a low score must follow an elementary level self- study course (English Express) using the software in the CSAL self-study centre in order to reach the minimum level (CEFR A2+/B1) needed to be able to follow the English language lessons which will be held in the second semester.

Course contents

Face to face classroom lessons organized by the CSAL (Dr. Elena Delfina Agnelli and Dr. Michael Lacey-Freeman). The English course is part of the first year syllabus and the lessons are held in the second semester. They aim to improve the students' English language skills regarding grammar and vocabulary, listening, speaking and pronunciation, bringing the students to an intermediate level of knowledge (B1+).

Objectives of the course

Knowledge:
The students will learn the language skills that enable them to understand the general meaning of various types of written texts and to recognize the significant points in both general and scientific documents in the English language.

Ability to apply the knowledge:
The students must be able to understand the general meaning and specific information when listening to a variety of audio materials and must be able to express their understanding in spoken English.

Program

Contents (F2F lessons, 4 CFU, 50 hours)
Units 1 -12 of the coursebook

Development of the course and examination

Methods for assessing learning outcomes:
The students' knowledge will be tested via a computer-based test and an oral examination.

Criteria for assessing learning outcomes:
The computer-based test has 5 sections: Listening (6 questions); Pronunciation (5 questions); Grammar (15 questions);, Reading (4 questions); Gap-fill (10 gaps). The questions are all Multiple choice or True/False. The maximum set time for the test is 1 hour 10 minutes.
During the oral examination the students will be asked to hold a short conversation concerning their chosen university studies. They will also be expected to read a short scientific text in English and translate it into Italian.

Criteria for measuring learning outcomes:
The final score is a result out of 30, with 18/30 being the minimum pass mark. The maximum score of 30/30 may be given with honours ("cum laude").

Criteria for conferring final mark:
The final score is calculated by adding together the score for the computer-based test and the oral examination. Honours ("cum laude") will be given when the final calculated score is greater than 30/30 and the student has proved to be fully competent in the subject.

Recommended reading

Coursebook: Life - Intermediate B1+ by Helen Stephenson, Paul Dummett and John Hughes, National Geographic Learning, CENGAGE.
Study pack with student's book with DVD, workbook with Audio CD
ISBN code: 9788853614780
Grammar: Essential Grammar in Use by Raymond Murphy (Italian Edition with key), Cambridge University Press.
Bilingual Dictionary (e.g. Zanichelli or Hoepli) and English Dictionary (e.g. Macmillan English Dictionary, Collins COBUILD Dictionary, Longman Active Study Dictionary, Oxford Advanced Learner's Dictionary or similar with CD-ROM)
All these materials are available for consultation in the CSAL self-study centre and additional materials can be found on the UNIVPM Moodle platform.

ENVIRONMENT REMEDIATION TECHNIQUES

FRANCESCA BEOLCHINI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 2^ semestre

Prerequisites

Basic mathematics, physics, general chemistry and microbiology.

Course contents

The course is given through lectures and numerical exercises, in some cases using the Microsoft Excel software.

Objectives of the course

Knowledge:
The main techniques for wastewater treatment technologies and control variables
The main techniques for water disinfection and potabilisation, and criteria for civil protection
The main techniques for soil bioremediation and control variables

Ability to apply the knowledge:
Management of urban wastewater treatment plants
Evaluation of the feasibility and management of the bioventing technique for soil remediation
Support function on water management under emergency conditions

Soft skills:
Numerical applications stimulate the critical thinking of each student, together with communication skills.

Program

Basic skills. Material balances. Theoretical models for reactors. Reaction Kinetics relevant for environmental remediation.
Wastewater treatment. Primary treatments. Biological processes for organic carbon degradation. Nitrification. Denitrification. Nitrification/Denitrification. Biological phosphorous removal. Suspended biomass activated sludge process. Fixed biomass processes. Control parameters for such processes.
Water treatment for Civil Protection. Disinfection. Potabilisation.

Soil bioremediation. In situ and ex situ technologies. Bioventing. Slurry bioreactor. Control parameters for such processes.

Development of the course and examination

Methods for assessing learning outcomes:
Oral exam.

Criteria for assessing learning outcomes:
The student has to show knowledge of subject matter and ability to apply it to simple practical cases.

Criteria for measuring learning outcomes:
The score is given by a number, out of 30 points. The minimum score required for passing the exam is 18.

Criteria for conferring final mark:
The final score is based on the oral exam.

Recommended reading

Copy of the slides (available on-line: www.disva.univpm.it)
Luca Bonomo, 2005. Bonifica di siti contaminati. McGraw Hill.
Metcalf & Eddy, 1991. Wastewater engineering: treatment, disposal, reuse. McGraw Hill.
Vismara, R., 2001. Depurazione biologica. Hoepli
EPA/540/R-95/534a. Bioventing principles and practice. Environmental Protection Development September 1995.

ENVIRONMENTAL MICROBIOLOGY

FRANCESCA COMITINI

Seat Scienze
A.A. 2016/2017
Credits 7
Hours 56
Period 1^ semestre

Prerequisites

Main knowledge on topics of General Biology.

Course contents

Theoretical lessons (4 credits, 32 hours) are planned together with laboratory practical experiments carried out individually or in small groups (2 credits, 16 hours). The frontal lessons are flanked with group activity of cooperative learning in which students develop inputs provided by the professor. Educational visits to environmental companies and / or centers applied to the bioremediation industry represent an integral part of the course.

Objectives of the course

KNOWLEDGE:
Analysis of microbial communities in natural environments and their role in environmental contamination.
Learn about and discuss issues relating to environmental microbial contamination.
To know and apply the main techniques of bioremediation of contaminated sites.

Ability to apply the knowledge:
Demonstrate to understand scientific articles and case studies related to monitoring and environmental management;
Be able to independently plan and manage an environmental microbiological control and analyze critically the results.
Be able to independently meet the material covered in class during classroom discussion of case studies.
Insights on the prevention on health risks from microbial contamination of different environments (confined, workplaces etc.)
- Analysis of case studies and knowledge on the management of issues related to environmental microbial contamination.
The student will know how to apply their knowledge to manage and analyze critical issues related to the prevention of microbial contamination in different environments.

Program

- Introduction on microbial diversity in natural environment.
- The soil as microbial habitat
- Biogeochemical cycles
- Environments and microbial contamination: notes about environmental factors that favor, the main microorganisms involved, health risks, concept of microbial contamination.
- Bioremediation
- Composting
- Work on the regulations on the prevention of contamination and the monitoring of soil.

- Examples of microbial environmental contamination in different environments (indoors, the workplace) as case studies

Development of the course and examination

Methods of learning assessment:
The exam consists of an oral exam, also the student delivery their lab reports.

Criteria for assessing learning outcomes:
In the lab reports the student must demonstrate that they have achieved the ability to apply the knowledge acquired during the frontal lessons, to enforce a simple laboratory analysis with the ability to critically draw a report test.

Criteria for measuring learning outcomes:
The final evaluation is expressed in thirty. The exam is valid when the grade is greater than or equal to 18. Criteria for awarding the final grade:

Criteria for conferring final mark:
The final grade is given by summing the evaluation of the oral exam with the laboratory report, up to a maximum of two points. Praise is given when the student has demonstrated full mastery of the subject.

Recommended reading

Lecture notes
Microbiologia ambientale ed elementi di ecologia microbica; Autore Barbieri Paola; Bestetti Giuseppina; Galli Enrica. CEA
Microbiologia agroambientale Autori B. Biavati, C. Sorlini. CEA
Slides available on the webpage of the class
Microbiologia ambientale ed elementi di ecologia microbica; Autore Barbieri Paola; Bestetti Giuseppina; Galli Enrica. CEA
Microbiologia agroambientale Autori B. Biavati, C. Sorlini. CEA

ENVIRONMENTAL MONITORING PROCEDURES

MARIA LETIZIA RUELLO

Seat Scienze
A.A. 2016/2017
Credits 2
Hours 16
Period 1^ semestre

Prerequisites

Fundamentals of chemistry and physic.

Course contents

The course will consist of assisted exercitation. The documents used during esercitations, accompanied by bibliography, will be available to students.

Objectives of the course

Knowledge:
The course will enable students to understand the basic knowledge about:
- procedure for implementing monitoring techniques to specific cases
- sampling in both air and water matrices
- validation of data within Continuous emission monitoring systems (CEMS)

Ability to apply the knowledge:
The student will also gain the following professionalising skills:
- apply national and international emission surveillance systems
- analyze and evaluate data from different experiments and CEMS programs, and from these results be able to describe and judge the status of the plant.

Soft skills:
The design exercitation, individual and team, helps to improve both the degree of independence of judgment in general of students, and their ability to communicate that stems also from the teamwork, and their ability to learn independently and to draw conclusions.

Program

Exercises (2 CFU, 16 hours):
Lab exercises:
Basic design of CEMS, as low as real cases of industrial plants subject to Integrated Pollution Prevention Control (IPPC).

At the end of the exercises, the student will have to deliver a report on the designing activities carried out, presenting for the case study, objective, relevant regulations, the plant description, proposed solutions, calculations to be executed and how to evaluate/interpret the results themselves.
Field exercises:
A one-day field trip will be organized, and dedicated to visit an industrial plant and its system of emission monitoring in the different environmental matrices.

Development of the course and examination

Methods for assessing learning outcomes:
The evaluation is through written and oral tests. In the written exam, students must approach the basic design of an environmental monitoring system with the aid of the technologies and methods used in the exercitations. In the oral exam the student is asked to discuss his/her written paper.

Criteria for assessing learning outcomes:
In the exam tests, the student must demonstrate the ability to use autonomously and correctly the key investigation technologies and strategies for environmental monitoring used during exercitations.

Criteria for measuring learning outcomes:
In the examination tests is evaluated, the autonomous capacity of the student to set up and solve the problems that are placed to her/him. It also evaluated the ability to properly and appropriately use technologies and strategies of environmental monitoring.

Criteria for conferring final mark:The certification of the suitability of the knowledges is assigned to students who demonstrate to be able to solve problems that are set and sufficient knowledge of technologies and strategies of environmental monitoring.

Recommended reading

Lecture notes
Technical annexes to the national and Community legislation on industrial emissions monitoring:
- Parte Quinta del D.Lgs. n. 152/06
- D.Lgs. n. 133/05
- D.M. 5 febbraio 1998 e s.m.i.
- http://www.academia.edu/319633/Wastewater_Quality_Monitoring_and_Treatment? (only for the Monitoring chapters) (last access July 8th 2016)

Supplementary reading (last access July 8th 2016)
http://ec.europa.eu/environment/industry/stationary/ied/legislation.htm
http://eippcb.jrc.ec.europa.eu/.
http://www2.arpalombardia.it/siti/arpalombardia/imprese/emissioni/SME/Pagine/SME.aspx
http://aia.minambiente.it

ENVIRONMENTAL TECHNICAL PHYSICS

PAOLO PRINCIPI

Seat Scienze
A.A. 2016/2017
Credits 7
Hours 56
Period 2^ semestre

Prerequisites

Students should master the major field body of knowledge covered in the following courses: mathematics and physics

Course contents

The course is developed through series of lectures, divided into blocks on specific topics and at the end of each phase of exercises designed to introduce students to the written test exam. As part of the course students can access the course materials in electronic form on the university website consists of: as pdf files on the slides shown during the lectures, the file in pdf related to numerical exercises carried out in previous academic years and the current one, the pdf's related to the tests of previous years and the work already undertaken in the current academic session, the results of the examinations.

Objectives of the course

Knowledge:
After completion of this course the student will learn through lecture and practice how heat flows through different materials to develop a better understanding basic tools of conduction, convection and radiation heat transfer for problems which involve the overall heat transfer coefficient. phenomenological aspects, mathematical formulation (basic conservation laws and constitutive laws) and analytical and
numerical resolution techniques. Methodologies of resolution of problems of technological interest which different formsof combined heat transfer are presented
Learners will be able to understand the general approach to the control of heat, air, and moisture to provide the theoretical background for the analysis of the building enclosures. The student will be initiate to the study of reversed cycles, thermal comfort to learn the environmental aspects of the processes. Formation in heat transfer by conduction, convection and radiation and fluid dynamics:

Ability to apply the knowledge
The student will also acquire the following professional skills: ability to make simple energy analysis, for example, the fuel used to cool the buildings on the territory in order to make strategies for the reduction of energy consumption and sending in the gas atmosphere greenhouse. Do anyway energy issue advice to the decision-maker with the aim of producing strategies to pursue environmental sustainability, reduce the consumption of fossil fuels and reduce the phenomenon of

climate change.

Soft skills
The exercises, performed by students in a collaborative way, but also independently, allow to learn, as well as the examination procedures also wrote the cooperation mechanisms in the development of energy strategies for environmental sustainability. These practices allow to acquire independent judgment, ability to learn and draw conclusions independently, but also to develop communication skills, enhanced by teamwork.

Program

Heat and mass transfer
The importance of heat transfer, the fundamental concepts and the basic modes of heat transfer. The Fourier low of conduction and the general heat conduction equation. The thermal conductivity. Steady state heat conduction in one dimension. The fundamental low of convection, The Newton low the boundary layer concept. Forced convection and natural convection. Heat transfer by radiation, the Stefan-Boltzmann low, black body radiation, Radiation from real surfaces and ideal grey surfaces. Solar radiation, reflection, transmission and absorption, combined heat transfer. Heat loss calculation between indoors and outdoors in a building.
Thermodynamics
The calculation of condensation risk, vapour resistivity, surface and interstitial condensation. Thermal comfort. Reversed Cycles, the reversed Carnot Cycle, Unit for refrigerating effect. Heat and moisture air, composition of air, the use of psychrometric chart.
Environmental criteria
the phenomenon of steam diffusion, temperature and saturation pressure, partial steam pressure , comparison between the diagrams, The calculation of condensation risk, vapour resistivity, surface and interstitial condensation. graphical method and analytical methods of analyses,

Thermal comfort
Physiological comfort, environmental comfort, thermo-hygrometric comfort. Human body as a thermodynamic system, the exchange of mass and energy, equation of comfort, energy balance of human body, Fanger and Gagge theories, metabolism, unit non-conventional (meth, clo), heat transfer by heat sensible and latent, inner and outer, the indices of comfort.

Development of the course and examination

Methods for assessing learning outcomes:
Written and oral exam will be given at the end of course at scheduled time.

Criteria for assessing learning outcomes:
The first deals with the solution of a numerical exercise related to the calculation of energy balance and exchanges of the technical systems considered in the course. This way we can assess the ability of the student of applying the knowledge and understanding of the analysis and solution techniques, and of making judgment and to correctly use the units of measurement.
The second one consists of some questions dealing with theoretical aspects of each main topic of the course : heat transfer, thermodynamics of moist air, thermal comfort.

Criteria for measuring learning outcomes:

The written test must be passed with a minimum score of 18/30 for access to the oral test. The oral test rating is assigned with minimum score of 18/30, considering the level of detail of the answers given by the student to questions on the topics of the course
At the end of the written and oral test is given the vote of thirty. It confirms the exam when the vote is greater than or equal to 18. It is expected to be awarded the highest marks (30 cum laude).

Criteria for conferring final mark:
The average of the marks obtained in the two tests (written and oral) determines the final grade exam. 30 cum laude is given when the student has demonstrated full mastery of the subject.

Recommended reading

Çengel Y.A., Termodinamica e Trasmissione del Calore - seconda edizione, McGraw-Hill Companies srl, Milano, 2013.
Lecture notes available for download from the teacher page of Univpm web site

ETHOLOGY

STEFANIA PUCE

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 1^ semestre

Prerequisites

The course of Zoology is strongly recommended.

Course contents

Lectures (5 credits, 40 hours) and practical training (1 credit, 8 hours).

Objectives of the course

Knowledge:
Students acquire a good knowledge of basic aspects of animal behaviour, behavioural strategies, proximate and ultimate causes of behaviour through many examples of experiments and observations carried out on both terrestrial and aquatic animals.

Ability to apply the knowledge:
The students can describe the basic aspects of animal behaviour and discuss the adaptive value of different behaviours. The students can describe the methods used to carry out observations and researches on animal behaviour.

Soft skills:
Photo and video materials showed, discussed and analysed during lectures and practices stimulate students' capacity of observation, reasoning and develop hypotheses.

Program

Content of the lectures (5 credits, 40 hours)
Introduction to the study of animal behaviour, instinct and learned behaviour, development of the behaviour, nervous system and behaviour, organization of the behaviour: cyclic behaviour, historic evolution of the behaviour, behavioural ecology, communication, habitat selection strategies, migrations, trophic behaviour and symbiosis, antipredatory strategies, evolution of the reproductive behaviour and parental cares, evolution of the mating systems, evolution of social behaviour, human ethology.
Practices (1 credit, 8 hours):

Viewing and comment of some documentaries related to the topics discussed during lectures; analysis of some short videos recorded by students by the method of “interval sampling” and charts of “activity budgets”

Development of the course and examination

Methods for assessing learning outcomes:
The exam consists of an oral test on the theoretical and the practical parts. The students must demonstrate that they have acquired the basic knowledge presented during the course and the ability to think and connect the different topics; moreover, with regard to the practical part, the students have to demonstrate they know the main methods discussed during classes used to carry out behavioural observations.

Criteria for assessing learning outcomes:
The level of knowledge acquired, exposed during the oral test, referring to lectures and to the practical parts, will be evaluated to assess the students’ preparation.

Criteria for measuring learning outcomes
The final mark is awarded out of thirty. The exam is passed when the grade is greater than or equal to 18. It is expected to be awarded the highest marks with honors (30 cum laude).

Criteria for conferring the final mark:
The final mark is given considering the levels of knowledge acquired and shown during the oral test, and it is conferred considering the theoretical and practical parts.

Recommended reading

Alcock, Etologia, un approccio evolutivo. Zanichelli

EVOLUTIONARY BIOLOGY OF MARINE VERTEBRATES

VINCENZO CAPUTO BARUCCHI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 2^ semestre

Prerequisites

A basic knowledge of genetics, zoology and ecology is required.

Course contents

The course takes place during the second semester of the first year (Second Level degree in Marine biology).

Objectives of the course

Knowledge:
The aim of the course is to depict a general view about evolution in the light of the outcome of the molecular biology and of developmental genetics, but without disregarding morphological and paleontological evidence. The importance of speciation processes and macroevolutionary trends is stressed, with examples from evolution of vertebrates adapted to marine environment.

Ability to apply the knowledge:
At the end of the course, graduates will be able i) to recognize and correctly classify the most representative species of the major taxonomic groups of marine vertebrates (agnathans, cartilaginous and bony fishes, reptiles, birds and mammals), ii) to explain the different adaptive specializations of vertebrate to marine environment; iii) apply the principles of conservation genetics to the management of species of marine vertebrates subject to commercial exploitation (fishery).

Soft Skills:
At the end of the course, students should know how biological processes like mutation, selection, migration and genetic drift are able to produce the evolutionary change. They shall also know the basic molecular methods (DNA extraction, amplification by PCR, genotyping) to monitor the genetic polymorphism of natural populations of marine vertebrates.

Program

Contents (frontal lessons, 5 CFU, 40 hours):
The coming of the modern evolutionary thought. Darwin and the natural selection; the

Neo-Darwinism and the “new synthesis”; phyletic gradualism vs punctuated equilibria; the neutral theory of molecular evolution.
Classification and evolution. Definitions and examples of taxonomic characters (morphological vs molecular; general vs special adaptations); taxonomic schools (numerical taxonomy, cladistics and evolutionary taxonomy); software for phylogenetic reconstruction.
Microevolution. The Hardy-Weinberg principle; gene flow and drift; species concepts; geographic variation and speciation; speciation in marine environment; stock concepts and fishery management; principles of conservation genetics.
Macroevolution. Homeotic genes and body plan organization; the origin of the high order taxa; evolutionary trends and mass extinction. Bony fishes as an example of primary radiation in aquatic environment: origin and evolution; biological and ecological traits of marine species. Marine reptiles (turtles) and Mammals (sirenians, pinnipeds and cetaceans) as examples of recolonization of aquatic environment from terrestrial ancestors: origin and evolution; biological and ecological traits of extant species and conservation problems.
Lab practice (1 CFU, 8 hours). Methods for the identification of marine vertebrate species. Population genetics analysis (DNA extraction, amplification by PCR, genotyping).

Development of the course and examination

Methods for assessing learning outcomes:
The exam is oral.

Criteria for assessing learning outcomes:
Criteria for evaluating learning will be based on the student's level of competence (acquired knowledge and capacity in exposing the subject).

Criteria for measuring learning outcomes:
The learning measurement criteria will be expressed by a scale of thirty.

Criteria for conferring final mark:
Considering enough the score 18/30, giving praise to students who have distinguished themselves for the sake of clarity and full knowledge for the matter.

Recommended reading

Appunti di lezione
Berta A., Sumich J. L., 2006. Marine mammals. Evolutionary biology. Academic Press (second edition).
Freeman S., Herron J. C., 2014. Evolutionary analysis. Fifth edition. Pearson.
Ridley M., 2004. Evoluzione. McGraw Hill.
Futuyma D.J., 2008. L’evoluzione. Zanichelli.
Pough F. H., et al., 2014 Zoologia dei Vertebrati. Pearson.

FERMENTATION BIOTECHNOLOGY

MAURIZIO CIANI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 2^ semestre

Prerequisites

Knowledge of the issues of the courses on General Biology, General Microbiology, Genetics and Biotechnology of microorganisms.

Course contents

Both theoretical lectures (5 credits, 40 hours) and laboratory practical work carried out individually or in small groups (1 credit, 8 hours) are planned. The teaching material of the lectures will be provided in the reserved area. Teaching materials for the exercises will be provided to each planned exercise and the elaborated results will be made available in the reserved area.

Objectives of the course

Knowledge:
The course will allow students to acquire knowledge on the most important fermentation industries.

Ability to apply the knowledge:
With the support of the lab hours student will be able to evaluate and prepare biotechnological fermentation processes.

Program

The microorganisms in fermentation processes. Biofuels: bioethanol and biodiesel. Biodiesel: biomass and exploitation of by-products. Bioethanol: biomass, pretreatment, the fermentation process. The brewing industry: the production chain with particular reference to the fermentative process and microbiological control process. Wine production: technologies of production and the role of microorganisms in the production process. alcoholic, malo-lactic and malo-alcoholic fermentations. The spoilage microorganisms.

Development of the course and examination

Methods for assessing learning outcomes:
oral examination

Criteria for assessing learning outcomes:
learning evaluation will be performed by means of questions and taking into account the arguments put forward by the student.

Criteria for measuring learning outcomes:
The student must demonstrate that it has acquired knowledge and mastery in the use of microorganisms in biotechnological processes

Criteria for conferring final mark:
the final grade will be out of thirty. The student who does not have the reports on laboratory exercises will also be evaluated on such topics

Recommended reading

M. Manzoni Microbiologia Industriale CEA Editrice 2006
Waites et al. Industrial Microbiology: An introduction. Blackwell Science , Oxford 2001
El-Mansi E.M.T. et al. Fermentation Microbiology and Biotechnology CRC Taylor & Francis
Microbiologia enologica. A cura di Giovanna Suzzi e Rosanna Tofalo Edagricole. 2014

FIRE PREVENTION AND INDUSTRIAL RISK CONTROL

GIUSEPPE DEL BROCCO

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 2^ semestre

Prerequisites

Good knowledge of the basics of science subjects, even at the high school level, to manage the issues of the course.

Course contents

The course normally will carry out in the classic “Front Mode”.
During the course will be planed a shared visits to the VVF principals, commercial activities and/or productive where are installed Fire protection systems, and if is possible to visit Ascoli’s earthquake zone, to study issues of security building.

Objectives of the course

Knowledge
The course will provide a special sensitivity on issues relatively to security and to acquire sensitivity as people and as future professionals.

Ability to apply the knowledge
The student will propose simple example applications on some of the topics processed in the course.

Soft skills
You will do the synthetic surveys on economic advisability of investing in security, assuming data of its cost, the insurance relief, in parallel, the issues that avoids.

Program

The schedule is based on four main themes:
- Fundamental objectives of fire prevention;
- Technology of materials and structures for passive protection;
- Systems technology and systems for active protection;
- Fire Risk Analysis;
- Fire safety engineering and exercises.

The course during the year may change, in a shared manner in dependence of certain variables, always respecting the educational structure.

Exercises
During the course we will schedule some tours.

Development of the course and examination

Methods for assessing learning outcomes:
The Learning assessment will be in a classic mode and it will consist in a written test and an oral.

Criteria for assessing learning outcomes:
In the written examination, students must propose synthetic and effective answers to problems of issues discussed during the lessons.

Criteria for measuring learning outcomes:
The final grade is in thirtieth. The exam is passed when the grade is greater or equal to 18. It is expected to be awarded the highest marks with honors (30 cum laude).

Criteria for conferring final mark:
The final vote will not be the sum of the votes of the two tests carried out by the student (written and oral test), but it will be the idea, as objective as possible, that the teacher will be made based on the evidence, in particular the oral test. Will not be admitted to the oral the student that in the written test reported a lower score 18.

Recommended reading

The literature on the subject is vast and varied. For the teacher does not exist books to recommend. In particular almost every subject there are several contributions on internet, also produced by the technical expert working on the territory of Fire department.
For example, one of the final activities of the course would be to produce a selected bibliography divided by topics discussed in the lessons, to benefit of future courses.

FIRE SAFETY RISK ASSESSMENT

MAURO MALIZIA

Seat Scienze
A.A. 2016/2017
Credits 2
Hours 16
Period 2^ semestre

Prerequisites

Knowledge of the topics of the courses on Physics and Chemistry.

Course contents

The course consists of theoretical lectures and exercises (2 credits, 16 hours).

Objectives of the course

Knowledge:
The course enables students to acquire the fundamental knowledge of the theoretical and methodological basis of main techniques for fighting fire.

Ability to apply the knowledge:
At the end of the course, the student should also acquire the following professional skills: ability to carry out basic fire risk assessment and identify the minimum fire protection features required for a construction.

Soft skills:
The execution of reports on the exercises carried out contribute to improve for the student the learning capacity in autonomy, and the ability to draw conclusions.

Program

Content (lectures, 2 CFU, 16 hours).
Scope and general principles of fire safety. Normative references. Terms and definitions
Fundamentals of physical and chemical fire. Fire prevention measures.
Reaction to fire, resistance to fire, compartimentation, means of escape.
Fire fighting equipment and fixed firefighting systems (fire extinguishers, hydrant systems, hose systems, automatic sprinkler systems etc.)
Smoke and heat control systems.
Automatic fire detection and fire alarm systems.
Emergency lighting.

Fire-fighting risk assessment. Fire safety management. Fire safety in the workplace.
Exercises.

Development of the course and examination

Methods for assessing learning outcomes:
The learning assessment will be in a classic mode and it will consist in a written test and an oral discussion of the script. Thirty questions are provided for the examination.

Criteria for assessing learning outcomes:
In the written and oral examination, students must propose synthetic and effective answers to problems of issues discussed during the lessons.

Criteria for measuring learning outcomes:
The final mark is attributed in thirtieths. Successful completion of the examination will lead to grades ranging from 18 to 30, and 30 with laud.

Criteria for conferring final mark:
The final mark is attributed by the evaluation of the written test and oral discussion. The student that in the written test reported a lower score 18 will not be admitted to the oral. The laud is attributed when the student demonstrates complete mastery of the matter.

Recommended reading

Lecture notes

FOOD BIOCHEMISTRY

LUCA TIANO

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 2^ semestre

Prerequisites

Basic knowledge in Chemistry and Biochemistry is desirable.

Course contents

The course is implemented both through classroom lectures as well as through laboratory practicals in the didactic laboratories. These are carried out in small groups (3-5 students), on specific topics that have been treated during the course. In support of the classroom lecture, on the on line Moodle platform, teaching materials, instructions and protocols of laboratory exercises are loaded:. Seminars on specific topics of particular interest may be organized in agreement with students.

Objectives of the course

Knowledge:
At the end of the course, the student will have achieved an overall knowledge on: the structure, function and nutritional significance of the fundamental food macronutrients and micronutrients; the reactions in which nutrients are involved during food processing and storage; the main biochemical and metabolic processes involved in food intake and nutrient utilization. Students will have the information for understanding the molecular and metabolic mechanisms involved in human diseases and disorders related to nutrition.

Ability to apply the knowledge:
At the end of the course, students will have achieved an overall knowledge and competence on the fundamental points necessary to deal the issues related to nutritional aspects and to apply this knowledge in the profession.

Soft skills:
The laboratory practicals at the individual level and in groups, and the discussion and interpretation of the results obtained, will contribute to improve the decision-making skills of each student in general, as well as the ability to communicate within a group, and the ability to reach conclusions.

Program

Contents of the lectures:
Food and nutrition: use of the terms and operational meaning.
Nutritional standards and dietary guidelines: body mass index and its use for the diagnosis of obesity in adults. The RDAs and adequacy of food intake.
Categories of nutrients, macronutrients and micronutrients.
Carbohydrates: definition and nutritional classification, food sources, energy value. Digestion, absorption and role of available carbohydrates in the diet, the minimum and recommended requirements. Factors affecting the bioavailability of carbohydrates. Glycemic index and glycemic load and their biochemical meaning. Dietary fiber. Sweetening power of sugar and artificial sweeteners. Prebiotics and Probiotics.
Lipids: classification and chemical composition. Food sources and energy value. Saturated, monounsaturated and polyunsaturated, trans fatty acids. Essentiality of fatty acids. Lipid requirements and pathophysiological roles of lipids. Dietary cholesterol and endogenous cholesterol. Digestion and absorption and plasma lipoproteins.
Proteins: nutritional and energy value meaning. Amino acids: nutritional and metabolic classification. Protein turnover. The nutritional value of protein. Integration and complementation of food proteins. Digestion and absorption. Daily requirement and pathophysiological roles.
Vitamins: nutritional significance. Fat-soluble and water soluble vitamins, their biochemical deficiency and toxicity, requirements, food sources and bioavailability.
Minerals: classification of main macro and micro elements. Food sources and bioavailability, requirements and deficiencies, toxicities.
Phytonutrients (polyphenols, carotenoids, glucosinolates). Food sources and their pathophysiological importance.
Major changes nutrients undergo during processing and storage of food: enzymatic and non-enzymatic browning reaction (Maillard reaction and caramelization); oxidation of lipids and the role of antioxidants; degradation and / or oxidation of proteins; loss of vitamins and phytonutrients.
Food and health: the molecular basis of diseases associated with wrong eating habits. Functional foods.

Laboratory Practicals:
Determination on normal and pathological lyophilized serum of the concentration of proteins, enzymes and metabolites routinely analysed in biomedical diagnostics, using diagnostic kits and spectrophotometric measurements. Determination of metabolites and physical examination of urine using dipsticks and diagnostic kits. Determination of antioxidant activity on different samples of white and red wine using a spectrophotometric assay based on a stable, coloured radical. At the end of each practical, the student has to hand in the data obtained for comparison with data from other groups/students, followed by discussion/interpretation of the results obtained.

Development of the course and examination

Methods for assessing learning outcomes:
The exam consists in oral examination with questions targeted to evaluate the knowledge on the topics of the course.

Criteria for assessing learning outcomes:
The student has to demonstrate that he/she knows and has mastered all the topics of the course and to possess the information needed to deal issues related to nutrition / diet.

Criteria for measuring learning outcomes:
The final exam mark is out of 30. The exam is considered passed when the mark is greater or equal

to 18. There is also the possibility of giving full marks with honors (30 cum laude).

Criteria for conferring final mark:
The final mark is given based on the ability demonstrated by the student during the exam of being competent on the topics of the course

Recommended reading

Notes taken during the lectures and powerpoint presentation handed out by the lecturer (on line Moodle platform)

Further reading:
I. COZZANI e E. DAINESE. Biochimica degli Alimenti e della Nutrizione. Piccin, Padova, 2006
A. MARIANI COSTANTINI, C. CANNELLA, G. TOMASSI, Fondamenti di Nutrizione Umana, Il Pensiero Scientifico Editore, Roma.

FOOD MICROBIOLOGY

FRANCESCA COMITINI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 2^ semestre

Prerequisites

Main knowledge on topics of General Microbiology and Biotechnology of Microorganisms

Course contents

Theoretical lessons (4 credits, 32 hours) are planned together with laboratory practical experiments carried out individually or in small groups (2 credits, 16 hours). The frontal lessons are flanked with group activity of cooperative learning in which students develop inputs provided by the professor. Educational visits to food companies and / or research centers applied to the food industry represent an integral part of the course.

Objectives of the course

Knowledge:
The objective of the course is to introduce the student to the protechnological role of microorganisms in food. The main microbial groups commonly associated with food will be taken into consideration, particularly focusing on their role in spoilage, foodborne disease and food fermentations. Furthermore, ways to control the microbial development in food will be introduced. Finally, approaches for principal fermented foods will be addressed.

Ability to apply the knowledge:
The student will acquire the basic understanding regarding food microbiology. More specifically, it is expected that the different roles (safety, spoilage, technological importance) of microorganisms in food will be clear. Similarly, knowledge concerning the different approaches employed for limiting or guiding microbial development in food will be obtained.

Program

The class focuses on subjects that are configured in the learning context of quality and safety.

Frontal lessons:
Parameters that influence the survival or resistance of microorganisms in fermented foods.
Effect of various technological approaches employed by the food industry on the physiology of

microorganisms in foods.
Microorganisms involved in food fermentations (metabolism, characteristics)
Wine Microbiology: preliminary winemaking technology informations
The wine mo: non-Saccharomyces and S. cerevisiae
Classification of wine yeasts: characterization and identification
Natural and inoculated industrial fermentations
The malolactic bacteria, malolactic fermentation and yeast interactions
The ri-fermentative processes of wines: the sparkling wine
The wine faults
Microbiology of Dairy products: lactic acid bacteria and lactic fermentation
Dairy products: milk and fermented milk
Probiotics, prebiotics, pathogens and spoilage of milk
Cheeses
Microbiology of fermented sausages
Other food matrix: eggs, sauces and honey
The HACCP and FSO systems for food security
The role of bacteriophages in food microbiology

Lab Classes:
Sampling and microbiological analysis of food
Microbial counts, isolation
Identification of food isolates

Development of the course and examination

Methods of learning assessment:
The evaluation of the class is based on an oral exam.
The exam consists of an oral exam, also the student delivery their lab reports.

Criteria for assessing learning outcomes:
In the lab reports the student must demonstrate that they have achieved the ability to apply the knowledge acquired during the frontal lessons, to enforce a simple laboratory analysis with the ability to critically draw a report test.

Criteria for measuring learning outcomes:
The final evaluation is expressed in thirty. The exam is valid when the grade is greater than or equal to 18.

Criteria for conferring final mark:
The final grade is given by summing the evaluation of the oral exam with the laboratory report, up to a maximum of two points. Praise is given when the student has demonstrated full mastery of the subject.

Recommended reading

Slides available on the webpage of the class.
Microbiologia dei prodotti alimentari, G. A. Farris, M. Gobbetti, E. Neviani, M. Vincenzini, Casa Editrice Ambrosiana.

Microbiologia degli alimenti, J. M. Jay, M. J. Loessner, D. A. Golden. Springer.
Microbiologia degli Alimenti, Galli Volonterio, Casa Editrice Ambrosiana.

FORECASTING AND PREVENTION OF NATURAL DISASTER

MAURIZIO FERRETTI

Seat Scienze
A.A. 2016/2017
Credits 9
Hours 72
Period Corso annuale

Prerequisites

Elements of mathematics, geology, geomorphology, meteorology, topography.

Course contents

There will be lectures and practical exercises carried out individually or in small groups. Educational trips are also provided.

Objectives of the course

Knowledge:
Students will acquire the basic knowledge about natural hazards that may evolve into catastrophic scenarios. Predictability of such risks and remote control techniques, monitoring, supervision and interpretation of data and the physical parameters that contribute to the understanding of hazardous events are the other key concept of the course.

Knowledge:
Students will acquire the methodology for the approach to knowledge and analysis of natural hazards in multidisciplinary context. They will relate them to multiple factors such as the organization of the territory and of human activities.

Soft skills:
Lectures, tests in classroom and exercises help the student to became confident with specific terminology related to risks and improve its autonomy to judge and exanimate new unusual and unpredictable scenarios.

Program

RISK CALCULATION
Identification and risk calculation (the matrix method), cartographic reading and interpretation, analysis of topographic maps.
THE MODELING OPERATIONAL CHAIN FOR LANDSLIDE AND FLOOD RISK FORECAST
Nowcasting forecast tools: weather satellite a and radar

Forecast models: Global Circulation Models and Limited Area Models
Forecast using meteorological model outputs.
LANDSLIDE RISK
Lithological setting of Marche
Landslides: predisposing and triggering factors.
Analysis of different case studies
Rainfall and landslides relation for landslide forecast
Rainfall landslides thresholds
Physical based models and empirical relations for landslide forecast
Other regions studies
CF Marche activities
FLOOD RISK
Flood development stage
spatial and temporal scale
rainfall interpolation
rainfall data processing
Hydrological models
Rainfall flood thresholds
Elements of hydraulics models
Flood risk mitigation
FIRE RISK
Monitoring integrated systems
Risk management. Extinguishing activities
Planning and prevention
SEISMIC RISK
Seismogenesis.
Precursors.
Monitoring systems and data processing
Prevention activities
Case studies
VOLCANIC RISK
volcanism
Precursors.
PREVENTION ACTIVITIES
Case studies
EMERGENCY PLANNING
Summary of laws for emergency planning
Data for planning activities
Augustus method
Scenarios
Operational activities for risk management
EMERGENCY PLANNING
Emergency planning methods and civil protection plans as a non-structural prevention tools. At least 2 excursions dedicated to the direct knowledge of remote control systems, monitoring and strategic infrastructures.

An educational trip of two days dedicated to the specific knowledge of the control, monitoring, management and coordination of activities for the prediction and prevention of natural hazards is foreseen.

Development of the course and examination

Methods for assessing learning outcomes:
During the course, two tests are presented to students with at least 15 open questions. Questions concerns topics treated in previous lessons.

Criteria for assessing learning outcomes:
Mid test results are used during the final exam which is based on an interview with the student. Such oral examination consist in at least 3 questions.

Criteria for measuring learning outcomes:
The final mark is awarded out of thirty.

Criteria for conferring final mark:
The exam is passed when the grade is greater than or equal to 18. It is expected to be awarded the highest marks with honors (30 cum laude)

Recommended reading

Lectures notes;
Rosso Renzo, manuale di protezione idraulica del territorio. Appendice sulla normativa italiana in materia di difesa del suolo, protezione civile e dighe, CUSL (Milano) collana scientifica;
David E. Alexander, “Calamità Naturali”; Pitagora Editrice Bologna

FUNDAMENTALS OF BIOLOGY

MARIA ASSUNTA BISCOTTI

Seat Scienze
A.A. 2016/2017
Credits 7
Hours 56
Period 1^ semestre

Prerequisites

Knowledge of the basic concepts of physics, chemistry and genetics.

Course contents

Lectures are planned (6 credits) as well as laboratory practises (1 CFU).

Objectives of the course

Knowledge. At the end of the course students will have acquired the knowledge of the structure of biological macromolecules and of the general aspects of living organisms, the organization and functions of prokaryotic and eukaryotic cells, the molecular mechanisms responsible for flow of gene information from DNA to proteins, processes of gametogenesis and fertilization and the transmission of hereditary characters.

Ability to apply knowledge. At the end of the course students must be able to distinguish the main biological macromolecules, to understand the differences between prokaryotic and eukaryotic organisms, to recognize structures and cellular organelles, and the phases of the cell cycle. Moreover knowledge of the karyotype, meiosis, gametogenesis and the basic principles of Mendelian genetics will allow to understand the mechanisms of transmission of characters in organisms.

Soft skills. Through laboratory practices students will acquire autonomy in judgment and communication skills also arising from work in groups.

Program

General features of living matter. The cell theory. Chemical composition of living matter: the biological importance of water. The major classes of biological compounds: carbohydrates, lipids, proteins, nucleic acids.
Main cell study methods, the compound light microscope, the electron microscope. Virus.
Morphology and metabolism of prokaryotic cell. The eukaryotic cell: plasma membrane (structure and function), cytoskeleton (microtubules, microfilaments and intermediate filaments), rough and

smooth endoplasmic reticulum, Golgi apparatus, lysosomes, peroxisomes, exocytosis and endocytosis, cilia and flagella, mitochondria, chloroplasts, nucleus and nucleolus, cell junctions, cell communication (synaptic signaling, endocrine and neuroendocrine).
Information flow of living matter. DNA replication, transcription in prokaryotes and eukaryotes, maturation of mRNA, rRNA and tRNA. The apparatus of translation: ribosomes and tRNAs, the genetic code, translation in prokaryotes and eukaryotes. post-translational modifications and post-synthetic fate of proteins. The concept of the gene. The organization of the genome. The regulation of gene expression.
Cell division: cell cycle regulation. Mitosis. Meiosis. The human karyotype. Mendel's laws. autosomal dominant, autosomal recessive, sex-linked inheritance. Non-Mendelian inheritance. Asexual reproduction. Sexual reproduction: spermatogenesis, oogenesis. Ovarian and uterine cycle. Fertilization and basical elements of embryology.
The laboratory practices are based on key course topics such as the use of light microscopy for the study of cells, the nucleic acids, the karyotype, mitosis, and genetics.

Development of the course and examination

Methods for assessing learning outcomes:
Learning will be evaluated by oral exam.

Criteria for assessing learning outcomes:
During the oral exam the knowledge and understanding of the study subjects will be assessed by questions with different levels of difficulty on the topics covered.

Criteria for measuring learning outcomes:
The final mark will take into account the accuracy of contents and the terminology used by the student to answer the questions.

Criteria for conferring final mark:
The final mark will be assigned on the basis of the student's ability to provide answers that demonstrate mastery of the subject.

Recommended reading

Chieffi et al. Biologia e Genetica (Edises). Donati et al., Campbell. Biologia e Genetica (Pearson). Colombo e Olmo Biologia (Edi-Ermes).

FUNDAMENTALS OF EARTH SCIENCES

ALESSANDRA NEGRI

Seat Scienze
A.A. 2016/2017
Credits 8
Hours 64
Period 2^ semestre

Prerequisites

None

Course contents

Theoretical lessons (5 credits, 40 hours) and laboratory practical work carried out individually or in small groups and field exercises (2 credits, 24 hours).

Objectives of the course

knowledge:
The course enables students to acquire the basic knowledge related to the Earth sciences

Ability to apply the knowledge:
The student will also acquire the following professional skills: the ability to identify the rocks, Reading and interpretation of geological maps skills.

Soft skills:
Ability in communication and Synthesis.

Program

The earth: structure and composition
Major endogenous processes (volcanoes and earthquakes) –
The minerals of the rocks: identification, technical properties, uses
Sedimentary rocks Formation of sedimentary rocks; structure of sedimentary rocks; classification of sedimentary rocks, carbonate rocks, siliceous rocks, clastic rocks and their varieties; pyroclastic rocks; organogenic rocks, chemical rocks. Fossil fuels; evaporitic rocks.
Magmatic rocks Extrusive and intrusive, classification by Streckeisen
Metamorphic rocks Metamorphic processes and facies, types of metamorphism. Structure and composition of metamorphic rocks, index minerals of metamorphic rocks.
The expansion of the ocean floor The mid-ocean ridges, the large fracture zones, heat flow, the expansion of the ocean floor; paleomagnetism, reverse polarity. Exploration of the ocean,

methodologies and tools, Margins, Platform, Escarpment and Upward. Sedimentation on the margins and in the deep sea. And sedimentation processes in different environments: transitional river slopes, glacial. Concepts of subsidence, isostasy.
Plate Tectonics Structure of the lithosphere, convective cells, causes movement of the plates, rifted margins, transform, active and dynamic descriptive elements. Arc-trench and their structure. Hot spots. Seismicity and earthquakes. The Orogenesis Examples: Alps, Apennines.
Elements of structural geology and structural geomorphology The deformations of the rocks; arrangement of rocks, factors that influence the deformation of the rocks; regional movements of the earth's crust. Faults, their classification and their elements. Grabens. Folds, their classification and their elements. Nappe.
Elements of stratigraphy Stratigraphic methods, principles and stratigraphic units. The Geological Time Scale
Topographic and Geological maps Elements of interpretation of topographic maps and geological maps, morphological profile design.

Laboratory exercises Igneous and metamorphic sedimentary rocks identification, Reading and interpretation of topographic and geological maps.

Fieldwork to Umbria and Marche hinterland to observe in the field what has been described in class and to identify elements of lithology Stratigraphy and geology. Use of the geological compass

Development of the course and examination

Methods for assessing learning outcomes:
Practical Rocks identifications (10 points). Written Test and later review / discussion of the papers (20 points).
In the test 20 open questions are scheduled. To Each question is given a score between zero and one. The exam is passed when the final grade is greater than or equal to 18. During the course of lessons is also the possibility to participate in trials ongoing (rocks identification).

Criteria for assessing learning outcomes:
In the written test, the student must demonstrate knowledge of principles and methods (theory) of the fundamental of the earth sciences.

Criteria for assessing learning outcomes:
The final mark is awarded out of thirty. The exam is passed when the grade is greater than or equal to 18. It is expected to be awarded the highest marks with honors (30 cum laude).

Criteria for conferring final mark:
The final grade is given by adding to the written exam (up to 20 points) one of the rocks recognition test (up to 10 points). honors is attributed when the score obtained from the previous sum exceeds the value 30 while the student has demonstrated full knowledge of the subject.

Recommended reading

Teacher’s Notes
Capire la Terra - Frank Press & Raymond Siever (Zanichelli);
Scienze della Terra - Pompeo Casati (Città Studi Edizioni)

FUNDAMENTALS OF ECOLOGICAL SYSTEMS ANALYSIS

CRISTINA GAMBI

Seat Scienze
A.A. 2016/2017
Credits 8
Hours 64
Period 2^ semestre

Prerequisites

Knowledge of Mathematics, Physics, General Chemistry, Organic Chemistry, Fundamentals of Biology, Oceanography, Meteorology and Climatology

Course contents

The course is based on lectures (7 credits, 56 hours) and on practical exercises (1 credit, 8 hours) on data elaboration and definition of sampling strategies. The material presented in class is made available in the restricted area dedicated to the course in Sciences Moodle. The system will be used also to show the results of the exam.

Objectives of the course

Knowledge:
The course allows to acquire the basic knowledge of the ecology (concept of ecosystem, biotic and abiotic components and their interactions) and of the analysis of marine and terrestrial ecosystems (using different experimental approaches, methods and sampling strategies).

Ability to apply the knowledge:
The student will acquire the following professional skills: the ability to analyze an ecosystem with a holistic approach based on a proper sampling strategy and on the collection of a critical amount of data representative of the investigated system.

Soft skills:
The data processing and presentation during the practical exercises will help to improve the level of autonomy of the student in dealing with ecological issues and his/her communication ability to present a topic.

Program

Content (lectures, 7 CFU, 56 hours):
Ecosystem: definition, structure, properties and fundamental components. Comparison between marine and terrestrial ecosystems. Abiotic factors and their relationships with organisms. Organic

matter, detritus, biomass. Primary and secondary production. The cycle of water and the main biogeochemical cycles. Population ecology principles. Life strategy: r and k species. Ecological niche and habitat. Resilience and resistance. Resources and trophic structure. Species interactions: predation and competition. Biodiversity and ecological stability. Diversity index, measuring biodiversity, spatial and temporal gradients. Trophic chains and nets. Analysis of some selected ecosystems. Sampling strategy and methods in marine and terrestrial ecosystems.

Practical exercises:
Elaboration of ecological data collected in different cases study.
Presentation of the results of the analysis performed during the practical exercises.

Development of the course and examination

Methods for assessing learning outcomes:
The student will show knowledge gained during the course by means of a written test based on 32 questions: 30 questions are closed and multiple-choice while two questions are open. Multiple answers can be correct in the closed questions. All correct responses = 1 point; every wrong answer = - 0.2 points; one correct answer of the two = 0.5 points (1 point fractionated by the number of correct answers); a response correct of the two and one wrong = 1/2 = 0.5- 0.2 = 0.3 points; two correct answers and one wrong = 1-0.2 = 0.8 points. I cannot answer and no answer (not open) = 0 points.

Criteria for assessing learning outcomes:
In the written examination, students have to demonstrate that they have acquired basic principles of the ecology (characteristics of ecosystems, their functioning and dynamics). The two open questions will allow to evaluate the autonomy to deal with an issue and then the ability to communicate the information gained during the course.

Criteria for measuring learning outcomes:
The final vote of the exam is attributed in thirty. The exam is passed when the score is equal or higher than 18. In case of a score higher than 30 the final vote will be cum laude.

Criteria for conferring final mark:
The final score is awarded following the written exam. Praise is attributed when the score obtained by the written test exceeds the value of 30.

Recommended reading

Notes from lessons
Odum EP. 2001. Ecologia, un ponte tra scienza e società. Piccin, Padova
Bregon M, Harper JL, Townsend CR. 2000. Ecologia, individui, popolazioni, comunità. Zanichelli, Bologna
Chelazzi G, Provini A, Santini G. 2004. Ecologia dagli organismi agli ecosistemi. Ambrosiana, Milano

FUNDAMENTALS OF ENVIRONMENTAL IMPACT ASSESSMENT

STEFANIA GORBI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 1^ semestre

Prerequisites

Knowledge of ecological processes, biology and marine sedimentary environment

Course contents

The course includes lectures and laboratory practical activities in the computer laboratory; the course will aimed to prepare students for defining general criteria for the environmental impact assessment, both in industrialized and developing countries, and to develop conceptual and methodological criteria for the formulation of the quality standards.
Students will study some example of environmental impact assessment according to the main European directives; a practical activity will carried out through the presentation of an environmental impact study.

Objectives of the course

Knowledge:
The course enables students to acquire the fundamental knowledge of the theoretical and methodological basis for the environmental standard quality assessment (with particular concern to the marine environment), to define the complexity between development of productive activities and environmental protection, management options and environmental impact assessment

Ability to apply the knowledge:
At the end of the course, the student should have the capability to describe fundamentals and general principles of environmental impact assessment, to apply criteria for environmental management of coastal areas, dredging, remediation and coastal erosion, to know the main European policies regarding the environmental management and marine pollution prevention, to apply criteria for the study of the impact assessment in marine and coastal environment.

Program

Prevention of marine environmental pollution: economic and political issues.
Resources definition, resource use, economic value of the resources.
Environmental Quality Standard (EQS); formulation, technical aspects and critical points in setting limits for quality standards. Determination of the Quality Standards for the marine environment.
Environmental Impact Assessment (EIA): main normative guidelines, administrative and technical procedures; screening and scooping.
The Environmental Impact Study (EIS): main normative guidelines, definition of an environmental impact study, alternatives and mitigations.
EIA and SIA: main differences between the environmental and strategic impact assessment.
REACH regulation: Registration, Evaluation, Authorization and Restriction of Chemical substances.
Integrated Pollution Prevention and Control Directive and procedure for the Environmental Authorization (EA).
Marine Strategy Framework Directive 2008/56/CE for a Good Marine Environmental Status.
Management of contaminated marine sediment: analytical procedures to characterized their quality.
Economy and normative restrictions to prevent, limit, monitor and remediate environmental pollution in marine environment. Practical examples on management options and technical approaches in dredging and disposal of sediments.
Remediation of contaminated marine area.

PRACTICAL ACTIVITY. Practical activity will carried out in the computer lab where students will use the main web sites concerning the Environmental Impact Assessment; the will learn to consult all the information on the EIA procedures and EIS. A PPT presentation will be prepared on a EIS, chosen among those available on the web site: http://www.va.minambiente.it/it-IT

Development of the course and examination

Methods for assessing learning outcomes
Oral examination in which the students have to answer to the questions (almost 3) concerning the issues of the lectures and the practical activities.

Criteria for assessing learning outcomes:
During the oral exam, the students must demonstrate that they have acquired basic knowledge about the main issues concerning the lessons and practical activities.

Criteria for measuring learning outcomes:
The final mark is assigned in a scale of thirty. The exam is passed when the score is equal or greater than 18. It is expected to be awarded the highest marks with honors (30 cum laude).

Criteria for conferring final mark:
The final score is based on the result of the oral examination

Recommended reading

Lecture notes and slides https://servizi.scienze.univpm.it/moodle
«Biochimica Applicata» M. Stoppini, V. Bellotti EdiSES.

FUNDAMENTALS OF OCEANOGRAPHY, METEOROLOGY AND CLIMATOLOGY

FRANCESCO BOCCANERA

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 2^ semestre

Prerequisites

Knowledge of matemathical subjects

Course contents

Theoretical lessons and practical works carried out both as individual and little groups works, are planned.

Objectives of the course

Knowledge:
The course enables students to acquire the basic knowledge of physics of geophysical fluids (dynamics and thermodynamics), in order to understand the relevant processes and the interactions between them. It also provides knowledge about some aspects of cloud microphysics, of planetary boundary layer and the main radiative processes. Some knowledges about the processes that regulate the Earth's climate complete the
Course

Ability to apply the knowledge:
The student will also acquire the following professional skills: the ability of description of the main physical phenomena that affect the atmosphere and the ocean, for a better understanding of the connection with the different topics or with different environmental issues.

Soft skills:
The course helps to improve the capacity of analysis and synthesis of information and the communication skills of the students.

Program

Contents (lezioni frontali, 6 CFU, 48 ore):
Introduction to atmospheric and oceanographic science.
Oceanography, meteorology and climatology and their applications; physical properties of seawater; atmosphere structure; physical parameters and their distribution; scales of atmospheric motions.

Atmospheric thermodynamics
The gas laws; the hydrostatic equation; adiabatic processes; potential temperature; phase transitions; static stability; thermodynamic diagrams
Clouds and precipitation
saturation; nucleation of water droplets and ice crystals; growth mechanisms; classification of clouds
Fluidodynamics
forces and Newton's second law; equations of motion; winds and currents; the continuity equation; apparent forces in a rotating system; geostrophic approximation; Rossby waves; vorticity
Radiative phenomena
The spectrum of radiation; radiation laws; orbital factors; absorption, emission and diffusion; the global energy balance
The general circulation
Energy considerations; thermal wind; jet stream; general circulation of the atmosphere
Synoptic meteorology
structures of high and low pressure; cyclogenesis; air masses and fronts; analysis of synoptic charts; weather forecasting
Boundary layer and small-scale circulation
evolution of the boundary layer; turbulence; Ekman spiral; small-scale atmospheric circulations
Oceanography
composition and physical characteristics of seawater; ocean circulation; tydal forcing
Climatology
types of climate; history of the Earth's climate; climate change; ocean-atmosphere interaction; teleconnections: "El Niño-Southern Oscillation (ENSO)" and North Atlantic Oscillation (NAO).

Practical works:
Exercitations on the use of thermodinamic diagrams are planned.

Development of the course and examination

Methods for assessing learning outcomes:
The assessment of learning is through an oral interview. The exam consists of three questions regarding course content, which may also include the use of knowledges acquired through the exercitations. For each response is given a score between 0 and 10 points. The exam is passed when the final grade is greater than or equal to 18.

Criteria for assessing learning outcomes:
During the interview, kowledge of the course arguments, mathematical formalism and communication ability are evaluated.

Criteria for measuring learning outcomes:
The final mark is awarded out of thirty. The exam is passed when the mark is greater than or equal to 18. It is expected to be awarded the highest marks with honors (30 cum laude).

Criteria for conferring final mark:
The final grade is given by adding the scores for each of the three questions of the exam. Laude is attributed when the score obtained from the previous sum is equal to the value of 30, and at the same time, the student has demonstrated good command of the subject.

Recommended reading

teacher's lecture notes
J. M. Wallace, P. V. Hobbs: Atmospheric Science II ed., Academic Press
R. V. Rohli, A. J. Vega, Climatology, Jones and Barlett Publishers
S. Pond, G. L. Pickard, Introductory Dynamic Oceanography, II ed., Pergamon Press

GENERAL MICROBIOLOGY (A-L)

FRANCESCA BIAVASCO

Seat Scienze
A.A. 2016/2017
Credits 8
Hours 64
Period 2^ semestre

Prerequisites

Basic knowledge of Biochemistry and Cytology

Course contents

The course encompasses lectures (7 credits, 56 hours), including classroom exercises, and lab practice in small working groups (1 credit, 8 hours). Course attendance is not mandatory, although lab practice is strongly recommended. Students who have not followed labs must anyway know their content and be able to describe the experimental assays (they can find detailed lecture notes on the Department web site and ask the professor for clarification).

Objectives of the course

Knowledge:
At the end of the course students will be required to know the structure and metabolic features of the different groups of microorganisms, both cellular and acellular; the interactions of microorganisms among themselves, with other living organisms and with the environment; microbial pathogenicity and host defense mechanisms. They will also be required to have basic knowledge of microorganism cultivation and of methods for their count and growth control by physical and chemical agents. Students will also be aware of the different fields of application of Microbiology.

Ability to apply the knowledge:
Students will have the ability of recognizing the different types of microorganisms on the bases of their peculiar features (e.g. nutrient requirement, staining properties, motility), growing bacteria and obtaining pure cultures, determining bacterial loads (CFU and OD determination) and antibiotic susceptibility (disk diffusion) by basic technical approaches.

Soft skills:
Lab practice will contribute to carry out basic lab techniques and to develop students’ independence in terms of work management (use of standards and controls), the ability to work as a part of a team and to a critical interpretation of the results.

Program

What you'll learn (theoretical tarining,7 credits, 56 hours).Diversity and history of microorganisms. The three-domain view of life. Prokaryotes, eukaryotes, viruses.
The prokaryotes. Bacteria and Archaea.
Structure and function of prokaryotic cells. The cell surface of bacteria: Gram-positive and Gram-negative bacterial cell wall, Peptidoglycan structure and biosynthesis. Surface polysaccarides, flagella, and fimbriae. The cell surface of Archaea.
The cytoplasmic membrane and the cytoplasm. The Endospore: structure, sporulation and germination.
Mechanics of flagella-mediated motility, chemotaxis; other types of motility. Bacterial differentiation.
Bacterial genetics: bacterial DNA replication; mobile genetic elements (plasmids, insertion sequences, transposons). Horizontal gene transfer among bacteria: transformation, transduction and conjugation.
The eukaryotic microbes. General features, reproduction and classification of protozoa and fungi.
Biological cycles of the main parasites that are pathogenic to humans
The viruses. General features. Viruses of mammalian cells: structure and classification; steps of viral replication. Effects on host cells. Viral persistence, latency and cellular transformation.
Bacteriophages. Virulent and lysogenic bacteriophages: phage T4 and phage lambda replication; lysogenic conversion.
Microbial nutrition and growth. Metabolic types: aerobic, anaerobic, fermentation, photosynthesis; breakdown of polymers and transport across the cytoplasmic membrane. Interactions of prokaryotes with their environment.
Study and cultivation of Microorganisms. Methods to Microscopy and staining. Cultivation of microorganisms: selection of medium and atmosphere; pure cultures; measurement of growth, the growth curve. Methods of virus cultivation.
Control of microbial growth. Disinfection and sterilization. Antibiotics: general features, mechanisms of action and resistance. Antimicrobial susceptibility testing: antibiogram.
Microbial ecology and microorganism-host interactions. Microbial communities. Symbiotic interactions: commensalism, mutualism, parasitism. Pathogenicity and virulence: adhesiveness, invasiveness and toxin production. Endotoxins and exotoxins. Nonspecific and specific human body defenses. Immune response, antigens and antibodies, cells involved in the immune response, vaccines.
Lab practice (1 credit, 8 hours)
- Pure cultures;
- Use of different culture media, both rich and selective/differential;
- Evaluation of bacterial load by CFU determination and spectrophotometer readings;
- Phage titration and host range determination;
- Disk diffusion antibiotic susceptibility test.

Development of the course and examination

Methods for assessing learning outcomes:
The exam will take the form of an interview and each student will be asked three questions. Erasmus students can have a written multiple-choice test in either English or Italian including 30 questions.

Criteria for assessing learning outcomes:
Each student will be required to demonstrate an understanding of the asked topic and to be able to organize a logical and understandable answer, he should also be able to make connections with different general microbiology topics and with related, and entry required, disciplines. The student will be required to demonstrate his knowledge of the theoretical bases of the sperimental

procedures he is asked to describe.
Students who will face the written test will have to mark the correct answer.

Criteria for assessing learning outcomes:
A 30-point scale will be used to measure your performance, with 18 being the minimum score to pass the exam and 30 being the highest. In the event of an outstanding performance, the professor can decide to reward the students with a 30 cum laude.

Criteria for conferring final mark:
The final mark will be awarded based on the evaluation of the answers to the three questions. Honors will be awarded when the mark is 30 and the student has demonstrated a particularly good command of the matter.

Recommended reading

D.R. Wessner, C. Dupont, T.C. Charles. Microbiologia. Casa Editrice Ambrosiana 2015.
Gianni Dehò e Enrica Galli. Biologia dei microrganismi. Casa Editrice Ambrosiana 2014.
Madigan, Martinko, Stahl, Clark. Brock-Biologia dei microrganismi. Volume 1-Microbiologia generale, Casa Editrice Pearson 2012.
Wiley M., Sherwood M., Woolverton. J. Prescott, Microbiologia – volume 1- Microbiologia generale, casa Editrice McGraw – Hill 2009.
Schaechter, Ingraham, Neidhardt “Microbiologia”. Casa Editrice Zanichelli, 2007.
Lecture and lab practice exercises notes.

GENERAL MICROBIOLOGY (M-Z)

FRANCESCA BIAVASCO

Seat Scienze
A.A. 2016/2017
Credits 8
Hours 64
Period 2^ semestre

Prerequisites

Basic knowledge of Biochemistry and Cytology

Course contents

The course encompasses lectures (7 credits, 56 hours), including classroom exercises, and lab practice in small working groups (1 credit, 8 hours). Course attendance is not mandatory, although lab practice is strongly recommended. Students who have not followed labs must anyway know their content and be able to describe the experimental assays (they can find detailed lecture notes on the Department web site and ask the professor for clarification).

Objectives of the course

Knowledge:
At the end of the course students will be required to know the structure and metabolic features of the different groups of microorganisms, both cellular and acellular; the interactions of microorganisms among themselves, with other living organisms and with the environment; microbial pathogenicity and host defense mechanisms. They will also be required to have basic knowledge of microorganism cultivation and of methods for their count and growth control by physical and chemical agents. Students will also be aware of the different fields of application of Microbiology.

Ability to apply knowledge:
Students will have the ability of recognizing the different types of microorganisms on the bases of their peculiar features (e.g. nutrient requirement, staining properties, motility), growing bacteria and obtaining pure cultures, determining bacterial loads (CFU and OD determination) and antibiotic susceptibility (disk diffusion) by basic technical approaches.

Soft skills:
Lab practice will contribute to carry out basic lab techniques and to develop students' independence in terms of work management (use of standards and controls), the ability to work as a part of a team and to a critical interpretation of the results.

Program

What you’ll learn (theoretical tarining,7 credits, 56 hours).Diversity and history of microorganisms.
The three-domain view of life. Prokaryotes, eukaryotes, viruses.
The prokaryotes. Bacteria and Archaea.
Structure and function of prokaryotic cells. The cell surface of bacteria: Gram-positive and Gram-negative bacterial cell wall, Peptidoglycan structure and biosynthesis. Surface polysaccarides, flagella, and fimbriae. The cell surface of Archaea.
The cytoplasmic membrane and the cytoplasm. The Endospore: structure, sporulation and germination.
Mechanics of flagella-mediated motility, chemotaxis; other types of motility. Bacterial differentiation.
Bacterial genetics: bacterial DNA replication; mobile genetic elements (plasmids, insertion sequences, transposons). Horizontal gene transfer among bacteria: transformation, transduction and conjugation.
The eukaryotic microbes. General features, reproduction and classification of protozoa and fungi.
Biological cycles of the main parasites that are pathogenic to humans
The viruses. General features. Viruses of mammalian cells: structure and classification; steps of viral replication. Effects on host cells. Viral persistence, latency and cellular transformation.
Bacteriophages. Virulent and lysogenic bacteriophages: phage T4 and phage lambda replication; lysogenic conversion.
Microbial nutrition and growth. Metabolic types: aerobic, anaerobic, fermentation, photosynthesis; breakdown of polymers and transport across the cytoplasmic membrane. Interactions of prokaryotes with their environment.
Study and cultivation of Microorganisms. Methods to Microscopy and staining. Cultivation of microorganisms: selection of medium and atmosphere; pure cultures; measurement of growth, the growth curve. Methods of virus cultivation.
Control of microbial growth. Disinfection and sterilization. Antibiotics: general features, mechanisms of action and resistance. Antimicrobial susceptibility testing: antibiogram.
Microbial ecology and microorganism-host interactions. Microbial communities. Symbiotic interactions: commensalism, mutualism, parasitism. Pathogenicity and virulence: adhesiveness, invasiveness and toxin production. Endotoxins and exotoxins. Nonspecific and specific human body defenses. Immune response, antigens and antibodies, cells involved in the immune response, vaccines.
Lab practice (1 credit, 8 hours)
- Pure cultures;
- Use of different culture media, both rich and selective/differential;
- Evaluation of bacterial load by CFU determination and spectrophotometer readings;
- Phage titration and host range determination;
- Disk diffusion antibiotic susceptibility test.

Development of the course and examination

Methods for assessing learning outcomes:
The exam will take the form of an interview and each student will be asked three questions. Erasmus students can have a written multiple-choice test in either English or Italian including 30 questions.

Criteria for assessing learning outcomes:
Each student will be required to demonstrate an understanding of the asked topic and to be able to organize a logical and understandable answer, he should also be able to make connections with different general microbiology topics and with related, and entry required, disciplines. The student will be required to demonstrate his knowledge of the theoretical bases of the sperimental

procedures he is asked to describe.
Students who will face the written test will have to mark the correct answer.

Criteria for assessing learning outcomes:
A 30-point scale will be used to measure your performance, with 18 being the minimum score to pass the exam and 30 being the highest. In the event of an outstanding performance, the professor can decide to reward the students with a 30 cum laude.

Criteria for conferring final mark:
The final mark will be awarded based on the evaluation of the answers to the three questions. Honors will be awarded when the mark is 30 and the student has demonstrated a particularly good command of the matter.

Recommended reading

D.R. Wessner, C. Dupont, T.C. Charles. Microbiologia. Casa Editrice Ambrosiana 2015.
Gianni Dehò e Enrica Galli. Biologia dei microrganismi. Casa Editrice Ambrosiana 2014.
Madigan, Martinko, Bender, Buckley, Stahl. Brock-Biologia dei microrganismi. 14ed, Casa Editrice Pearson 2016.
Wiley M., Sherwood M., Woolverton. J. Prescott, Microbiologia – volume 1- Microbiologia generale, casa Editrice McGraw – Hill 2009.
Schaechter, Ingraham, Neidhardt “Microbiologia”. Casa Editrice Zanichelli, 2007.
Lecture and lab practice exercises notes.

GENERAL PHYSIOLOGY (A-L)

PAOLO MIGANI

Seat Scienze
A.A. 2016/2017
Credits 9
Hours 72
Period 2^ semestre

Prerequisites

To attend the course of General Physiology, students must have notions of Mathematics, Physics, Chemistry and Comparative Anatomy, at the level of the corresponding Biological Sciences courses. Basic notions on Biochemistry would be beneficial.

Course contents

The course constitutes of theoretical classes to take place in a total period of 72 hours. Practical classes with the use of living animals or recently dissected organs will not take place to spare animal's life and suffering. During theoretical classes, however, numerical simulations will be conducted on dynamics and regulation of physiological parameters, particularly in the cardiovascular field.

Objectives of the course

Knowledge:
The aim of the General Physiology course is to provide the students with basic knowledge of structure and specific functions of organs and apparatuses in animal organisms (particularly Vertebrates).

Ability to apply the knowledge:
Another aim of the General Physiology course is that of the increase of student's knowledge on the application of laws of physics and physical chemistry on the understanding of basic and regulatory mechanisms in animal organs and apparatuses.

Soft skill:
Another aim is the development of the student's attitude towards the general usage of the Scientific Method. Another aim is that of promoting the knowledge of the theoretical and practical aspects of the main analytical methods in use in different fields of the biological research.

Program

Course classes will cover the present list of topics:
Overview of aims, theories and methods of General Physiology.
Morphology and functional organization of Central Nervous System and neuromuscular apparatus.
Structure and functions of membranes in excitable cells. Membrane electric field and potential.
Electrochemical potential. Ionic composition of intra and extracellular fluids; Nernst´s equation and the equilibrium potential. Membrane permeability; ion pumps.
The action potential. Electric models of excitable membranes. Membrane ionic conductance; voltage-dependent channels. Initiation and distance transmission of the action potential.
The sensory structures and functions. Sensory receptors. Special sensory organs in marine animals.
Synapses: morphology and functions. Electrical synapses. Chemical synapses. Synaptic transmitters; synaptic membrane receptors. Excitatory and inhibitory post-synaptic potentials.
Skeletal and smooth muscles: features and functions. The role of skeletal muscles in movements and posture. Skeletal muscle structure: biochemistry and the constituents of the functional unit (sarcomere). The neuromuscular synapse and nervous command. Excitation-contraction coupling. Nature and role of the visco-elastic components in contraction. Vertebrate posture and movements.
The Vertebrate circulatory apparatus: morphology and functional features. Functions of myocardium and conduction tissue. Mechanics of the cardiac cycle. Electric events of the cardiac cycle and electrocardiography. Blood vessel structure at the microscopic and macroscopic level, with references to blood circulation. Circulatory physics and hemodynamics. Regulation in hemodynamic parameters: physiology of the intrinsic regulation. External regulation: Autonomic Nervous System and the integrated cardiovascular reflexes.
The Vertebrate respiratory apparatus: morphology and functions. Mechanics in lungs, airways and thoracic cage. Mechanics of the respiratory cycle: automatic cycle control ad its chemical regulation. Gas exchanges in gills, alveoli and in tissues. Physical chemistry of gas exchanges through epithelia.
Blood transport of respiratory gases. Structure and functions of the haemoglobins and myoglobin.
The renal apparatus in Vertebrates and non-Vertebrates: morphology and functions. Physics of glomerular filtration; measurement and physiological relevance of the renal clearance of blood substances.
The tubular reabsorption. Outline of the transport of solutes in cells; membrane carriers. Water obligatory and facultative reabsorption.
The pH in body fluids. Buffer systems in extra and intracellular fluids. Physiological and pathological pH changes and their renal regulation.

Development of the course and examination

Methods for assessing learning outcomes:
Exams for the General Physiology course constitute by a written test and an oral examination.
There will be no mid-term exams.
The written test constitute of three short texts, as responses to questions on general physiological topics. Question titles will indicate sub-topics, following a possible logical progression from general to specific topics; students will be free, however, to develop in their writings a personal path for the expression of their knowledge.
As an early evaluation each writing will be scored to a maximum of ten points.
The oral examination will take the form of a discussion/revision of writings and could either add or subtract points to their earlier score.

Criteria for assessing learning outcomes:
Students should show in their written answers and during the oral discussion the followings

1. To have knowledge of the structure and the anatomical relations of organs and apparatuses where physiological mechanisms listed in the course program take place;
2. To have knowledge of physics and physical chemistry laws on which those mechanisms are based;
3. To have proficiency on the applications of those laws to explain physiological mechanisms. In the occurrence of crucial experiments on those mechanisms, students should describe the logical frame that links the design of the experiments themselves and their results.

Criteria for measuring learning outcomes:
The maximum possible score for each of the written answers will be 10 points. This maximum score will be reduced by multiplication by a number ranging from 1.0 to 0.75, following the tested level of knowledge on the matter described at the first point of the previous paragraph. A reduction corresponding to the lesser fraction will also apply when students will show sole knowledge of memorized data and/or evidently misunderstand the anatomical and functional reality of organs and apparatuses. The same reduction will also apply for the lack of knowledge on the laws described at the second point of the previous paragraph and for the lack of proficiency on the logical application of those laws, as at the third point of the paragraph. The multiplication of all fractional numbers with the maximum possible score will constitute the actual score for the written exam; this score could be modified by the refinement of the fractions following the oral examination.

Criteria for conferring final mark:
The final score constitutes by points out of a maximum of 30, constituted by the sum of the scores of each written answer (10 points multiplied by the fractional numbers). Students will pass the exam by a minimum of 18 points or higher score. A ‘cum laude’ praise is granted to students whenever they attain a maximum score and demonstrate a full mastery of the matter.

Recommended reading

Detailed lecture notes on the General Physiology course (A-L), in the University online site.
Textbook by different Authors (edited by E. D'Angelo and A. Peres). Fisiologia: molecole, cellule e sistemi. EdiErmes, Milano.
C. Casella V. Taglietti (Auth.s) Principi di Fisiologia - Volume I e II, La Goliardica Pavese.
D.U. Silverthorn (Auth.) Fisiologia, Casa Editrice Ambrosiana.

GENERAL PHYSIOLOGY (M-Z)

PAOLO MIGANI

Seat Scienze
A.A. 2016/2017
Credits 9
Hours 81
Period 2^ semestre

Prerequisites

To attend the course of General Physiology, students must have notions of Mathematics, Physics, Chemistry and Comparative Anatomy, at the level of the corresponding Biological Sciences courses. Basic notions on Biochemistry would be beneficial.

Course contents

The course constitutes of theoretical classes to take place in a total period of 72 hours. Practical classes with the use of living animals or recently dissected organs will not take place to spare animal's life and suffering. During theoretical classes, however, numerical simulations will be conducted on dynamics and regulation of physiological parameters, particularly in the cardiovascular field.

Objectives of the course

Knowledge:
The aim of the General Physiology course is to provide the students with basic knowledge of structure and specific functions of organs and apparatuses in animal organisms (particularly Vertebrates).

Ability to apply the knowledge:
Another aim of the General Physiology course is that of the increase of student's knowledge on the application of laws of physics and physical chemistry on the understanding of basic and regulatory mechanisms in animal organs and apparatuses.

Soft skill:
Another aim is the development of the student's attitude towards the general usage of the Scientific Method. Another aim is that of promoting the knowledge of the theoretical and practical aspects of the main analytical methods in use in different fields of the biological research.

Program

Course classes will cover the present list of topics:
Overview of aims, theories and methods of General Physiology.
Morphology and functional organization of Central Nervous System and neuromuscular apparatus.
Structure and functions of membranes in excitable cells. Membrane electric field and potential. Electrochemical potential. Ionic composition of intra and extracellular fluids; Nernst´s equation and the equilibrium potential. Membrane permeability; ion pumps.
The action potential. Electric models of excitable membranes. Membrane ionic conductance; voltage-dependent channels. Initiation and distance transmission of the action potential.
The sensory structures and functions. Sensory receptors. Special sensory organs in marine animals.
Synapses: morphology and functions. Electrical synapses. Chemical synapses. Synaptic transmitters; synaptic membrane receptors. Excitatory and inhibitory post-synaptic potentials.
Skeletal and smooth muscles: features and functions. The role of skeletal muscles in movements and posture. Skeletal muscle structure: biochemistry and the constituents of the functional unit (sarcomere). The neuromuscular synapse and nervous command. Excitation-contraction coupling. Nature and role of the visco-elastic components in contraction. Vertebrate posture and movements.
The Vertebrate circulatory apparatus: morphology and functional features. Functions of myocardium and conduction tissue. Mechanics of the cardiac cycle. Electric events of the cardiac cycle and electrocardiography. Blood vessel structure at the microscopic and macroscopic level, with references to blood circulation. Circulatory physics and hemodynamics. Regulation in hemodynamic parameters: physiology of the intrinsic regulation. External regulation: Autonomic Nervous System and the integrated cardiovascular reflexes.
The Vertebrate respiratory apparatus: morphology and functions. Mechanics in lungs, airways and thoracic cage. Mechanics of the respiratory cycle: automatic cycle control ad its chemical regulation. Gas exchanges in gills, alveoli and in tissues. Physical chemistry of gas exchanges through epithelia.
Blood transport of respiratory gases. Structure and functions of the haemoglobins and myoglobin.
The renal apparatus in Vertebrates and non-Vertebrates: morphology and functions. Physics of glomerular filtration; measurement and physiological relevance of the renal clearance of blood substances.
The tubular reabsorption. Outline of the transport of solutes in cells; membrane carriers. Water obligatory and facultative reabsorption.
The pH in body fluids. Buffer systems in extra and intracellular fluids. Physiological and pathological pH changes and their renal regulation.

Development of the course and examination

Methods for assessing learning outcomes:
Exams for the General Physiology course constitute by a written test and an oral examination. There will be no mid-term exams.
The written test constitute of three short texts, as responses to questions on general physiological topics. Question titles will indicate sub-topics, following a possible logical progression from general to specific topics; students will be free, however, to develop in their writings a personal path for the expression of their knowledge.
As an early evaluation each writing will be scored to a maximum of ten points.
The oral examination will take the form of a discussion/revision of writings and could either add or subtract points to their earlier score.

Criteria for assessing learning outcomes:
Students should show in their written answers and during the oral discussion the followings

1. To have knowledge of the structure and the anatomical relations of organs and apparatuses where physiological mechanisms listed in the course program take place;
2. To have knowledge of physics and physical chemistry laws on which those mechanisms are based;
3. To have proficiency on the applications of those laws to explain physiological mechanisms. In the occurrence of crucial experiments on those mechanisms, students should describe the logical frame that links the design of the experiments themselves and their results.

Criteria for measuring learning outcomes:
The maximum possible score for each of the written answers will be 10 points. This maximum score will be reduced by multiplication by a number ranging from 1.0 to 0.75, following the tested level of knowledge on the matter described at the first point of the previous paragraph. A reduction corresponding to the lesser fraction will also apply when students will show sole knowledge of memorized data and/or evidently misunderstand the anatomical and functional reality of organs and apparatuses. The same reduction will also apply for the lack of knowledge on the laws described at the second point of the previous paragraph and for the lack of proficiency on the logical application of those laws, as at the third point of the paragraph. The multiplication of all fractional numbers with the maximum possible score will constitute the actual score for the written exam; this score could be modified by the refinement of the fractions following the oral examination.

Criteria for conferring final mark:
The final score constitutes by points out of a maximum of 30, constituted by the sum of the scores of each written answer (10 points multiplied by the fractional numbers). Students will pass the exam by a minimum of 18 points or higher score. A ‘cum laude’ praise is granted to students whenever they attain a maximum score and demonstrate a full mastery of the matter.

Recommended reading

Detailed lecture notes on the General Physiology course (A-L), in the University online site.
Textbook by different Authors (edited by E. D'Angelo and A. Peres). Fisiologia: molecole, cellule e sistemi. EdiErmes, Milano.
C. Casella V. Taglietti (Auth.s) Principi di Fisiologia - Volume I e II, La Goliardica Pavese.
D.U. Silverthorn (Auth.) Fisiologia, Casa Editrice Ambrosiana.

GENETIC ENGINEERING

TIZIANA CACCIAMANI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 2^ semestre

Prerequisites

The course provides a multidisciplinary approach, therefore good background in Molecular Biology, Microbiology, Genetics, Biochemistry and Bioinformatics are suggested.

Course contents

The course provides a multidisciplinary approach, therefore good background in Molecular Biology, Microbiology, Genetics, Biochemistry and Bioinformatics are suggested.

Objectives of the course

Knowledge
The course provides students with:
the theoretical and methodological bases used to produce recombinant DNA in different organisms; (b) know how to draw information from genetic, protein and medical databases for applications design in various biotechnological fields; (c) basic information on the current safety rules required to use genetically modified organisms.

Ability to apply the knowledge:
Students will gain the ability:
to perform basic manipulations for cloning, expression, and analysis of genes, following the safety rules; (b) to consult the databases to design the cloning, expression and modifications of a gene in different organisms, according to special applications in the medical, industrial, food and environmental fields; (c) to assess the benefits and risks associated with genetically modified organisms produced.

Soft skills
The exercises directed to the in silico design of a cloning experiment for a particular application will help the students to develop the ability to analyze and synthesize information from different fields, making judgments on autonomy, solve problems, work in groups and improve their communication skills.

Program

The course provides a multidisciplinary approach, therefore good background in Molecular Biology, Microbiology, Genetics, Biochemistry and Bioinformatics are suggested.

Development of the course and examination

Methods for assessing learning outcomes:
The exam will consist of an interview with at least three questions on different topics and a discussion of the laboratory reports submitted.
The student submits (online) their lab reports at least one week before the exam session.

Criteria for assessing learning outcomes:
During the oral examination the three questions will be used to evaluate:
(a) the theoretical and practical knowledge acquired by the students, (b) the ability to present a topic in a clear and appropriate way and (c)the degree of independent judgment reached at the end of the course.
In lab reports, student should demonstrates that he/she has achieved the ability to apply the knowledge acquired during the course to design a simple protocol for recombinant protein production and he/she is able to properly evaluate the results obtained.

Criteria for measuring learning outcomes:
The higher grade will be express by 30/30 and if the student's performance will be excellent, it is expected to be awarded (lode).
For each oral question is provided a score from 0 to 8.
The reports will be evaluated from 1 to 6 points.

Criteria for conferring final mark:
Being an integrated course, the final grade is attributed upon evaluation of the overall results obtained in each single module. Concerning the Genetic Engineering module, the grade it is given by adding the scores of oral responses and reports evaluation. The higher grade is 30/30 and the student must achieve a minimum score of 18/30 to pass the exam. The grade 30/30 cum laude will be used for student able to discuss properly, critically and with great competence the topics.

Recommended reading

S. Primrose, RD. Twyman, B.Old - Genetic Engineering, Principles and features- Zanichelli, 2004.
B.R. Glick, J.J. Pasternak - Molecular Biotechnology, principles and applications of DNA ricombinante- Zanichelli, 1999.
Some topics will be integrated with technical manuals, articles and reviews suggested by the teacher as PDF format in the course website

GENETICS (A-L)

DAVIDE BIZZARO

Seat Scienze
A.A. 2016/2017
Credits 8
Hours 64
Period 2^ semestre

Prerequisites

Zoology, Cytology and Biochemistry

Course contents

Completion of the course allows the student to obtain 8 credits in total, specifically 7 credits CFU for theoretical classes and 1 credit CFU for practical classes.

Objectives of the course

Knowledge:
Students have to acquire the fundamental concepts of the structure and function of eukariotic and prokariotic genes and genomes, as well as the interactions between genes and environment. The understanding of the molecular mechanisms driving evolution and variability is a must.

Ability to apply the knowledge:
Students have to demonstrate confidence with the competences acquired and to be able to critically apply them in the wide field of biomedicine and biotechnology.

Soft skills:
The participation to practical classes, together with the discussions and research highlights will contribute to enhance in students their communication skills, critical capability, and learning ability.

Program

CLASSICAL GENETICS: Mendelian and non-Mendelian modes of inheritance that govern passage of genetic traits across generation, Basic structure and function of chromosomes and genomes, biological variation resulting from recombination, mutation, and selection. Mitosis and meiosis.
MOLECULAR GENETICS: Nucleic acids: from discovery to chemical composition and function. Molecular processes of DNA replication, transcription and translation. Characteristics of the genetic code. The origins of the human species. How a genetic sequence is determined and how it helps us understand genetic relationships between species. Eukariotic and procariotic genes. Imprinting. Mutations. DNA damage and repair. Analysis and manipulation of genes at the molecular level.

Chromosomal aberrations.
POPULATION GENETICS: The Hardy-Weinberg law. DNA variation, natural selection, stationary distribution.

Practical lectures. Determination of the TAS2R38 polymorphism that is associated to the capability of tasting Phenylthiocarbamide (PTC) through genomic DNA isolation and amplification, followed by specific genotyping analysis.

Development of the course and examination

Methods for assessing learning outcomes:
The final oral exam includes questions regarding classical, molecular and population genetics. The oral exam aims at demonstrating the acquired notions and the deep comprehension of the principles of Genetics.

Criteria for assessing learning outcomes:
The course foresees an optional writing exam about Classical Genetics. For students passing the optional exam, the final exam aims at assessing their knowledge regarding Molecular and Population Genetics.

Criteria for measuring learning outcomes:
The final mark is attributed basing on the oral exam or upon completion of both, the optional and oral exam.

Criteria for conferring final mark:
To pass the exam the student has to prove his/her basic understanding of the basic genetic mechanisms governing the biological processes. Students able to connect the different areas of Genetics and demonstrate the capability of applying them to the wide areas of Biomedicine and Biotechnology will obtain the maximum score.

Recommended reading

P. J. Russel, Genetica: un approccio molecolare. IVa edizione. Pearson, 2014.
S. Pimpinelli et al., Genetica. Casa Editrice Ambrosiana, 2014 R.
J. Brooker. Principi di Genetica. Mc Graw-Hill, 2010 D.
P. Snustad, M. J. Simmons. Principi di Genetica. IVa edizione. Edises, 2010 A.
J. Griffiths et al., Genetica. Principi di analisi formale. VII edizione. Zanichelli, 2013 L.
H. HARTWELL et al., Genetica - dall’analisi formale alla genomica. IIa edizione Mc Graw-Hill 2008

GENETICS (M-Z)

BRUNA CORRADETTI

Seat Scienze
A.A. 2016/2017
Credits 8
Hours 64
Period 2^ semestre

Prerequisites

Zoology, Cytology and Biochemistry

Course contents

Completion of the course allows the student to obtain 8 credits in total, specifically 7 credits CFU for theoretical classes and 1 credit CFU for practical classes.

Objectives of the course

Knowledge:
Students have to acquire the fundamental concepts of the structure and function of eukariotic and prokariotic genes and genomes, as well as the interactions between genes and environment. The understanding of the molecular mechanisms driving evolution and variability is a must.

Ability to apply the knowledge:
Students have to demonstrate confidence with the competences acquired and to be able to critically apply them in the wide field of biomedicine and biotechnology.

Soft skills:
The participation to practical classes, together with the discussions and research highlights will contribute to enhance in students their communication skills, critical capability, and learning ability.

Program

CLASSICAL GENETICS: Mendelian and non-Mendelian modes of inheritance that govern passage of genetic traits across generation, Basic structure and function of chromosomes and genomes, biological variation resulting from recombination, mutation, and selection. Mitosis and meiosis.
MOLECULAR GENETICS: Nucleic acids: from discovery to chemical composition and function. Molecular processes of DNA replication, transcription and translation. Characteristics of the genetic code. The origins of the human species. How a genetic sequence is determined and how it helps us understand genetic relationships between species. Eukariotic and procariotic genes. Imprinting. Mutations. DNA damage and repair. Analysis and manipulation of genes at the molecular level.

Chromosomal aberrations.
POPULATION GENETICS: The Hardy-Weinberg law. DNA variation, natural selection, stationary distribution.

Practical lectures. Determination of the TAS2R38 polymorphism that is associated to the capability of tasting Phenylthiocarbamide (PTC) through genomic DNA isolation and amplification, followed by specific genotyping analysis.

Development of the course and examination

Methods for assessing learning outcomes:
The final oral exam includes questions regarding classical, molecular and population genetics. The oral exam aims at demonstrating the acquired notions and the deep comprehension of the principles of Genetics.

Criteria for assessing learning outcomes:
The course foresees an optional writing exam about Classical Genetics. For students passing the optional exam, the final exam aims at assessing their knowledge regarding Molecular and Population Genetics.

Criteria for measuring learning outcomes:
The final mark is attributed basing on the oral exam or upon completion of both, the optional and oral exam.

Criteria for conferring final mark:
To pass the exam the student has to prove his/her basic understanding of the basic genetic mechanisms governing the biological processes. Students able to connect the different areas of Genetics and demonstrate the capability of applying them to the wide areas of Biomedicine and Biotechnology will obtain the maximum score.

Recommended reading

P. J. Russel, Genetica: un approccio molecolare. IVa edizione. Pearson, 2014.
S. Pimpinelli et al., Genetica. Casa Editrice Ambrosiana, 2014 R.
J. Brooker. Principi di Genetica. Mc Graw-Hill, 2010 D.
P. Snustad, M. J. Simmons. Principi di Genetica. IVa edizione. Edises, 2010 A.
J. Griffiths et al., Genetica. Principi di analisi formale. VII edizione. Zanichelli, 2013 L.
H. HARTWELL et al., Genetica - dall’analisi formale alla genomica. IIa edizione Mc Graw-Hill 2008

GEOGRAPHY OF RISK AND DISASTERS

FAUSTO MARINCIONI

Seat Scienze
A.A. 2016/2017
Credits 7
Hours 56
Period 1^ semestre

Prerequisites

No particular prerequisites are required to attend this course, except for a general knowledge of the basic principles of Earth science.

Course contents

The course consists of frontal lectures, accompanied by critical reading activities of scientific articles and other material that students will have to discuss in the classroom, both with the teacher and other students. Short field trips are also scheduled to visit real life examples of the extreme events discussed in class (eg. landslides, flood plains, earthquake effects). The course also includes a 2 or 3 day field trip (depending on financial availability) to visit places affected by past disasters or vulnerable to future impact, or to attend civil protection exercises. Finally, students can decide to develop independent studies projects on forecast methods or risk prevention and mitigation strategies. Given the strong interactive nature of the course, attendance to lectures and class activities is strongly recommended.

Objectives of the course

Knowledge:
The course aims at enabling students to acquire basic knowledge on natural processes and extreme events that may harm people and economic activities. At the end of the course, students should be able to grasp the complexity of the human-environment relationship, and highlight the anthropogenic origin of risk and disaster. This is achieved by providing students with the knowledge of both environmental processes (including climate change) and social processes that create the conditions of vulnerability, as well as the possible response in terms of civil protection activities to prevent and mitigate potential impacts.

Ability to apply the knowledge:
Critical readings and class discussions will compel students to gain ability to effectively communicate issues related to civil protection. The possibility to develop independent study projects is also aimed at fostering student's ability in maximizing their own personal characteristics and their knowledge on the subjects of sustainable development, adaptive capacity and resilience to disasters. All these activities will climax with the participation to drills organized by the civil protection, thus giving the students maximum training momentum to best apply their knowledge and individual characteristics. Following are some of the skills that the course seeks to develop in

students: acquire and interpret information, communicate effectively; Interpersonal, intercultural, social and civic competence; resourcefulness; problem solving; pinpoint links and correlations. Ultimately, the course aims at providing both the technical and scientific knowledge on disasters and on civil protection activities, and to stimulate the individual to take advantage of his/her own characteristics (cognitive, emotional and volitional). The goal is to prepare students to face future professional challenges.

Soft skills:
Understanding the surrounding environment and learn how to survive and adapt to it requires skills built that derives from thorough synthesis of theoretical knowledge and life experiences. Performing activities of civil protection means, inter-alia, to be able to cross the disciplinary boundaries, work in team, manage time effectively, being practical, learn from mistakes, make the best use available resources, communicate effectively, follow the rules and above all know how to handle the unexpected.

Program

Pivotal in the understanding of catastrophic events is the realization that vulnerability and risk are created by an improper use of the natural and technological systems by the humankind. This module covers the basic concepts of human-ecology and discuss the most important disaster agents. The course also initiates students to the basics of emergency management; its organization, the essential activities, the different typologies of hazards, the available technologies and the planning strategies.

The course is divided into three thematic areas: (i) environmental geography and human ecology of disasters; (ii) natural hazards and possible effects, (iii) the human response to disaster. Below are the specific details for each theme.

Environmental geography and human ecology of disasters: Culture, ethics and disasters; The human-environment relationship: evil nature or bad environmental management?; Natural cycles and extreme events in relation to the socio-economic processes; hazard, vulnerability, disaster and crisis; Safety, risk and the cost/benefit ratio; Emergency and crisis (the alteration of the normal function); Time-space scales in disasters;

Natural hazards and possible effects: Energy sources of hazard; Geophysical hazards (earthquakes, volcanic eruptions, tsunamis, landslides, coastal erosion, subsidence); Climate hazards (hurricanes, tornadoes, storms, floods, droughts, fires); Bio-ecological hazards (epidemics, pest invasion, extinctions); Social hazards (wars, terrorism, refugees, urban fires, collapse of infrastructures);

The human response to disaster: The socio-economic impact; Forecast, prevention, mitigation and emergency planning; Search and rescue; Short and long term reconstruction; Spatial analysis and urban planning; The lessons from disasters: past, present and future.

Development of the course and examination

Methods for assessing learning outcomes:
The course final exam is oral and there are no midterms or written tests. However, classroom

activities include critical reading and discussion of scientific material. The active participation of the students in these class discussions is among the learning evaluation methods. Similarly, the development of an independent study project, and the presentation of its results in class contributes to assess students' learning as well as to the final grade the student will obtain from the course.

Criteria for assessing learning outcomes:
During the oral exam the student must demonstrate good knowledge of environmental geography and human ecology subjects related to human development and adaptation to the surround environment and habitat, as well as knowledge of the various types of natural hazards discussed in class, including principles and methods of emergency management. The exam questions will cover proportionately these three thematic areas. Students must demonstrate to have achieved the ability to apply the concepts learned, both in terms of technical skills, and in terms of reasoning and ability to formulate strategies to overcome hazard and disaster scenarios.

Criteria for measuring learning outcomes:
The course final grade will be express in thirtieth. The passing mark is 18/30. Students showing thorough preparation and insightful analysis will be awarded the highest marks with honors (30 cum laude).

Criteria for measuring learning outcomes:
The final grade is given by adding the evaluation of the various answers to questions on the three thematic areas covered in the teaching. An active participation in the critical reading exercises performed in class, as well as the development of an independent study, will bring an additional bonus to the final grade exam. Bonuses, however, may not exceed 3/30. Honors (30 cum laude) will awarded to the students who demonstrates to have fully mastered the subject.

Recommended reading

Notes and teaching materials provided in class and made available online
Calamità Naturali. David E. Alexander Pitagora Editrice, Bologna 1990
Natural Disasters. Patrick L.Abbott Mc Graw Hill. New York 2004
Disasters by Design: a reassessment of natural hazards in the USA. D.S. Mileti. Joseph Henry Press, Washington D.C. 1999.
Natural Disasters. D.E. Alexander. Chapman and Hall, New York 1993.
The Environment as Hazard (second edition). I. Burton, R.W. Kates, and G. F. White. Guilford Press, New York, 1993.
Hazards: Local, National, Global. G.F. White, Oxford University Press, New York, 1974

GEOLOGIC AND GEOMORPHOLOGIC FIELD SURVEYING AND CARTOGRAPHY

ALESSANDRA NEGRI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 2^ semestre

Prerequisites

Cognitive prerequisites concerning geology (lithology, stratigraphy, petrography), geophysics and geodynamics, basic concepts of topography, cartography and geodesy, as well as basic notions on geo-technologies (GIS, GPS, vector cartography, etc.) are essential to territorial analysis.

Course contents

The course of geological and geomorphological survey techniques is delivered by means of class teaching and field mapping laboratory.

Objectives of the course

Knowledge:
The course aims to provide students with the knowledge of basic methodologies for field surveying, mapping and collection of spatial data. The territorial analysis (geology and geomorphology) is an indispensable element of any investigation whose objective is provision of civil protection, support to commercial ventures, whether these are relating to engineering, construction or prospecting raw materials and hydrocarbons.
The course enables students to acquire the basic knowledge on the analysis of geological phenomena from the observation of the landscape. Since surveying techniques and mapping are activities peculiar to geologic and geomorphologic surveyors, having specific training and background, the course herewith offered is necessarily limited to learning rudiments of field practices and territorial analysis.

Ability to apply the knowledge:
Students acquire the capacity to map simple geological features and to deduct their meaning from simple cartographic representation, so as to deduce quantitative elements through the stratimetric analysis.

Program

List of content (classroom lectures, 5 CFU, 40 hours):
General part: stratigraphy and tectonics

- Introduction to the course; purpose and importance of geological surveying and mapping.
- Types of geological surveys, according to scope and purpose.
- Basic geologic maps and thematic maps.
- Concepts of lithostratigraphy: description, classification and recognition of rock formations on the basis of lithology, geometry, lateral variations and continuity.
- Principles of lithostratigraphy as the base of geological surveying.
- Facies and their definition: facies analysis and its use in cartography.
- Fundamental stratigraphic units and their use.
- Stratigraphic correlations.
- Surfaces of stratigraphic discontinuities.
- Elements of descriptive tectonics.
- Mappable geological surfaces: bedding, cleavage.
- Mappable geological structures: folds elements and faults planes.
-Elements of Geomorphology

Methods of geological surveying and mapping.
- Tools for geological survey and their use.
- Planning a geological survey
- Usefulness of remote-sensing imagery in geological survey.
- Mapping of geological surfaces
- Choice of suitable trace for geological-section, execution of geological sections from geologic maps
- Introduction to stratimetry.
- Methods of measuring thickness of formations in the field.
- Stratigraphic correlations in the field.
- Organization and equipment for geological surveying.
- Methods of graphic representation
- Executing simple stratigraphic sections with the assistance of meter stick and Jacob's staff.
- Recognition, measurement and positioning of primary geologic features on maps.

Interpreting geological maps and sections
- Geological maps, geomorphological maps, geological sections, their reading and interpretation
- Significance of geological maps interpretation.
- Detecting and recording information for specific surveys.

Field tutorials (1CFU 10 hours)
Practical group exercises of geological mapping on a scale of 1:25,000 to 1:10,000 and development of a simple geological map of an assigned area.

Development of the course and examination

Methods for assessing learning outcomes:
The assessment of proficiency is performed through a written stratimetry test followed by a discussion on all program's topics. The field practice exercise is complemented by the compilation of a technical report, which, if ranked positive, is considered in the definition of the final grade.
Criteria for assessing learning outcomes:
The student should demonstrate the understanding of general concepts of geology, geomorphology, cartography and stratimetry.
Criteria for measuring learning outcomes:
The final grade is assigned in points, up to a maximum of 30. The exam is passed when the grade is greater than or equal to 18. In case of outstanding performance, the highest marks with honours (30 cum laude) are awarded.

Criteria for conferring final mark:
The final grade is awarded on the basis of the marks obtained in the oral test. Honours are granted whenever the student proves originality in the exposure and mastery of the subject matter.

Recommended reading

E. Coe Ed. (2010) – Geological Field Techniques. Wiley-Blackwell Ed.
B.C.M. Butler & J.D. Bell (1991) – Lettura ed interpretazione delle carte geologiche. Zanichelli.
G. Cremonini (1995) – Rilevamento Geologico. Realizzazione ed interpretazione delle carte geologiche. Pitagora Ed. (fuori commercio)
A.V. Damiani (1984) – Geologia sul terreno e Rilevamento geologico. Zanichelli Ed. (fuori commercio)
Bell, F.G. (2001), Geologia ambientale, Zanichelli Editore, Bologna
B. Simpson (1992) – Lettura delle carte geologiche – Flaccovio Ed.
C.Venturini 2012 Realizzare e Leggere carte e sezioni Geologiche. Flaccovio Editore

GEOLOGICAL RISK

MASSIMO SARTI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 1^ semestre

Prerequisites

Cognitive prerequisites concerning geology (lithology, stratigraphy, petrography), geophysics and geodynamics, basic concepts of topography, cartography and geodesy, as well as basic notions on geo-technologies (GIS, GPS, vector cartography, etc.) are essential to territorial analysis.

Course contents

The course of geological and geomorphological survey techniques is delivered by means of class teaching and field mapping laboratory.

Objectives of the course

Knowledge:
The course aims to provide knowledge on methodology of risk analysis and on the geological risk agents, including techniques for forecasting and monitoring of extreme events. Through lectures students acquire notions seismology, volcanology, hydrogeology and engineering geology, with particular reference to intensity of expected phenomena and their impact on the environment and human activities.

Ability to apply the knowledge:
Through the study of a series of natural phenomena, enhanced in effectiveness by means of field visits and seminars, students acquire the ability to apply their knowledge to real-world examples and implement simple monitoring and control techniques. The understanding of matter is high on average.

Program

List of content (classroom lectures, 6 CFU, 48 hours):
Introductory concepts: hazard, vulnerability and risk analysis
Methodologies of risk analysis
Seismic risk
- Earthquakes: general concepts
- Liquefaction of the soil under seismic conditions; case studies

- Tsunami, case studies
- Large earthquakes in history, case studies
- Earthquake monitoring and forecasting

Volcanic risk
- Volcanoes: general concepts
- Italian volcanism, case studies
- Volcanic monitoring and forecasting

Idrogeologic risk
- Landslides and avalanches: general concepts and classification
- Large landslides in history, case studies,
- Monitoring and forecasting slope stability
- Floods, general concepts and monitoring methodologies

Geomorphological risk
- Coastal erosion, general concepts and mitigation interventions

Development of the course and examination

Methods for assessing learning outcomes:
The assessment of proficiency is performed through a written test consisting of 30 questions formulated on all subject's integrated course components, including geological and climatic risk and an oral discussion on the same.

Criteria for assessing learning outcomes:
The student should demonstrate the understanding of general concepts and specific aspects of seismology, volcanology and geology and foundations of risk analysis.

Criteria for measuring learning outcomes:
The final grade is assigned in points, up to a maximum of 30. The exam is passed when the grade is greater than or equal to 18. In case of outstanding performance, the highest marks with honours (30 cum laude) is awarded.

Criteria for conferring final mark:
The final grade is awarded on the basis of the marks obtained in the oral test. Honours are granted whenever the student proves originality in the exposure and mastery of the subject matter. Being an integrated course.

Recommended reading

Barberi F., Santacroce R., Carapezza M.L., Terra Pericolosa, Edizioni ETS
Le scienze. Quaderni, n.59, Il rischio sismico, a cura di Enzo Boschi, 1991
Crespellani T., Nardi R., Simoncini C., La liquefazione del terreno in condizioni sismiche, Zanichelli, 1991
Ollier Cliff, Vulcani, Zanichelli, 1994
Le scienze. Quaderni, n.4, I vulcani a cura di Gasparini P., 1983
Storia Geologica d'Italia. Gli ultimi 200 milioni di anni. A. Bosellini, Eds. Zanichelli.
Geologia Ambientale. Teoria e pratica. F.G. Bell, Eds. Zanichelli.

GIS TOOLS FOR ENVIRONMENTAL AND CIVIL PROTECTION

FRANCESCA SINI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 2^ semestre

Prerequisites

IT basic knowledge

Course contents

Frontal lectures in the field of Geomatics (26 hours) and opensource Quantum GIS labs (22 ore)

Objectives of the course

Knowledge
The course introduces students to the tools and techniques of the Geographic Information Systems (GIS), providing an overview of GIS theory, basis of geodesy and cartograghy, remote sensing, related technologies and applications for environmental and civil protection.
On completion of this course students will have:
- an understanding of concepts and theories that underpin GIS;
- an understanding of the functionality and data analysis tools used in applications of GIS
- an understanding of the role of GIS technology for decision making in planning and improvement processes
A relevant part of the course has been reserved for practical exercises and opensource GIS labs.

Ability to apply the knowledge
On completion of this course students will have an understanding of the issues relating to project management, data collection/data availability and data processing.
Students will be able to:
- demonstrate a detailed knowledge of the concepts and theories of modern GIS;
- be familiar with resources, literature and techniques for applying GIS to problem solving;

Soft skills
On completion of this course students will have an improvement to solve in autonomy specific spatial data mapping, management and analysis problems. Moreover laboratories and project management will contribute to improve the working group ability and the communication skills.

Program

Contents of the lectures (26 hours)
Introduction to GIS technology. Geodesy and Cartography; Geographic reference systems and EPSG catalogues. Remote Sensing introduction: active and passive sensors; Global Navigation Satellite System; Digital Terrain Models (DTM); GIS data models; metadata; data quality; geodatabase and DBMS; thematic maps; spatial analysis and geoprocessing; layout; interoperability and data web source; webgis; open source and commercial GIS softwares overview; ECDL GIS certification.GIS applications in the field of the environment and civil protection;

Laboratory Practicals (22 hours)
Opensource softwares tutorial (Quantum GIS); GIS training and exercises (n. 1-5); GIS Project on assigned civil protection case studies;

Development of the course and examination

Methods for assessing learning outcomes:
The final examination takes place individually, through an oral test on Geomatics theory and discussion about the GIS project design and results. GIS project must be handed in a week before the day of the evaluation.

Criteria for assessing learning outcomes:
The student has to answer the question in such a way as to demonstrate sufficient knowledge of the course subject. Basic skill on GIS data visualization, analysis and geoprocessing, mapping through Qgis software must be proved.

Criteria for measuring learning outcomes:
The exams involve an evaluation which is expressed as a grade of out of 30. An exam is deemed to be passed successfully if the final grade is equal to or higher than 18/30. In the event of a full grade (30/30), the Examination Board may grant honours (lode).

Criteria for conferring final mark:
Final mark is the sum of the evaluation about acquired knowledge of the concepts and theories of modern GIS (by oral test) and skills to solve specific spatial data mapping, management and analysis problems (through labs and GIS project design and result).
Adequate knowledge both in GIS theory and software skill is required to pass the exams (at least 18/30 in both components).

Recommended reading

Caiaffa E., ECDL GIS. La rappresentazione cartografica e i fondamenti del GIS, McGraw-Hill, 2011.
Introduzione alla Geomatica- Gianfranco Amadio, Dario Flaccovio Editore, 2012.
GIS open source per geologia e ambiente- Valerio Noti, Dario Flaccovio Editore, 2014.
Course notes;
Quantum GIS manual and tutorials (http://www.qgis.org)

HUMAN ANATOMY

MANRICO MORRONI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 2^ semestre

Prerequisites

Knowledge of the Histology

Course contents

The course consists of ex-cathedra lessons and laboratory exercitations conducted in small groups (maximum 24 students for each group). The exercitations consist in the observation of histologic sections of human organs by light microscopy.
The teacher inserts in moodle the slides projected to lesson.

Objectives of the course

Knowledge:
At the end of the course the student must acquire sufficient knowledge to describe human body organization. Such knowledges are fundamental to understand the functions of both organs and systems. The student must attend both lectures and exercitations in order to achieve such results. These lessons will be based on the arguments listed in the programme.

Ability to apply the knowledge:
The student must be able to interpret human histological sections during the exercitations by the use of the light microscopy.

Program

Course content (ex-cathedra lessons, 6 CFU, 48 hours):
Organization of human body and anatomical nomenclature. Skin and its appendages. Short account of musculoskeletal system. Cardiovascular and lymphatic system (thymus, lymph node and spleen). Gastrointestinal tract. Respiratory tract. Urinary system. Male and female reproductive system. Endocrine system. Central nervous system.
The student must learn both macroscopic (basic knowledge) and microscopic (detailed knowledge) appearance for each organ.

Laboratory:
By light microscopy, recognition of the histological sections (slides) of human organs. Differential diagnostic criteria between the organs.

Development of the course and examination

Methods for assessing learning outcomes:
The exam consists of two tests: practice and oral. In the first the student must describe a histological section selected from the teacher, which follows the diagnosis of the organ. Passing the practice test, the student can access to oral test. This latter consists in two questions: 1) macroscopic description (weight, size, consistency, location, relationship), including the vascularization, and, mainly, microscopic description of an internal organ, 2) description of a part of the central nervous system or a nervous via (sensitive or motor).

Criteria for assessing learning outcomes:
In the practice test the student must prove of recognizing the tissues that make an organ and how they are assembled in the organ that he is observing. In the oral test, it will be evaluated his ability to describe both macroscopically and, in particular, microscopically an internal organ, a part of the central nervous, or, alternately, a nervous via (ascending or descending).

Criteria for measuring learning outcomes:
The final vote is attributed thirty. The exam is passed when the vote is greater than or equal to 18. It is expected to be awarded of full marks with honors (30 cum laude).

Criteria for conferring final mark:
The final vote is attributed by adding to the rating of the practice test to that of the oral test. Summa cum laude is attributed when the student shows full mastery of the matter, also from a point of view of the anatomical nomenclature.

Recommended reading

Marco Artico et al.: Anatomia Umana - Principi. edi-ermes, Milano, 2005.
Manrico Morroni: Anatomia Microscopica Funzionale dei Visceri Umani. edi-ermes, Milano, 2008.
Manrico Morroni: Anatomia Microscopica – Atlante, edi-ermes, Milano, 2014.
Giovanni Grasso: Sistema Nervoso Centrale, Piccin, Padova, 2014.

ICT FOR EMERGENCY MANAGEMENT AND ENVIRONMENTAL PROTECTION

LUCA ABETI

Seat Scienze
A.A. 2016/2017
Credits 7
Hours 56
Period 1^ semestre

Prerequisites

Basic knowledge in computer science, logic and mathematics.

Course contents

The course consists in four parts, two parts concerning respectively the theoretical foundation of informative systems and communication networks, one part concerning the design and integration issues in the development of new ICT systems, and finally, one part concerning the technologies currently applied in emergency management and environmental protection. In particular, the course evidences issues related to project management in Public Administration and for e-Government projects.

Objectives of the course

Knowledge:
The goal of this course is to make students aware of the main Information and Communication Technology (ICT) instruments. It focuses on the explanation of the relationships between the development of new ICT projects and business process reengineering in the emergency management and environmental protection domains. Main topics of the course relate to data, information and knowledge management and communication networks.

Ability to apply the knowledge:
The student will be able to understand architecture of computers, data management systems and information transmission networks. He will use software development and methods and he will be abile to design new technologies for the Public Administration applied to the civil protection, for instance: information sharing, analogical and digital radio communication technologies, ROIP e VOIP systems.

Soft skills
The student will face with project management tools and planning tools useful also in other contexts. Human–Computer Interaction involve the study of cognitive psychology, ergonomic, design and User eXperience design

Program

Part I – Information Systems: Using ICT in emergency management and environmental protection; Fundaments of Computer Science; Information Systems and civil protection; Semi-structured knowledge, Semantics and Big Data;
Part II – Networks and Communication Systems: Fundaments of Telecommunications; Communication Networks; Networking; World Wide Web.
Part III – Design and development: Project management of new technologies in Public Administration; Software Engineering; Human-Computer Interaction.
Part IV – Applied Technologies: Remote Sensing and GIS system; Critical Infrastructures; Risk Modeling and Analysis; Information Sharing and collaboration; Analogical and Digital Radio Communication; ROIP and VOIP Systems.

Development of the course and examination

Methods for assessing learning outcomes:
The examination will consist in an evaluation of the work carried out during lectures and a written test .

Criteria for assessing learning outcomes:
The student has to be clear the computer architecture and how it works. Issues and opportunities given by technologies applied to the environment protection and emergency management must be well known. He has to be able to apply design methodologies to the study of environmental conditions, information and communication systems and use software and technologies for the civil protection and environmental protection.

Criteria for measuring learning outcomes:
The exam is considered successfully passed with a score of 18 to 30. It is possible to reach summa cum laude (30 e lode).

Criteria for conferring final mark:
The exam consists in a 6 question test. Five questions will be evaluated from 0 to 6 and the last question will be evaluated from 0 to 3. The final score will be the sum of each question score.

Recommended reading

Lectures Notes
Pine (2006), John C. Pine, Technology in emergency Management, John Wiley and Sons ISBN: 978-0471789734, Danvers, MA, USA, pp. 312
Atzeni, Ceri (2014), C. Atzeni, S. Ceri, S. Paraboschi, R. Torlone, Basi Di Dati - Modelli e Linguaggi di Interrogazione, Mc Graw-Hill, ISBN: 9788838665875, Roma, IT, pp. 784.
Tanenbaum (2013), Tanenbaum Andrew S.; Austin Todd, Architettura dei calcolatori. Un approccio strutturale, Pearson Informatica, ISBN : 9788871929620, London, UK, pp. 796.

INDUSTRIAL AND CHEMICAL RISK (chemical risk)

SAMUELE RINALDI

Seat Scienze
A.A. 2016/2017
Credits 4
Hours 32
Period 1^ semestre

Prerequisites

No prerequisites are needed.

Course contents

The course consists of 64 hours (8 credits) of theory lectures, of which 32 hours (4 credits) of Chemical Risk (Prof. Samuele Rinaldi) and 32 hours (4 credits) of Industrial Risk (Prof. Dino Poggiali).

Objectives of the course

Knowledge:
The course allows students to learn the knowledge about the chemical risk related to occupational safety and health, the ways the risk can be generated and the potential damages. In particular, the course allows students to learn how to assess the chemical risk, especially with respect to the health risk, using both environmental measurements and algorithms, and how to choose the various protective equipment.

Ability to apply the knowledge:
The students will have to learn the following skills: they will have to be able to identify what are the sources of chemical risk in an occupational environment and to evaluate the extent of the risk itself and of potential health damages. The students will have to be able also to choose, for any hypothetical case, the correct protective equipment.

Program

Contents of the lectures (4 credits, 32 hours):
Introduction: legal and toxicological definitions. The old and new directives on chemical risk and classification of chemical agents. Chemical risk assessment for the health (toxicological risk): general aspects, legislative overview, health surveillance, exposure limit values, overview on carcinogens. Risk assessment for human health through environmental measurements: laws and directives, examples of procedures. Risk assessment through algorithms: general aspects, Movarisch, Archimede, Inforisk, Menarini, Cheope, Laborisch and ARPA/ISPRA algorithms.

Personal protective equipment: classification, criteria for the selection and use of APVR, garments, gloves and glasses. Collective protection equipment.

Development of the course and examination

Methods for assessing learning outcomes:
The examination consists of an oral exam that consists of 3 questions with open response. A score between zero and ten is attributed at every question. The exam is passed when the final grade is equal or above 18.

Criteria for assessing learning outcomes:
In the oral exam, the student will have to demonstrate both the knowledge of subjects and the ability to use the knowledge to solve hypothetical problems. In particular, the student will have to be able to evaluate the chemical risk, using either environmental measurements or algorithms.

Criteria for measuring learning outcomes:
The final grade is attributed in thirtieths. Successful completion of the examination will lead to grades ranging from 18 to 30 with honours.

Criteria for conferring final grade:
The final grade is attributed by summing the score of the 3 questions. The honours are awarded when the student demonstrate the full knowledge of the subject and the ability to solve hypothetical problems related to the chemical risk assessment.

Recommended reading

Notes taken during the lectures.
Legislation related to chemical and industrial risk and powerpoint presentations handed out by the lecturer.

INDUSTRIAL AND CHEMICAL RISK (industrial risk)

DINO POGGIALI

Seat Scienze
A.A. 2016/2017
Credits 4
Hours 32
Period 1^ semestre

Prerequisites

No prerequisites are needed.

Course contents

The course consists of 64 hours (8 credits) of theory lectures, of which 32 hours (4 credits) of Chemical Risk (Prof. Samuele Rinaldi) and 32 hours (4 credits) of Industrial Risk (Prof. Dino Poggiali).

Objectives of the course

Knowledge:
The course allows students to learn the knowledge about the different types of industrial plants and equipment that may develop an energy release (fire and/or explosion) and/or dangerous material. During the lessons will be treated also methods for the risk assessment and the risk control, and compensation measures referring to local and EU regulations.

Ability to apply the knowledge:
The students will have to learn the following skills: capability to evaluate the industrial risk assessment for environment and health in different situations, through the use of appropriate models. Moreover, the student will obtain capability in choosing appropriate safety measures to reduce or contain industrial risk.

Program

Contents of the lectures (4 credits, 32 hours):
Industrial plants equipment and components; Dangerous substances: classification methods; Industrial plants generated risks: energy and materials release; mathematical models of release; industrial risk analysis and assessment: theory and practical applications; safety management system, National and EU regulations on industrial risk; tests on chemical and industrial risk and problems solution about the application of regulations and/or about technical criteria on specific case stories.

Development of the course and examination

Methods for assessing learning outcomes:
The examination consists of an oral exam that consists of 3 questions with open response. A score between zero and ten is attributed at every question. The exam is passed when the final grade is equal or above 18.

Criteria for assessing learning outcomes:
In the oral exam, the student will have to demonstrate both the knowledge of subjects and the ability to use the knowledge to solve hypothetical problems. In particular, the student will have to be able to evaluate the chemical risk, using either environmental measurements or algorithms.

Criteria for measuring learning outcomes:
The final grade is attributed in thirtieths. Successful completion of the examination will lead to grades ranging from 18 to 30 with honours.

Criteria for conferring final grade:
The final grade is attributed by summing the score of the 3 questions. The honours are awarded when the student demonstrate the full knowledge of the subject and the ability to solve hypothetical problems related to the chemical risk assessment.

Recommended reading

Notes taken during the lectures.
Legislation related to chemical and industrial risk and powerpoint presentations handed out by the lecturer.

INSTRUMENTAL ANALYTICAL CHEMISTRY

GIUSEPPE SCARPONI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 1^ semestre

Prerequisites

Knowledge of the topics of the courses on Mathematics, Physics, General and Organic Chemistry.

Course contents

The course consists of theoretical lectures (5 credits, 40 hours) and laboratory practical work carried out individually or at small groups (1 credit, 16 hours) and fieldwork. An e-learning didactic activity is available in parallel to the normal frontal course. It includes: the didactic material, the self-evaluation tests, numerical exercises, instructions for the laboratory exercises, booking for the laboratory exercises, a section for the upload of laboratory reports from the students, information and booking for the field work, attendances to lectures and laboratory exercises, results of examinations.

Objectives of the course

Knowledge:
The course enables students to acquire the fundamental knowledge of the theoretical and methodological basis of main techniques for chemical analysis (gravimetry, volumetry, potentiometry, conductimetry, UV-Vis spectrophotometry), and their applications in real matrices (spring waters, river waters, snow, atmospheric aerosol).

Ability to apply the knowledge:
At the end of the course, the student should also acquire the following professional skills: ability to carry out basic laboratory chemical analyses (gravimetric, volumetric, potentiometric, conductimetric, UV-Vis spectrophotometric) devoted to the analytical control of real matrices included the step of field sampling.

Soft skills:
The execution of laboratory analyses (alone or in-group), as well as the drafting and editing of reports on the exercises carried out, contribute to improve for the student the degree of judgement autonomy in general, the communicative capacity (which derives also from the teamwork), the learning capacity in autonomy, and the ability to draw conclusions from experimental data.

Program

Content (lectures, 5 CFU, 40 hours). Fundamentals of chemical analysis. Phases of the analytical process. Stoichiometric calculations of analytical chemistry. Quality of analytical data. Errors. Precision. Accuracy. Certified reference materials. Basic equipment for quantitative chemical analysis. Analytical balance and calibration control. Volumetric glassware and its calibration. Classical analytical methods of gravimetry and volumetry. Some instrumental analytical techniques: electrochemical (potentiometry, conductimetry) and spectrochemical (UV-Vis), with applicationsin the biological field.

Laboratory exercises (1 credit, 16 hours/student). Volumetric determination of HCl by strong acic-strong base titration and using acid/base indicators. Determination of acidity of rain or snow by potentiomentric titration. Conductimetric titration of HCl with NaOH. Determination of chlorides in river water by conductimetric precipitation titration. Determination of iodides, fluorides and chlorides in river water and hot spring water by direct potentiometry (calibration curve method). Spectrophotometric determination of nitrites in river water (calibration curve method). Spectrophotometric determination of Fe(III) in river water (standard addition method). At the end of the exercises, the student will have to consign (electronically) a report on the laboratory activity showing, for each experiment: the data obtained, the calculations performed, the analytical results computed (expressed with the correct number of significant figures), and their discussion and interpretation.

Field work (two one-day school trips). Two one-day school trips are expected to be carried out (one in winter, one in summer) dedicated to field activity: sampling of snow and spring water with analyses on site (pH, conductivity, chloride, fluoride, iodide, nitrate), and visit to plants for bottling of mineral water.

Development of the course and examination

Methods for assessing learning outcomes:
The student consigns (on line) his own laboratory reports. The assessment method is a written classwork (open questions) and subsequent revision/discussion of the script. Thirty open questions are provided for the examination, which include also numerical exercises on stoichiometric calculations involved on gravimetric and volumetric analyses. To each question, a score included between zero and one is assigned. Passing of the written exam is bonded to the acquisition, on the stoichiometric calculations, of a score of at least half of the maximum obtainable. To the sum obtained other two points are added to obtain the final result of the written classwork. Moreover, for the final grade, up to two points maximum will be assigned with reference to the reports of laboratory exercises. The exam is passed when the final score is higher or equal to 18. During the course of lectures it is also foregone the possibility of participating to “in itinere” written classwork (1st and 2nd partial test). The result of a partial test may be mediated with the other provided the obtained score be at least 15, with the constraint referred above. In case of negative or unsatisfactory result in one of the two partial tests, it can be retrieved in the immediately following examination session.

Criteria for assessing learning outcomes:
In the written classwork, the student will have to demonstrate to have acquired a sound knowledge of basics and methods (theory and practice) of the chemical analytical methodologies of gravimetry, titrimetry, potentiometry, conductimetry, spectrophotometry (UV-Vis). In the laboratory reports, the student will have to demonstrate of having achieved the capacity to apply the acquired knowledge during the course to the execution of simple laboratory analyses and the capacity to write critically, in autonomy and/or in-group, a test report.

Criteria for measuring learning outcomes:
The final mark is attributed in thirtieths. Successful completion of the examination will lead to grades ranging from 18 to 30, and 30 with laud.

Criteria for conferring final mark:
The final mark is attributed by summing to the evaluation of the written classwork that of the laboratory report, the latter up to two points. The laud is attributed when the score obtained by the previous sum exceeds the value of 30 and contemporaneously the student demonstrates complete mastery of the matter.

Recommended reading

Lecture notes
D.A. Skoog, D.M. West, F.J. Holler, S.R. Crouch. Fondamenti di chimica analitica, 3rd edn., EdiSES, Napoli, 2015.
D.C. Harris. Chimica analitica quantitativa, Zanichelli, Bologna, 2005.

INTEGRATED SYSTEMS FOR ENVIRONMENT MANAGEMENT AND REMEDIATION

FRANCESCA BEOLCHINI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 1^ semestre

Prerequisites

Basic elements in mathematics, physics, general chemistry

Course contents

The course is given through lectures and numerical exercises, in some cases using the Microsoft Excel software and the Thinkstep Gabi software.

Objectives of the course

Knowledge:
At the end of the teaching course, the student will know the best available technologies for waste treatment and environment remediation, together with reference regulations

Ability to apply the knowledge:
Mass and energy balances on mechanical biological treatment, anaerobic digestion, incineration, landfilling facilities.
Mass balances on environmental remediation techniques and estimation of times of remediation.
Application of LCA methodology to simple cases and interpretation of risk analysis reports

Soft skills:
Numerical applications stimulate the critical thinking of each student, together with communication skills.

Program

Waste: definitions, classification and characterisation. Waste disposal and treatment technologies: selection platforms, composting, anaerobic digestion, incineration, landfill. Regulations.
Management of specific classes of wastes: electric and electronic equipment waste, exhaust batteries.
Environment remediation: in situ/ex situ technologies for contaminated sediment, pump and treat systems and permeable reactive barriers for contaminated groundwater, remediation of contaminates soil.

Life Cycle Analysis methodology Industrial quantitative risk analysis. Risk analysis applied to contaminated sites.

Development of the course and examination

Methods for assessing learning outcomes:
Oral exam.

Criteria for assessing learning outcomes:
The student has to show knowledge of subject matter and ability to apply it to simple practical cases.

Criteria for measuring learning outcomes:
The score is given by a number, out of 30 points. The minimum score required for passing the exam is 18.

Criteria for conferring final mark:
The final score is based on the oral exam.

Recommended reading

Copy of the slides (available on-line: www.disva.univpm.it)
Paul Wiliams, 2006 Waste Treatment and Disposal 2nd Ed. John Wiley.
Luca Bonomo, 2005. Bonifica di siti contaminati. McGraw Hill.
The International Reference Life Cycle Data System (ILCD) Handbook. JRC European Commission, 2012
Guidelines for Chemical Process Quantitative Risk analysis, 2nd edition. American Institute of Chemical Engineers (AIChE), New York, 2000.
Criteri metodologici per l'applicazione dell'analisi assoluta di rischio ai siti contaminati ISPRA, 2006.

LABORATORY OF BIOACTIVE MOLECULES

GIOVANNA MOBBILI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 2^ semestre

Prerequisites

Fundamentals General, Organic Chemistry and Biochemistry.

Course contents

The course includes theoretical lectures (4 credits, 32 hours) and laboratory practical work carried out individually or in small groups (2 credits, 16 hours). Teaching materials, numerical exercises, instructions for laboratory exercises will be provided in e-learning modality.

Objectives of the course

Knowledge:
The course aims to introduce students to the problems encountered in the design and delivery of bioactive molecules. By studying general and specific examples, focus will be placed on the structural changes that allow to design and optimize a bioactive molecule. The course also enables students to acquire basic knowledge on the theoretical and methodological foundations of the main spectroscopic techniques (in particular NMR and IR) and their applications in the field of structure determination of bioactive molecules.

Ability to apply the knowledge:
The exercises carried out in the classroom and in the laboratory will allow the student to acquire the ability to connect the structural features of a molecule with its chemical and physical properties and later with the biopharmaceutical properties of a potential active ingredient.

Soft skills:
The execution of laboratory experiments and subsequent reporting on the experiments performed, will enhance the ability to collect and interpret experimental data, to draw conclusions and to know how to deliver them.

Program

Target identification. Serendipitous discoveries, Rational approaches, Me too research, Optimization of drug side effects, Combinatorial chemistry, Virtual screening.

Biopharmaceutical properties of drugs. Physicochemical parameters and drug absorption: solubility, ionization and pH, lipophilicity, hydrogen bond, electronic properties.
Structure and pharmacological activity. Optic and geometric isomerism, conformational isomerism, isosterism and pharmacological activity. Target identification methods.
Drug delivery systems.
Characterization of bioactive molecules. Infrared Spectroscopy. Identification of IR spectra of organic compounds. Biological applications of Microimaging FT-IR technique. 1H and 13C Nuclear Magnetic Resonance. Analysis of 1H NMR spectra of organic compounds.
Laboratory experiments on topics covered in class.

Development of the course and examination

Methods for assessing learning outcomes:
The assessment method is an oral examination during which the student could be asked to solve exercises similar to those performed with the teacher during the lectures. The exam can be taken after the evaluation of a written report on the laboratory experiences. The exam is passed when the final grade is greater than or equal to 18.

Criteria for assessing learning outcomes:
The student will have to demonstrate the ability to rationalize the behavior of an ionizable bioactive molecule as a function of pH as well as to have acquired the basic knowledge of the main structural changes that can be introduced in a molecule to improve its pharmacodynamics and pharmacokinetics. He will have to demonstrate the acquisition of a sound knowledge of basics of NMR and IR spectroscopic techniques and also to be able to interpret simple NMR and IR spectra. In the laboratory reports the student will have to demonstrate the ability to apply the acquired knowledge to the execution of simple laboratory experiments, to collect the experimental data and discuss them critically.

Criteria for measuring learning outcomes:
The final mark is conferred in thirtieths. Successful completion of the examination will lead to grades ranging from 18 to 30, and 30 with laud.

Criteria for conferring final mark:
The final mark is conferred by adding to the evaluation of the oral examination that of the laboratory report, the latter up to 6 points. During the oral examination the student could be asked on three topics , each of which will get a maximum of 9 points. The laud is attributed when the score obtained by the previous sum exceeds the value of 30 and contemporaneously the student demonstrates complete mastery of the matter.

Recommended reading

Lecture notes
Edited by F.D.King, Medicinal Chemistry. Principles and Practice, Royal Society of Chemistry, Cambridge, 2002.
Richard B. Silverman, The Organic Chemistry of Drug Design and Drug Action, Academic Press, 1992.
Foye, Lemke, Williams, Principi di Chimica Farmaceutica, PICCIN, Padova, 1998.
Chiappe D’andrea – TECNICHE SPETTROSCOPICHE E IDENTIFICAZIONE DI COMPOSTI

LEGISLATION AND ENVIRONMENTAL MONITORING (Environmental Monitoring)

ANNA ANNIBALDI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 2^ semestre

Prerequisites

Knowledge of the topics of the courses on mathematic, physic, general inorganic, organic and instrumental analytical chemistry.

Course contents

The course consists of theoretical lectures (5 credits, 40 hours) and laboratory practical work carried out individually or at small groups and fieldwork (1 credit, 8 hours). During the course the teacher organizes some seminars on actual environmental topic, taken by an expert of the field (ARPA manager).

Objectives of the course

Knowledge:
The course enables students to acquire the fundamental knowledge of the principal techniques of environmental monitoring according to regulations in force in the different matrices air (particulate matter, deposit, and emission), water (marine and coastal water, lake and fluvial water, underground water) sediments and soil. Besides the course provides the knowledge on environmental biomonitoring and on the main instrumental techniques for the analysis of the matrices studied.

Ability to apply the knowledge:
The student should also acquire the following professional skills: ability to project an environmental monitoring of air, water and soil, ability to carry out samples collection and analyses, ability to value the analytical data obtained according to law limits, provided by national and international institutions.

Soft skills: The planning of an environmental monitoring and related activities contribute to improve for the student the degree of judgement autonomy in general, because the student will learn the capability to value the data obtained in line with the corresponding limits law, encouraging a discussion above. The communicative capacity will be stimulated during the lessons by discussing with the teacher some scientific report or papers (even in English language) on environmental monitoring of air, water and soil in sites with a different antrophic impact: these capabilities will be encouraged by attendance to some seminar on environmental topic, carried out by manager of the sector. The execution of field and laboratory analyses contributes to improve for the student the degree of judgement autonomy in general, the communicative capacity (which derives also from the teamwork), the learning capacity in autonomy, and the ability to draw conclusions from experimental data.

Program

Content (lectures, 5 CFU, 40 hours).
Environmental monitoring: general aspects and regulations in force. Monitoring phases: identification of regulation in force and bibliography; choice of environmental components and indicators; selection of monitoring area and sites; planning of monitoring activities; environmental monitoring activity; results analysis. Quality of analytical data: accuracy and precision, repeatability and reproducibility, detection limit, validation of analytical data (law limits and statistical tests).
Air
Air monitoring: general aspects and regulations in force (EU, national and local). Particulate matter (PM10, PM2.5). Pollutants to monitor and relative sampling methods (CO, SO2, NO2,O3…).Identification of monitoring area (urban, rural,…) and of potential contamination source. Particulate matter sampling (gravimetric and optical samplers). Atmospheric deposition sampling (wet and dry samplers, throughfall stemflow, runoff). Passive sampling of the air (passive samplers, Radiello samplers). Air emission sampling (Pitot tubes, isokinetic sampling). Detectors of gas polluting. Air biomonitoring (mosses, lichens, aeroplancton and other organisms).
Water
Water monitoring (fresh, marine and coastal, lakes and rivers): general aspects and regulations in force (WFD, Marine Strategy). Physical and chemical characteristics of water and identification of dangerous and priority pollutants and other substances to reveal for evaluating chemical state of water. Water sampling: regularity and site sampling, sampling systems. Sample treatment and storage. Groundwater: sampling (by piezometers) and analysis of principal organic and inorganic pollutants
Sediments: sampling and chemical-physical analysis. Water biomonitoring: toxicity tests for biomolecular and physiological organisms response to experimental situations; monitoring of ecosystem exposed to environmental stress.
Soil
Soil monitoring: general aspects and regulations in force. Geo-physical survey and measure of principal parameters. Diffuse soil contamination or contaminated sites. Types of sampling for soil and analyses of principal pollutants. Official methods of chemical analysis of soil. Gas in the soil: sampling and analysis. VOC analysis in soil: head space technique. Monitoring of interstitial water in the soil. Soil biomonitoring using ecotoxicological and biological indicators.
Principal extraction methods (MAE, LLE, SPE) and analysis (GC, HPLC, ICP-MS, AAS) for environmental monitoring.

Laboratory exercises (1 credits, 8 hourst). Determination of the phosphates in water, determination of soil humidity, measurements of pH and conductivity of soil samples.
Field work (two one-day school trips). Two one-day school trips are expected to be carried out dedicated to field activity: sampling of snow with analyses on site (pH, conductivity, chloride, fluoride, iodide, nitrate), and visit to water treatment plant.

Development of the course and examination

Methods for assessing learning outcomes:

The examination is an oral exam: during the examination the teacher evaluates the student learning.

Criteria for assessing learning outcomes:
During the oral examination the student will be demonstrate to know:
- at least two topics of the whole programme of environmental monitoring,
- at least two topics of the whole programme of environmental legislation.

Criteria for measuring learning outcomes:
The final mark is attributed in thirtieths. Successful completion of the examination will lead to grades ranging from 18 to 30, and 30 with laud.

Criteria for conferring final mark:
The final mark is attributed by evaluating the learning of the student on the contents of the course and by evaluating the complete mastery of the matter.

Recommended reading

- Copy of slides available
- R. Cozzi, P. Protti, T. Ruaro, Elementi di analisi chimica strumentale, Analisi chimica dei materiali, Analisi chimica ambientale, Zanichelli, Bologna, second edition 2013.
- APAT, Metodi analitici per le acque, manuali e linee guida 29/2003, APAT., 2003.
- http://www.minambiente.it/home_it/home_acqua.html?lang=it&Area=Acqua
- http://www.minambiente.it/home_it/home_aria.html?lang=it&Area=Aria
- http://www.minambiente.it/home_it/home_territorio.html?lang=it&Area=Territorio
- http://www.arpa.marche.it/doc/htm/center_flash.asp
- http://www.arpat.toscana.it/index.html
- http://www.arpa.piemonte.it

LEGISLATION AND ENVIRONMENTAL MONITORING (Legislation)

RAFFAELE CHITARRONI

Seat Scienze
A.A. 2016/2017
Credits 4
Hours 32
Period 2^ semestre

Prerequisites

None

Course contents

Lectures and presentation of case studies (4 credits, 32 hours)

Objectives of the course

Knowledge:
The course enables students to acquire knowledge of the national and international legal framework of environmental law.
Specifically, students will gain the knowledge:
• the general principles of law and the legal systems (sources of law, legal systems, organs and responsibilities, administrative proceedings);
• the international environmental law (principles, sources and historical development of the international and EU environmental law);
• the general and the special section of national environmental law.

Ability to apply the knowledge:
The student will be able to find, understand and apply to national and international standards of environmental law.

Soft skills:
Students will gain the knowledge of the regulatory framework in which they're going to carry out any future technical and scientific activities on the environment.

Program

Lectures and presentation of case studies (4 CFU, 32ore):

LAW PRINCIPLE: the sources of law, the elements and the powers of the state, (the difference between organ and office), the competence, administrative decentralization, the interests and the

rights and forms of protection, the administrative procedure and the participation, the right to access.
LAW AND ENVIRONMENT: environmental law, sources of international environmental law, the principles of international environmental law, the prohibition of transboundary pollution, the prevention principle, the precautionary principle, the polluter pays principle, cooperation between states, sustainable development, common but differentiated responsibility, the Kyoto Protocol.
EUROPEAN LAW ENVIRONMENT: regulations, directives, decisions and opinions, the European Union treaties, the EMAS, the ECOLABEL.
NATIONAL ENVIRONMENTAL LAW (GENERAL SECTION): the environment and the constitution, the principles of subsidiarity differentiation and adequacy, the peculiarities of the sources and environmental instruments, the principles of environmental action, the right of access to environmental information, ISPRA, ARPA, environmental groups, environmental administrative proceedings.
ENVIRONMENTAL INFORMATION IN ITALY
ENVIRONMENTAL PROCEDURES: VIA, VAS, AIA, AUA
THE ENVIRONMENTAL DAMAGE: general aspects of environmental damage, preventive action, recovery action, action for damages
RESPONSIBILITY 'AND INSTRUMENTS OF ENVIRONMENTAL DAMAGE PROTECTION: civil liability, criminal liability, the ordinary and administrative jurisdiction, administrative and criminal penalties, the administrative offense, the offense: elements, subjects involved, the phases of the criminal proceedings, the judicial police, the environmental crime
WATER: the prevention of water pollution, water resources management, soil conservation, the Floods Directive
AIR: general aspects, prevention and limitation of atmospheric emissions of installations and activities, civil heating systems, fuels, quality assessment, ambient air, ozone, global warming, transboundary pollution, urban traffic.
NOISE POLLUTION
ELECTROMAGNETIC POLLUTION
WASTE: principles, concepts, the waste management activities, recovery activities necessary skills, licenses and registration, monitoring of waste, the sanctions system, packaging
INDUSTRIAL MAJOR ACCIDENT: the Seveso directives and their implementation, purpose, definitions, categories of establishments, the skills, the means of prevention, the domino effect, the highly concentrated areas of establishments, emergency plans, information and consultation of the population in case of emergency
ENVIRONMENTAL RECLAMATION: preliminary issue, regulatory changes, sites to be reclaimed, procedures, water reclamation, soil reclamation, owner not guilty, transactions
PARKS AND PROTECTED NATURAL AREAS

Development of the course and examination

Methods for assessing learning outcomes:
The examination is an oral exam: during the examination the teacher evaluates the student learning.

Criteria for assessing learning outcomes:
During the oral examination the student will be demonstrate to know:
- at least two topics of the whole programme of environmental monitoring,
- at least two topics of the whole programme of environmental legislation.

Criteria for measuring learning outcomes:

The final mark is attributed in thirtieths. Successful completion of the examination will lead to grades ranging from 18 to 30, and 30 with laud.

Criteria for conferring final mark:
The final mark is attributed by evaluating the learning of the student on the contents of the course and by evaluating the complete mastery of the matter.

Recommended reading

Copy of slides available

One of the Following texts
E. Benacci, Compendio di diritto dell’ambiente, Ed. Simone, 2016, VIII ed.
G. Rossi (a cura di), Diritto dell’ambiente, Giappichelli 2015, III ed.
AA.VV., Diritto dellambiente, Ed. Simone 2011, IX ed.

MARINE ANIMAL BIODIVERSITY

BARBARA CALCINAI

Seat Scienze
A.A. 2016/2017
Credits 7
Hours 56
Period 1^ semestre

Prerequisites

Knowledge of the main marine, zoological groups.

Course contents

Lectures (5 credits, 40 hours approximately) and practical training in small groups (two or three students per group) (2 credits, 16 hours, approximately). The practical training involves the use of preserved zoological material in order to determine the zoological groups at species, genus, family or order level. Students have access to optical microscopes and stereo-microscopes and teaching material (keys, manuals etc.) to perform the exercises.

Objectives of the course

Aims

Knowledge:
The course enables students to acquire general knowledge on different aspects of marine biodiversity, mainly of the Mediterranean Sea. Aspects related to the change of marine biodiversity will be addressed on the basis of the main biogeographical subdivisions of the marine environment. The course also provides the technical basis for the identification of some, main groups of marine animals.

Ability to apply the knowledge:
The student will be able to use the knowledge acquired during the course to recognize, promote and manage the biodiversity of marine organisms.

Soft skills:
Laboratory activities carried out in small groups, stimulate the judgment capacity and the communication skill; the knowledge acquired during the course will be used by the students during the labs by testing their ability to learn and draw conclusions.

Program

Content of the lectures (5 credits, 40 hours, approximately):
Biodiversity: importance and definitions of biodiversity; comparison between marine and terrestrial biodiversity; the characteristics of the biodiversity; basics of cladistic analysis; types of extinctions; turnover of a species; speciation in the marine environment: overview; historical and geological events and biodiversity; the biodiversity of the Mediterranean: historical-geological and recent causes; Messinian crisis and Biodiversity of the Mediterranean Sea; theory of current inversion and biodiversity; factors that regulate lessepsian migration and anti-lessepsian migration; examples of Lessepsian fauna; spatial gradients of biodiversity; theory of insularity; dispersion and diffusion; concept of barriers to the dispersion and dispersion mechanisms; major biogeographical subdivisions of the marine environment; inter-tropical area, northern and southern temperate area, the western Indo-Pacific region, Atlanto-Mediterranean region, the Antarctic area, indo-polinesian province, Mediterranean-Atlantic province, Sarmatic province; MEOW biogeographic subdivisions; highly biodiverse environments, Mediterranean bioconstructions: Lithophyllum byssoides; vermetids and coralline algae, Cladocora caespitosa, Sabellaria; other examples of bioconstructions (Ficopomatus enigmaticus, Porifera etc.); biodiversity of the caves; factors affecting biodiversity with special reference to the invasions of alien species; examples of non-native species, consequences and mechanisms of introduction, with particular reference to the Mediterranean Sea. The Mediterranean Protected Fauna (marine invertebrates: porifera, cnidarians, molluscs, crustaceans, echinoderms): protected species.
Laboratory practicals (2 credits, 16 hours, approximately):
During the course some zoological groups such as Porifera, some groups of cnidarians, bivalves, crustaceans, will be investigated during labs activity. Dissections for the study of anatomical aspects of some zoological groups will be organized.

Development of the course and examination

Methods for assessing learning outcomes:
The degree of the preparation of the students will be evaluated through an oral exam. During the exam, students must demonstrate that they have acquired the knowledge presented during the course. The student must be able to expose the procedures and methods used during the laboratory training for identifying the zoological groups. The student will also be able to present the main systematic characters of the considered groups.

Criteria for assessing learning outcomes:
The level of knowledge acquired, exposed during the oral test, referring to lectures and to the practical training, will be evaluated to assess the students’ preparation.

Criteria for measuring learning outcomes:
The final mark is assigned as a fraction of 30. The exam is successfully passed when the mark is equal to or higher than 18/30. The highest mark can be assigned cum laude.

Criteria for conferring the final mark:
The final mark is given considering the levels of knowledge acquired and shown during the oral test, and it is conferred considering the theoretical and training parts.

Recommended reading

Notes taken during the lecturers and powerpoint presentations handed out by the lecturers.

Other suggested readings: Biodiversity an Introduction. Gaston & Spider. Blackwell Science.
Biogeografia. La dimensione spaziale dell'evoluzione. Zumino & Zullini. Casa Ed Ambrosiana.
Understanding Marine Biodiversity. National Research Consil. National Academy press.
Other publications available on line and Internet sites are also recommended and listed in the powerpoint presentations.

MARINE BIOLOGY (A-L)

ROBERTO DANOVARO

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 2^ semestre

Prerequisites

Knowledge of the main topics in Ecology, Zoology, Botany, and General Chemistry.

Course contents

Lectures (5 credits, 40 hours), laboratory practical exercises and field activities in small groups.

Objectives of the course

Knowledge:
The course aims to provide students with the basic principles of the Marine Biology, by studying the main marine environmental variables and biological responses, analyzing the relationships between structure/function/environment.

Ability to apply the knowledge:
The student must demonstrate the ability to apply theoretical knowledge to case studies, judging, independently, processes, phenomena and environmental events that may affect the sea.

Program

Content (lectures, 5 ECTS, 40 hours):
The content of the course covers the main characteristics of the marine environment, the adaptive and evolutionary aspects of the marine organisms as well as the main associations and assemblages of organisms of both the Mediterranean and other seas.
In particular: Marine biology history. Physics and Chemistry at sea, Biogeochemical cycles, Species evolution and adaptation, Life histories, Population dynamics, fluctuations and anomalies. Benthos. Biobuildings and bioerosions. Plankton. Nekton. Fisheries and aquaculture. Defense, trophic and reproductive strategies. Marine biogeography. Sustainable use, preservation and conservation.

Laboratory activities (1 CFU, 8 hours / student): The exercises consist in the analysis and selection of benthos and plankton samples.

Development of the course and examination

Methods for assessing learning outcomes:
The exam consists of a written test and subsequent review / discussion of the paper.

Criteria for assessing learning outcomes:
In the written test, the student must demonstrate knowledge of the main features, both biotic and abiotic environments and marine populations, demonstrating that it had achieved the ability to apply their knowledge to a specific case.

Criteria for measuring learning outcomes:
The final mark is awarded out of thirty. The exam is passed when the grade is greater than or equal to 18. It is expected to be awarded the highest marks with honors (30 cum laude).

Criteria for conferring final mark:
The final mark is conferred on the basis of the oral test.

Recommended reading

Lecture notes (Power Point)
DANOVARO R., 2012. Biologia marina. Calderini, Bologna
COGNETTI G., M. SARA' & G. MAGAZZU', 1999. Biologia marina. Calderini, Bologna NYBAKKEN J.W., 1988. Marine Ecology, a new approach. Harper & Row, New York VALIELA I., 1984. Marine Ecological Processes. Springer-Verlag, New York
DELLA CROCE N., R. CATTANEO-VIETTI & R. DANOVARO, 1997. Ecologia e protezione dell'ambiente marino costiero. Utet Libreria, Torino

MARINE BIOLOGY (M-Z)

CINZIA CORINALDESI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 2^ semestre

Prerequisites

Knowledge of the main topics in Physics, General Chemistry. Inorganic and organic chemistry, biochemistry, Ecology, Zoology and Botany.

Course contents

Frontal lectures (5 credits ECTS, 40 hours), and 1 credit of laboratory practical exercises and field activities or practical courses visiting external laboratories.

Objectives of the course

Knowledge:
The course aims to provide students with the basic principles of the Marine Biology, by studying the main marine environmental variables and biological responses, analyzing the relationships between structure/function/environment.

Ability to apply the knowledge:
The student should demonstrate their ability in linking different topics and in applying theoretical knowledge to case studies, judging independently, understanding processes of marine biology, phenomena and environmental events that may influence, drive or affect the life at sea.

Program

Content (lectures, 5 ECTS, 40 hours): The content of the course includes:
Past, present and future of marine biology, history of marine biology in Italy, the present and the future of marine biology, marine biology research in the next decade.
The marine environment, the deep ocean, properties and characteristics of the seawater, the properties of seawater determined by hydrogen bonds, determined by the properties of seawater salinity, the sea: a dynamic biosphere, sea and land compared.
Adaptations and specialization of marine organisms, adaptations to life in the sea, structure, locomotion and dispersion, structures of support and protection, bio-constructors, nutrition, metabolism and adaptation to temperature, mode of oxygen use, adaptation to exposure to 'air, adaptation to salinity, adaptation to pressure, light adaptation, vision, bioluminescence, receiving

systems, electrical conductivity, communicate and produce sounds in water.
Marine biodiversity, origin and evolution of life at sea, theories on the origin of life, evolution of marine biodiversity, speciation mechanisms at sea biodiversity in historical processes, marine animal populations in human history, quantify the biodiversity of organisms marine, biodiversity definitions, definition of the different levels of biodiversity, comparison between marine and terrestrial biodiversity, biodiversity measures, processes that control the distribution of marine biodiversity hotspots (hotspots) of biodiversity, biodiversity gradients, tropical biodiversity, pattern bathymetry of marine biodiversity, marine biogeography, biogeography terrestrial and marine biogeographic, biogeographical regions, biogeography of the Mediterranean, alien species and lessepsian migration, theories of evolution and of maintaining biodiversity, the relationship between biodiversity and functioning of marine ecosystems, loss of biodiversity.
Biodiversity and Ecology of Benthos, plankton and benthos in comparison, classification of benthos by size, femtobenthos, picobenthos, nanobenthos, microbenthos, meiobenthos (meiofauna), macrobenthos and megabenthos, macrophytobenthos (macrophytes), classification of benthos feeding types, benthos of hard bottom, benthos of soft sediments, biotic interactions in the seafloor, the benthos in space and time, the benthic bionomics, zonation of benthos, zonation of benthos according to the model of Peres and Picard, zonation of benthos according to Riedl.
Biodiversity and ecology of plankton, the organisms of plankton, classification based on the plankton distribution along the water column, plankton classification based on the life cycle, classification of plankton based on size classes, virioplankton, picoplankton, nanoplankton, microplankton, mesozooplankton , macro and mega-zooplankton, abundance of the different components of the plankton in comparison, distribution of plankton, an example of the plankton distribution at macroscale controlled by physical factors: El Niño, an example of small-scale distribution of plankton: the vertical migrations, ecology plankton, as do many phytoplankton species to coexist in a volume of water: a tribute to Santa Rosalia, nutritional modalities in zooplankton.
Biodiversity and ecology of the nekton and marine mammals, the main characteristics of the organisms of the nekton, fish, bony fishes, billfish, biodiversity patterns, ecology nekton, elasmobranchs, cephalopods, ecology of cephalopods, marine reptiles, seabirds, marine mammals, Sirenids, carnivores, cetaceans, large migrations of nekton, role of top predators in the food webs.
Ecosystem functioning, intraspecific processes, life cycles and reproduction, forms of resistance and benthic-pelagic coupling, primary production, secondary production, extra-specific processes, organic matter and debris in the water, dissolved organic matter in the sea (DOM), the coupling pelagic-benthic coupling, consequences of the export of organic matter to the seafloor.

Practical courses, field and laboratory analyses (1 CFU, 8 hours / student): The practical course consists in the analysis and sorting of benthos and plankton organisms. Identification of marine species, microscopic analyses. Depending on the research vessel availability also field activities are possible.

Development of the course and examination

Methods for assessing learning outcomes:
The examination consists of a multiple question test (generally 34), and each correct response is worth 1 point, followed by oral discussion (or direct verbalization of the test results). The oral discussion can improve the test score for up to 6 points. The results of the test remains valid for one year. More consecutive appeals can be tried and only the best score obtained is considered.

Criteria for assessing learning outcomes:
In the oral discussion (which is possible after passing the test), the students must demonstrate the knowledge of the main features, both biotic and abiotic environments and marine biology, as well as

the ability to apply the knowledge gained.

Criteria for measuring learning outcomes:
The final mark is awarded out of thirty. The exam is passed when the grade is greater than or equal to 18. It is expected to be awarded the highest marks with honours (30 cum laude).

Criteria for conferring final mark:
The final mark is conferred on the basis of the oral test.

Recommended reading

Power Points of the Lectures
Lecture notes
DANOVARO R., 2013. Biologia marina. Città Studi, De Agostini.

MARINE BIOLOGY AND ECOLOGY

ROBERTO DANOVARO

Seat Scienze
A.A. 2016/2017
Credits 7
Hours 56
Period 2^ semestre

Prerequisites

Knowledge of the main topics in Physics, General Chemistry. Inorganic and organic chemistry, biochemistry, Ecology, Zoology and Botany. Basic knowledge of marine biology.

Course contents

Frontal lectures (6 credits ECTS, 40 hours), and 1 credit of laboratory practical exercises and field activities including practical courses visiting external laboratories.

Objectives of the course

Knowledge:
The course aims to provide students with the advanced knowledge of the Marine Biology and ecology and of the marine ecosystems, and the ability of analyzing the relationships between structures and functions of marine ecosystems.

Ability to apply the knowledge:
The student should demonstrate their ability in linking different topics and in applying theoretical knowledge to case studies, judging independently, understanding processes of marine biology and ecology, and designing studies to understand the biodiversity and functioning of marine ecosystems, and the factors driving the patterns and functions of life at sea.

Program

Content (lectures, 6 ECTS, 48 hours): The content of the course includes the study of the following topics:
Interspecific interactions and trophic cascades, interspecific processes, predation, competition, facilitation and cooperation, symbiosis, parasitism, diseases of marine organisms, coral diseases, the overall interaction processes: networks and trophic cascades, food webs, food web of the debris, the circuit microbial (microbial loop), the viral circuit (viral shunt), bottom-up control of food webs, top-down control of food webs, mixed control "in the wasp waist", the key species (keystone), trophic cascades, biodiversity and ecosystem services.
Coastal ecosystems: lagoons, ecology of coastal lagoons, ecology models and functioning of

coastal lagoons, biodiversity of the lagoons, rocky intertidal, survival strategies in the intertidal environment, manufacturers primary of intertidal, zonation and competition, hard bottoms, consumers, niche dislocation to limit the effects of competition, predation on intertidal environment and the hypothesis of the intermediate disturbance, the key species, networks trophic, comparison of intertidal environments: hard bottoms vs soft bottoms, rocky subtidal, physical disturbance on benthic populations, biotic factors, the Mediterranean coral, underwater caves, cave biodiversity, adaptations in invertebrate life in the marine caves, food webs of the sea caves, forests of macro-algae, kelp forests, biodiversity associated with the kelp, food webs, forests of macroalgae in the Mediterranean, coastal ecosystems in comparison.
Ecosystems of coral reefs, seagrass beds and mangroves, coral reefs (coral reef), zoning within a coral reef (coral reef), types of coral reefs, the theory of the formation of coral reefs, the building corals characteristics, reproduction corals, coral nutrition and symbiotic relationship with zooxanthellae, the main limiting factors for the growth of corals, coral reef biodiversity, the functioning of coral reefs and food webs, primary consumers, deposivori / detritivores, secondary consumers, tertiary consumers, the competition for the space on coral reefs, interactions between coral reefs with adjacent ecosystems, seagrass beds, biodiversity associated with seagrasses, operation, mangroves, biodiversity associated with mangroves, operation of mangrove ecosystems, coastal ecosystems temperate-warm in comparison.
Deep-sea ecosystems, biodiversity of deep environments The azo theory of Forbes for deep environments, the origin of deep fauna, mechanisms of generation and maintenance of deep biodiversity, metabolism and function of ecosystems deep, deep sea habitats, underwater canyons, biodiversity, operation, seamounts, biodiversity of seamounts, deep coral, abyssal plains, biodiversity and adaptations, dwarfism and gigantism of abysmal abyssal, oceanic trenches, hadal biodiversity, marine ecosystems deep compared.
Extreme ecosystems: chemosynthetic ecosystems, hydrothermal vents, biodiversity associated with hydrothermal vents, ecosystem functioning, cold seeps and biodiversity of symbiotic organisms, habitat made by carcasses of large cetaceans (whale carcasses), biodiversity, the functioning of a whale carcass systems, affinity of the vents and seeps communities, hypoxic and anoxic systems (dead zones), areas minimum oxygen (oxygen minimum zones, OMZ), anoxic basins, hypersaline anoxic systems, extreme chemosynthetic ecosystems in comparison.
Polar ecosystems: the Arctic ecosystem, biogeography and characteristics, biodiversity, biodiversity in the sea ice, pelagic biodiversity, fish, marine mammals, benthic biodiversity, trophic networks and functioning of Arctic ecosystems, Antarctica, zoning, extension and size, habitat Antarctic, biodiversity, birds and mammals, trophic and operating networks, polar ecosystems compared.

Practical courses, field and laboratory analyses (1 CFU, 8 hours / student): The practical course consists in field work, using the research vessel Actea of the Department of Life and Environmental Sciences and in the collection of plankton and benthos samples, in the analysis and sorting of benthonic and planktonic organisms, the identification of marine species, microscopic analyses. Depending on the research vessel availability also field activities are possible.

Development of the course and examination

Methods for assessing learning outcomes:
The examination consists of written report on 3 questions, and each response is worth for up to 10 points, followed by oral discussion. The oral discussion can improve the test score for up to 6 points. The results of the written report remains valid for one year. More consecutive appeals can be tried and only the best score obtained is considered.

Criteria for assessing learning outcomes:

In the oral discussion (which is possible after passing the test), the students must demonstrate an advanced knowledge of the marine biology and ecology, of the both biotic and abiotic compoennts and their interactions, as well as the ability to apply the knowledge gained.

Criteria for measuring learning outcomes:
The final mark is awarded out of thirty. The exam is passed when the grade is greater than or equal to 18. It is expected to be awarded the highest marks with honours (30 cum laude).

Criteria for conferring final mark:
The final mark is conferred on the basis of the oral test.

Recommended reading

Power Points of the Lectures
Lecture notes
DANOVARO R., 2013. Biologia marina. Città Studi, De Agostini.

MARINE ECOTOXICOLOGY

FRANCESCO REGOLI

Seat Scienze
A.A. 2016/2017
Credits 7
Hours 56
Period 1^ semestre

Prerequisites

A good knowledge of basic chemistry, ecology and cell biology are important requisites for this course.

Course contents

The course is based on both theoretical lessons and practical exercitations on the main chemical contaminants, their environmental distribution and biological effects, bioindicator organisms, molecular and cellular responses to pollutants.

Objectives of the course

Knowledge
The Course is aimed to prepare students for the study of environmental pollution, with particular emphasis to the toxicological implications of chemicals on various biotic components. The course will also prepare students on environmental diffusion of contaminants, criteria for biomonitoring programs, assessment of biological risks, biomagnification and main issues in environmental toxicology. Particular emphasis will be given to bioindicator organisms, molecular and cellular responses to pollutants, use of biomarkers, biological and toxicity tests in research, normative guidelines and environmental impact assessment.

Ability to apply the knowledge:
At the end of the Course the student will have the capability to: describe main characteristics of chemicals and environmental distribution pathways; evaluate problems and results related to biomagnification, use of bioindicator organisms and biomarker analyses; use the main analytical methodologies for both chemical residues and cellular responses; organize and plan a biomonitoring program, choose bioindicators, define appropriate analyses and biomarkers to investigate, identify best methodological practices.

Soft skills:
Transversal competences include the integration between chemical properties of environmental pollutants and their biological effects: chemical-physical characteristics of such compounds, sources of input and distribution among environmental matrices are integrated with mechanism of accumulation, detoxification, differences of responsiveness and sensitivity of various species. These transversal competences will be further enhanced by practical exercitations when students will

acquire preliminary skills on analytical methodologies of chemicals in environmental matrices and biological tissues, as well as on toxicological measurements at molecular and cellular level.

Program

- Introduction and definition of ecotoxicology. –Main classes of environmental pollutants, distribution in environmental matrices and factors which affect their toxicity. Persistent pollutants, bioaccumulation and biomagnification. - Ecotoxicological approach in the marine environment; biomonitoring, biological resources and impact assessment. - Choice of bioindicator organisms. Mussel Watch programs. - Biological effects of chemicals, biomarkers at molecular cellular level with diagnostic and prognostic value. Effect and exposure biomarkers. - Biotransformation and toxicity of aromatic xenobiotics, polycyclic aromatic hydrocarbons, pesticides, halogenated hydrocarbons, dioxins. – Detoxification and toxicity of trace metals. Mercury and organotin compounds in trophic webs. Organophosphate and carbamate pesticides, and effects on acetylcholinesterase. – Role of lysosomes in detoxification and in pollutant-mediated pathologies. – Antioxidant defences and oxidative stress induced by pollutants. – Environmental genotoxicity and DNA damages as biomarkers. – Immunotoxicity in invertebrates and fish. – Endocrine disruptors in the marine environment. – Liver pathology and chemical carcinogenesis. – Emerging pollutants; from pharmaceuticals to nanoparticles. – Plastics and microplastics in the marine environment. - Toxicity Tests, general procedures, interpretation and applicability of results; examples of most commonly used tests for waters and sediments. - Elaboration of ecotoxicological results and definition of hazard indices. – Case studies of ecotoxicological applications.

Development of the course and examination

The examination is oral, based on questions and following discussion related to environmental pollutants, bioaccumulation mechanisms, detoxification pathways and onset of toxicity, monitoring and assessment of ecotoxicological risk.

Criteria for assessing learning outcomes:
During the examination, it will be evaluated the capability of the student to properly answer and discuss various issues, the general competence on problematics, the use of appropriate terminology, the capability to move from a topic to another one and make transversal links.

Criteria for measuring learning outcomes:
The final assessment is made of thirty. The examination is considered as passed with a vote of 18/30 or higher. The student can decide to decline the proposed vote and give again the examination in the following session.

Criteria for conferring final mark:
The final assessment will be given depending on the capability of the student to answer all the questions, general competence and ability to properly discuss various issues.

Recommended reading

Provided material, slides and scientific literature suggested on specific topics.

Fundamentals of Aquatic Toxicology. Edited by Gary M. Rand, Taylor & Francis
Biomarkers in Marine Organisms: a practical approach. Edited by Garrigues et al., Elsevier 2001

MARINE MICROBIOLOGY

CARLA VIGNAROLI

Seat Scienze
A.A. 2016/2017
Credits 7
Hours 56
Period 2^ semestre

Prerequisites

Basic knowledge of biochemistry, cytology, genetics and general microbiology

Course contents

Theoretical lessons (6 CFU, 48 hours) and practical activities (1 CFU, 8 hours)

Objectives of the course

Knowledge:
At the end of the course students will have to know metabolic and physiological features of the main taxonomic groups of marine microrganisms; they will also have to know the adaptative and survival strategies of marine bacteria, the fundamental role of microbes in marine ecosystem and the interactions between particular microbial species and the environment/marine organisms. Students will develop knowledge about pathogenicity mechanisms of some important human and/or fish pathogens and they will also learn to describe the main principles of methodology to be used in marine microbial communities study and in bacterial detection from sea-water samples.

Ability to apply the knowledge:
The student will also acquire the ability to perform basic microbiological analysis of seawater samples: determination of the microbial abundances, determination of fecal contamination of water by enumeration techniques and identification of faecal indicator bacteria, isolation and identification of native bacterial species, such as vibrios.

Soft skills:
Performing laboratory analysis in a teamwork will improve cooperativity and communication skills of students.

Program

Contents
Marine environment: general features and microbial communities. Distribution of the microbial populations in the marine habitats. The microbial loop and microbial food web. Role of

microrganisms in the ocean processes and in sulphur-, nitrogen- and carbon- cycle. Mechanisms of energy production among oligotrophic bacteria.
Principles of microbial taxonomy and methods to study microbial evolution. The main marine taxonomic groups of Bacteria. Photosynthetic bacteria, prochlorophytes and cyanobacteria, strategies and evolution of the most abundant photosynthetic bacteria in the oceans, microbial spheres and gliding motility in cyanobacteria. Toxic cyanobacteria and related harmful algal blooms. Chemoheterotrophs bacteria among marine proteobacteria, bacteria of the genus Pseudoalteromonas, Aeromonas and Vibrio, the Roseobacter group. Marine heterotrophs bacteria adapted to an oligotrophic lifestyle. Marine microbes as pathogens of humans and fishes and mechanisms of their pathogenicity. Structural features of Archaea and main groups and species of Archaea of oceans. The hyperthermophiles and halofiles, the methanogens. Hydrothermal vents community and black smokers. Survival strategies of marine hyperthermophiles and psychrophiles. Marine virus and their role in the prokaryotic biodiversity. Sampling methods and detection of marine microrganisms. Culture-based and culture-independent methods for the detection and identification of marine microbes. Interaction of microrganisms with marine environment, the chemotaxis, bacterial movement in aqueous environmental, adhesion and colonization of surfaces, biofilm formation. Air-water interface, bacterioneuston and hydrocarbon-degrading marine bacteria, sediment-planktonic interface and microbial mats. Interaction of microrganisms with other marine organisms, symbiotic associations. The quorum sensing mechanism, the biochemistry and biology of bacterial and dinoflagellata bioluminescence. Sewage seawater pollution and microbiological criteria for quality of coastal waters. Methods used for monitoring marine water quality.

Lab practice
During practical exercises the students will be able to perform microbiological analysis of sea-water samples: determination of fecal pollution by membrane filtration method and Most Probable Number technique; determination of the microbial abundances by culture-based methods; detection, isolation and identification of vibrios.

Development of the course and examination

Methods for assessing learning outcomes:
Oral examination consisting of three questions on the different topic areas of the course, including the methodologies.

Methods for assessing learning outcomes:
The student should be able to demonstrate to have acquired a good knowledge of the marine microbial diversity and of the techniques used in the study of marine microrganisms.

Criteria for measuring learning outcomes:
The examination mark is expressed as a whole number from 18 up to and including 30. 30 Cum laude could also be assigned to the most worthy students.

Criteria for conferring final mark:
The final examination mark is based on the ability of the student to give a clear and accurate account of the subject, to marshal arguments in a mature way, using appropriate scientific language.

Recommended reading

Class notes provided by the lecturer
Madigan, Martinko, Bender, Buckley, Stahl, "Brock biologia dei microrganismi", Pearson, 14a edizione, 2016.
Colin Munn - Marine Microbiology: ecology and applications – Garland Science, Taylor & Francis Group, 2nd edition (2011)

MARINE PLANT BIODIVERSITY

CECILIA MARIA TOTTI

Seat Scienze
A.A. 2016/2017
Credits 7
Hours 56
Period 2^ semestre

Prerequisites

Knowledge of topics of General Biology.

Course contents

Both theoretical (6 CFU, 48 hours) and practical (1 CFU, 8 hours) lessons will be provided.

Objectives of the course

Knowledge
This course will provide students the instruments for understanding the aspects of systematics, biology and ecology of algae groups and marine Angiosperms. Students will be provided with the instruments and the methodological approaches to recognize the marine plant groups. The students will know the biodiversity of plant communities in different marine environment, considering the main relationships with environmental factors. They will know also the main use of algae and the algae impact in human activities.

Ability to apply the knowledge:
Students will acquire the capability to recognize the main groups of marine plants which represents a professionalizing ability in several work felds.

Soft skills:
Knowledges acquired in this course, together with those acquired in other basic courses (e.g., Biodiversity of marine animals, and Marine Biology and Ecology) will provide students with the cultural basis of marine biology allowing them to recognize marine plants and enabling them to work in the field.

Program

Theoretical lessons (6 CFU, 48 hours)
Introduction to algae. General characteristics and ecology. Pjhylogenetic relationships.
Cyanobacteria: cytology, morphology, reproduction and ecology.
The origin of eukaryotic algae. Primary, secondary and tertiary endosymbiosis. The distribution of

algae in eukaryote supergroups.
Systematics and ecology of eukaryotic algae: Glaucophyta,Rhodophyta, Chlorophyta and Streptophyta, Cryptophyta, Haptophyta, Dinophyta, Stramenopili (Chrysophyceae, Bacillariohyceae, Dictyochophyceae, Raphidophyceae, Phaeophyceae etc.), Euglenophyta, Chlorarachniophyta. For each group the following topics will be addressed: general characteristics; origin and evolution; cell structure; anatomic and morphological organization; reproduction and life cycle; distribution and ecology; symbiotic relationships; economic importance and industrial uses; biogeography and alien species.
Seagrasses. Morphological, anatomical and reproductive adaptations. Biodiversity and biogeography. seagrasses of the Mediterranean Sea; meadow types. Systematics of the Mediterranean seagrasses.
Mangroves: biogeography; morphological, physiological and reproductive adaptations.
Phytoplankton communities. Analytical techniques. Sampling strategies for phytoplankton. Algal blooms. Factors affecting phytoplankton biodiversity and cycle. Annual cycles hypothetical and post-Sverdrup hypotheses. Biogeography and diversity of phytoplankton in the Mediterranean Sea. Deep Chlorophyll Maximum. Study cases: phytoplankton in the Adriatic Sea.
Microphytobenthos communities. Soft bottom microalgae (epipelon, epipsammon), hard bottom ones (epilithon), microalgae associated to organisms (epiphyton, epizoon). Growth forms of benthic microalgae. Importance and ecological role of microphytobenthos. Ecological factors affecting microphytobenthos growth.
Macrophyte communities. Environmental factors affecting benthic macrophytes. Algae morphotypes: relationships with grazing and production. Biogeography. Litophytic, psammophytic, epiphytic and drift seaweeds. Vegetation plans and macrophyte communities.
Harmful algal blooms. Toxic microalgae, exposure ways, and vector organisms. Main biointoxications (DSP, PSP, NSP, ASP, CFP, AZA). Raphidophyte and haptophyte toxins. Ciguatera. Palytoxins. Methods to preventing biointoxications.

Practical lessons (1 CFU, 8 hours/student)
Foe each students, for practical lessons (2 hours each) will be done.
I. Techniques to sample and analyse of phytoplankton. Observation at the light microscope of phytoplankton and microphytobenthos samples.
II. Setting up of algal cultures. Cell isolation. Preparation of growth medium.
III. Macroalgae identification. Sectioning of thalli at the cryotome. Setting up of slides and light microscope observations.
IV. Field practice. Sampling of substrata for the analysis of toxic epiphytic microalgae. Sample treatment and observation.

Development of the course and examination

Methods for assessing learning outcomes:
Evaluation of learning will be effected by oral examination. Examination consists in three questions on the course topics.

Criteria for assessing learning outcomes:
In the oral examination, the student should prove a good knowledge of Program topics.

Criteria for measuring learning outcomes:
The final mark is given in thirtieths. The examination is passed when the mark is higher or equal to 18/30. The cum laude assignation is also possible (30 cum laude).

Criteria for conferring final mark:
The final mark is given considering the student preparation, the thorough knowledge and the exposition ability.

Recommended reading

Lecture notes
GRAHAM L.E., GRAHAM J.M, WILCOX L.W., COOK M.E. 2016. Algae 3rd edition. LJLM Press.
LEE R.E., 2008. Phycology. 4th edition. Cambridge University Press.

MATHEMATICAL AND STATISTICAL METHODS

MILENA PETRINI

Seat Scienze
A.A. 2016/2017
Credits 9
Hours 72
Period 1^ semestre

Prerequisites

Basic elements of Calculus and Analytic Geometry

Course contents

There will be lectures and exercises for a total of 36 two-hour lessons each (9CFU).

Objectives of the course

Knowledge:
The course aims to introduce students to some theoretical, methodological and applicative elements of differential and integral calculus for real functions of one real variable and the basic elements of descriptive statistics (frequency distribution, indicators of centrality, dispersion, covariance, linear regression). It aims to provide students with the elements necessary for the understanding of analytical models in use for describing the scientific phenomena and the correct interpretation of the experimental data.

Ability to apply the knowledge:
The course aims to develop the ability to perform studies of functions, derivation, integration and solve simple differential equations. It also develops the ability to perform graphical representations of data and relative statistical analysis.

Soft Skills:
Classroom and individual resolution of many problems and exercises will improve learning ability and independence of judgment. The study of deductive logical topics and the correct use of logical mathematical language develops communication skills.

Program

Mathematics. Sets, Relations and Functions. Composition, invertibility. Natural, Integer, Rational and Real numbers. The Induction principle. Supremum, infimum, maximum, minimum. Modulus and powers. Exponential, logaritmic and angular functions. Limit of real sequences and its properties. Indeterminate forms. Monotone sequences. The Neper's number and related limits. Asymptotic

comparison. Limits of real function of real variable. Properties. Indeterminate forms. Monotone functions. Asymptotic comparison. Continuity; The Weierstrass's and the Intermediate Values Theorems. Derivative and Derivative Formulas. Successive Derivative. The Fermat's, Rolle's, Lagrange's and Cauchy's Theorems. Derivative and monotonicity. Convexity. Primitives. The De L'Hospital's Theorems. Asymptotes and the study of the graphs of functions. Definite Integral and its properties. Fundamental Theorem and Formula of the Integral Calculus. Indefinite Integral and integration methods: sum decomposition, by parts and substitution. General Integral for first order linear ordinary differential equations. The Cauchy Problem. The Bernoulli's equations. The Malthus and Verhulst models for the population dynamics.
Statistics: populations, characters and related typologies; Absolute and relative frequence. Modal class, median, mean, quartiles and percentiles, variance, standard deviation. Frequency distribution and its graphical representations. Multivariate distributions, covariance, correlation coefficient; linear regression and least squares method. Use of a spreadsheet with application to the descriptive analysis of a statistical population of data.

Development of the course and examination

Methods for assessing learning outcomes:
The exam consists of a written and an oral test, the tests will concern the topics covered during the course offered in the same academic year.
The registration to the first written test is mandatory, and has to be done on line on the university web page;
The written test consists of a number of problems and questions (from four to five, according to difficulty) concerning all topics treated during the course; this test will last two hours; the student will not be permitted the use of any kind of electronic device, not even a pocket calculator.
A minimum score of at least 15/30 in the written test is required for the admission to the oral test.
The list of the names of the students admitted to the oral test will be published by the teacher on his web page.
The oral test will contain mainly theoretical questions, some of which may be formulated in written form and contain exercises concerning course topics not covered in the written test or course topics in which the student may have shown weaknesses in the written test.
In case of a successful written test, the student may sit for the oral test either in the same session or the next available session, not later.
All written tests have to be correctly and fluently written, well organized, easily readable and with a negligible presence of corrections which must anyway not mar the esthetics of the text.
Honor code: each student pledges that the written tests are entirely his/her own work and that no input from other students or sources has been used; demeanors which are deemed unfair or not in line with these principles entail the failing of the exam.

Criteria for assessing learning outcomes:
In order to pass the exam the student must demonstrate a good understanding of all topics and concepts covered during the course, and which will be published on line as "Final program" or "Exam program" at the end of the course, and to be able to use them in solving typical calculus and statistical problems. Particular attention will be given to evaluate the student's ability to justify rigorously his assertions and in the proper use of logical mathematical language. In the statistic test the student must show knowledge of the statistical indicators used in his work and ability to interpret the results.

Criteria for measuring learning outcomes:
The final grade is attributed out of thirty. The exam is passed when the rating is greater than or

equal to 18. It is possible the award of full marks with honors (30 e lode).

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

Recommended reading

P. Marcellini - C. Sbordone, Elementi di Calcolo, Liguori editore. Marcellini - C. Sbordone, Esercitazioni di matematica vol. 1 (parte I e II), Liguori editore
P. Baldi, Introduzione alla probabilità. Con elementi di statistica, Mc Graw-Hill Editore.
Teacher's lecture notes

MATHEMATICS (A-L)

PIERO MONTECCHIARI

Seat Scienze
A.A. 2016/2017
Credits 8
Hours 64
Period 1^ semestre

Prerequisites

Basic elements of Calculus and Analytic Geometry

Course contents

There will be lectures and exercises for a total of 32 two-hour lessons each (8CFU).

Objectives of the course

Knowledge
The course aims to introduce students to some theoretical, methodological and applicative elements of differential and integral calculus for real functions of one real variable. It aims to provide students with the elements necessary for the understanding of analytical models in use for describing the scientific phenomena they will encounter in their later studies.

Ability to apply the knowledge:
Classroom and individual resolution of many problems and exercises will improve learning ability and independence of judgment. The study of deductive logical topics and the correct use of logical mathematical language develops communication skills.

Program

Sets, Relations and Functions. Composition, invertibility. Natural, Integer, Rational and Real numbers. The Induction principle. Supremum, infimum, maximum, minimum. Modulus and powers. Exponential, logaritmic and angular functions. Limit of real sequences and its properties. Indeterminate forms. Monotone sequences. The Neper's number and related limits. Asymptotic comparison. Limits of real function of real variable. Properties. Indeterminate forms. Monotone functions. Asymptotic comparison. Continuity; The Weierstrass's and the Intermediate Values Theorems. Derivative and Derivative Formulas. Successive Derivative. The Fermat's, Rolle's, Lagrange's and Cauchy's Theorems. Derivative and monotonicity. Convexity. Primitives. The De L'Hospital's Theorems. Asymptotes and the study of the graphs of functions. Definite Integral and its properties. Fundamental Theorem and Formula of the Integral Calculus. Indefinite Integral and integration methods: sum decomposition, by parts and substitution. General Integral for first order linear ordinary differential equations. The Cauchy Problem. The Bernoulli's equations. The Malthus and Verhulst models for the population dynamics.

Development of the course and examination

Methods for assessing learning outcomes:
The exam consists of two tests. The first test (written) consists of a multiple choice test consisting of ten questions. Each correct answer corresponds to a score of 3 points. The wrong answers or no dates are worth 0 points. The test will be a satisfactory result if the total score will be at least 18. The first trial allows access to the second trial (which must be made within the time of the next written test, the result of the first test is invalidated if not) the second test consists of 4 theoretical questions each rated up to a maximum score of 8 points. The second test will be a satisfactory result if the total score will be at least 18.

Criteria for assessing learning outcomes:
In the written test the student must demonstrate the ability to solve simple exercises. In the second test the student must demonstrate that he has learned the theoretical themes proposed in the lessons. Particular attention will be given to evaluate the student's ability to justify rigorously his assertions and in the proper use of logical mathematical language.

Criteria for measuring learning outcomes:
The final grade is attributed out of thirty. The exam is passed when the rating is greater than or equal to 18. It is possible the award of full marks with honors (30 e lode).

Criteria for conferring final mark:
The final grade is assigned equal to the average of marks obtained in the two tests.

Recommended reading

F.G Alessio, P. Montecchiari, Note di Analisi Matematica uno, Esculapio editore
P. Marcellini - C. Sbordone, Elementi di Calcolo, Liguori editore
P. Marcellini - C. Sbordone, Esercitazioni di matematica vol. 1 (parte I e II), Liguori editore

MATHEMATICS (M-Z)

DARIO GENOVESE

Seat Scienze
A.A. 2016/2017
Credits 8
Hours 64
Period 1^ semestre

Prerequisites

Basic elements of Calculus and Analytic Geometry

Course contents

There will be lectures and exercises for a total of 32 two-hour lessons each (8CFU).

Objectives of the course

Knowledge:
The course aims to introduce students to some theoretical, methodological and applicative elements of differential and integral calculus for real functions of one real variable. It aims to provide students with the elements necessary for the understanding of analytical models in use for describing the scientific phenomena they will encounter in their later studies.

Ability to apply the knowledge:
The course aims to develop the ability to perform studies of functions, derivation, integration and solve simple differential equations

Soft skills:
Classroom and individual resolution of many problems and exercises will improve learning ability and independence of judgment. The study of deductive logical topics and the correct use of logical mathematical language develops communication skills.

Program

Sets, Relations and Functions. Composition, invertibility. Natural, Integer, Rational and Real numbers. The Induction principle. Supremum, infimum, maximum, minimum. Modulus and powers. Exponential, logaritmic and angular functions. Limit of real sequences and its properties. Indeterminate forms. Monotone sequences. The Neper's number and related limits. Asymptotic comparison. Limits of real function of real variable. Properties. Indeterminate forms. Monotone functions. Asymptotic comparison. Continuity; The Weierstrass's and the Intermediate Values Theorems. Derivative and Derivative Formulas. Successive Derivative. The Fermat's, Rolle's, Lagrange's and Cauchy's Theorems. Derivative and monotonicity. Convexity. Primitives. The De L'Hospital's Theorems. Asymptotes and the study of the graphs of functions. Definite Integral and its properties. Fundamental Theorem and Formula of the Integral Calculus. Indefinite Integral and integration methods: sum decomposition, by parts and substitution. General Integral for first order linear ordinary differential equations. The Cauchy Problem. The Bernoulli's equations. The Malthus and Verhulst models for the population dynamics.

Development of the course and examination

Methods for assessing learning outcomes:The exam consists of two tests. The first test (written) consists of a multiple choice test consisting of ten questions. Each correct answer corresponds to a score of 3 points. The wrong answers or no dates are worth 0 points. The test will be a satisfactory result if the total score will be at least 18. The first trial allows access to the second trial (which must be made within the time of the next written test, the result of the first test is invalidated if not) the second test consists of 4 theoretical questions each rated up to a maximum score of 8 points. The second test will be a satisfactory result if the total score will be at least 18.

Criteria for assessing learning outcomes: In the written test the student must demonstrate the ability to solve simple exercises. In the second test the student must demonstrate that he has learned the theoretical themes proposed in the lessons. Particular attention will be given to evaluate the student's ability to justify rigorously his assertions and in the proper use of logical mathematical language.

Criteria for measuring learning outcomes:The final grade is attributed out of thirty. The exam is passed when the rating is greater than or equal to 18. It is possible the award of full marks with honors (30 e lode).

Criteria for conferring final mark:The final grade is assigned equal to the average of marks obtained in the two tests.

Recommended reading

F.G Alessio, P. Montecchiari, Note di Analisi Matematica uno, Esculapio editore
P. Marcellini - C. Sbordone, Elementi di Calcolo, Liguori editore
P. Marcellini - C. Sbordone, Esercitazioni di matematica vol. 1 (parte I e II), Liguori editore

MEDICINE OF DISASTER

MARIO CAROLI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 2^ semestre

Prerequisites

None

Course contents

Theoretical lectures are planned (6 credits, 48 hours) and practical exercises carried out individually or in small groups. At the frontal course is flanked educational activity containing, among other things: teaching materials, use of precompiled cards, use of video - audio, self-evaluation tests, elaboration of emergency plans virtual prehospital and hospital, to class attendance and tutorials practices, results of examinations.

Objectives of the course

Knowledge:
The course enables students to acquire the basic knowledge on Disaster Medicine, medical specialty that studies such as attitudes to assume in connection with an exceptional event, which, although of a different nature, is always characterized by a clear disproportion between the demands of the environment and response capacity of health relief. This is done through the theoretical and methodological study of the main techniques of analysis of the assessment and measurement of risk of a territory, the management of health resources, the role of operational center of 118, of the importance of medical aid chain and the various roles. Simultaneously provides students with the knowledge on the health care organization in the great mass gatherings, pitched on the characteristics of the health facilities, the triage and major incident personal health record, the hospital role in major incidents particularly on PEIMAF, PEI, PEVAC. Special attention will be placed also on the toxicological emergencies, and on international medical emergencies on the health aspects in mass casualties in developing countries and finally on the psychological aspects in the disaster. The course thus aims to introduce the basic principles of health management of relief operations in disaster situations, applying the methodology developed by the international scientific community. The individual medical emergency protocols are revised depending on the complexity of the logistics and management of major incident scenarios and provides a framework that allows to develop planning skills, sustainable welfare procedures and a rational approach to the management of emergency complex medical scenarios.

Ability to apply the knowledge:
The student must acquire the ability to carry out the analysis of the health risks of a virtual territory,

with the elaboration of a pre-hospital health emergency plan and will be able to fill out major incident personal health record using the START triage. It must also develop a plan PEIMAF (internal emergency plan for the surge of wounded) of a virtual hospital.

Soft skills:
The performance analysis of the health risks of an individual and group territory, as well as the drafting of health care pre-hospital and hospital emergency plans, help to improve both the degree of independence of judgment in general, both the communication skills that comes also work in groups, both the learning capacity and autonomy to draw conclusions, integrating the student with the other components of the emergency system involved in a disaster scenario (Fire brigade, Public Order Forces, Civil Defence, Volunteer).

Program

Content (lectures, 6 CFU, 42 hours + 6 hours of tutorial):
Introduction to Disaster Medicine: Epidemiology and classification of disasters: natural, technological and social. geographical distribution of the different types of disaster. impact on health, psychological and social in the population.
Evaluation and calculation of risk: risk recognition, risk calculation methods, FEMA model, Scenario FEMA model.
Role of the operations center 118: Current regulations, structural features and equipment that is attached to the helpline 118. Preparation of an emergency plan prehospital, tasks of the Operational Centre 118 in case of major accident.
Chain of survival and roles: Mitigation and elimination of the damage, phase of spontaneity, organizational phase, operational phase, health roles: Director of Relief Health (DSS), Director of Recovery Teams (DSR), Director of Transport (DTR), Director of the AMP (DPMA), the AMP Teams Healthcare, Recovery Teams.
Emergency Medical Module: Advanced Medical Post, PMA I, II, III level, Field Hospital, structural and functional characteristics, organization of materials, AMP, AMPS, LFH, Type 1, Type2, Type 3 (WHO), Role 1, Role2, Role 3 Role 4 (NATO).
Prehospital triage: Definition, directions, objectives and essential requirements of the Triage, types of triage in mass casualties (START and SMART), clinical simulations, personal health record in mass casualities (SSM).
Treatment within mass casualties: Definition, directions, goals of treatment within mass casualties, clinical simulations, ABCDE management in the territory.
Healthcare to mass gatherings: organization of health relief, Model of Arbon, the Maurer algorithm.
Hospital's role in major incident: Emergency System Urgency, analysis and calculation of risks, calculation of resources (space, materials, technologies, staff), event design, resource management in the hospital, activation of PEIMAF, PEI, PEVAC.
Chain of command in PEIMAF: responsibilities, tasks and characteristics of the hospital staff, the Directorate of mass casualties, Presidium of mass casualties, Crisis Unit, Director of Relief Health Hospital (DSSH), roles and functions in the phases of prevention, activation and preparation of the plan.
Functional areas and health treatments in PEIMAF: triage areas, code red, yellow and green, headquarters and structural characteristics, functions and general treatments, fit and function of the areas, routes and destination of the victims, functions and relationships of the areas Director .
Health issues in emergency toxicology: Chain of health relief, management of patients poisoned by chemicals, identification of the substance and toxicological syndromes, primary and secondary decontamination, territorial hospital and health intervention.
Health aspects in international mass casualties: food and nutrition, water and sanitation,

communicable diseases.
Psychology of disasters: the stressors and psychological risk to the victims and rescue workers, physical and behavioral reactions reactions, psychosocial teams for emergencies.
Field exercises (6 hours): There are two management simulations and organization of mass casualties on 3 hours each on the field.

Development of the course and examination

Methods for assessing learning outcomes:
The exam consists of a written test with 27 multiple-choice questions to be performed in 30 minutes. These include all of the topics covered during the course. Each question is given a score ranging from -3 to +4 depending on the degree of complexity of the application. Passing the exam it is bound to the acquisition, in the computation of the score, to a level at least equal to 65% of those questions considered essential to the knowledge of the course. The exam is passed when the final grade is greater than or equal to 18. In the event of loss or dissatisfaction of the vote, the examination can be repeated no earlier than one month to two additional attempts, taking into account that the level of difficulty of the questions will be more complex with each successive attempt. From the fourth attempt the exam you can play in single oral mode. This is to inform that you will not know the exact answer and / or errors made in the written test since some questions might be proposed again.

Criteria for assessing learning outcomes:
In the written test, the student must demonstrate knowledge of the principles and methodology of health care management in a disaster situation, and to have acquired basic knowledge of the main roles of the chain of command and control at both the prehospital level hospital.

Criteria for measuring learning outcomes:
The final mark is awarded out of thirty. The exam is passed when the grade is greater than or equal to 18. It is expected to be awarded the highest marks with honors (30 cum laude).

Criteria for conferring final mark:
The final vote is given by calculating the result of each response to the 27 questions in the test. The vote cum laude is given only when the student responds exactly to all the test questions or when the student has demonstrated full mastery of the subject to the oral examination.

Recommended reading

The teacher text (handed over by the teacher during ongoing)
For those who do not attend lessons text you can be requested by writing to the following address:
caroli.mario@tiscali.it

MODELING OF BIOLOGICAL SYSTEMS

ROBERTA GALEAZZI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 1^ semestre

Prerequisites

Basic knowledge of Bioinformatics, Chemistry and Physics.

Course contents

During the course, there will be both theory frontal lessons (4 credits, 32 hours) and practical laboratory exercises (2 credits, 16 hours) which will be carried out individually or in small groups. Support materials for the preparation of the final exams will be distributed such as the instruction for the practical exercises.

Objectives of the course

Knowledge At the end of the course, the students must have a full-scale introduction to computational chemistry and molecular modeling, including special topics on computational-aided drug design. More in details, they will have knowledge of the state-of-art techniques for energy and structure calculations (both for small ligands, drugs and for macromolecules such as proteins and nucleic acids).

Ability to apply the knowledge:
The course goal is to develop a practical understanding of computational methods (strengths, limitations, applicability) and competence in applying these methods to molecular modeling in order to solve and explain biological relevant problems. The students should be also able to use some molecular modeling software to predict the 3D structure of proteins, and the ligand-receptor association.

Program

FRONTAL LESSONS (4 credits, 32 hours):
Introduction to molecular modeling and simulation: problems, challenges, and approaches. Basic protein structure; Introduction to quantum and molecular mechanics. Biomolecular force fields; non bonded computations. Protein folding prediction; Theoretical prediction of Mechanism of Enzymatic reaction. Complete minimization methods; Homology and comparative modeling for 3D protein predicition, new challenges to GPCRs model construction. Conformational search applied to the

study of bioactive conformation: Systematic search and Monte Carlo method and Molecular dynamics simulated annealing approach. Full atom molecular dynamics methods: approach and challenges to simulation in membrane bilayers. Molecular docking: methods and application to rational drug design. Computer-Aided Drug Design: peptidomimetics as novel antibiotics (casa studies); the solvation problem: current status and future developments. Dynamics of proteins and peptides in membrane: state of art and applications.

LABORATORY LESSONS (2 credits, 16 hours):
Practical exercises taken to the DISVA informatics laboratory about some arguments discussed in the frontal lessons (such as molecular docking and comparative protein modeling).

Development of the course and examination

Methods for assessing learning outcomes:
The student will send the written lab reports by e-mail in PDF or doc version. The exam consists of an oral on topics covered in class or, alternatively, in a written assignment to multiple choice questions (n. 10, 1 pt /question) and of 5 open questions (4 pt /question). For the final grade the reports of the exercises will be evaluated, and they are awarded up to a maximum of two points. The exam is passed when the final grade is greater than or equal to 18.

Criteria for assessing learning outcomes:
In the written test, the student must demonstrate knowledge of principles and methods (theory and practice) of molecular modeling methodologies and to have acquired basic knowledge on methods for the prediction of protein structure and drug-receptor interactions. In the lab reports, the students must demonstrate that they have achieved the ability to apply the knowledge acquired during the training, to enforce a simple laboratory computational experiment and the ability to critically draw, independently and / or in a group, a report test.

Criteria for measuring learning outcomes:
The final mark is awarded out of thirty. The exam is passed when the grade is greater than or equal to 18. It is expected to be awarded the highest marks with honors (30 cum laude).

Criteria for conferring final mark:
The final grade is given by summing the evaluation of the oral or written test with the score assigned to the laboratory report, the latter up to a maximum of two points. “30 cum laude” is attributed when the score obtained from the previous sum exceeds the value 30 while the student has demonstrated full mastery of the subject.

Recommended reading

Materials distributed during lessons (papers and diapositives)
A.R. Leach, Molecular Modeling - Principles and applications, Longman, second edition, 2001.
C.J.Cramer, Essentials of Computational Chemistry: Theories and Models, John Wiley & Sons, 2004.
T. Schlick, Molecular Modeling. An Interdisciplinary Guide, Second Edition, Springer Verlag, New York ,2010.
D. C. Rapaport, The Art of Molecular Dynamics Simulation, 2004, ISBN 0-521-82568-7
Jan H. Jensen, Molecular Modeling Basics, CRC Press, 2010

MOLECULAR BIOLOGY (A-L)

ANNA LA TEANA

Seat Scienze
A.A. 2016/2017
Credits 8
Hours 64
Period 2^ semestre

Prerequisites

Knowledge of basic General Chemistry, Cytology, Organic Chemistry and Biological Chemistry is required.

Course contents

The course is organized in lectures (7 CFU, 56 hours) and laboratories (1 CFU, 8 hours). Handouts of the lectures, protocols for the laboratories and booking forms for the laboratories are loaded on the Moodle platform of DiSVA website.

Objectives of the course

Knowledge:
Students will learn about the structure-function relationship of nucleic acids and of nucleic acids interacting proteins, the molecular mechanisms of DNA duplication, RNA transcription and maturation, translation and regulation of gene expression. The course will also provide a description of the different experimental procedures, which have led to current knowledge.

Ability to apply the knowledge:
Students will be able to apply the acquired knowledge about the working principles of genetic material to other topics such as Genetics, Developmental Biology and Cell Biology. Furthermore, they will be able to apply some basic DNA manipulation and analysis techniques; they will be able to search nucleic acid and protein sequences in databases and to use software specific for restriction analysis and site-directed mutagenesis of DNA fragments.

Soft skills:
The practical experience during the laboratories together with the discussions on the experimental results will improve students' autonomy and ability to evaluate critically scientific data. Furthermore, the organization of the laboratories in small groups will facilitate the coordination and communication abilities.

Program

Content (lectures 7 CFU, 56 hours):
Nucleic acids. Structure and chemical-physical properties. Nucleic acids as genetic material. DNA topology. Structural organization of viral, prokaryotic and eukaryotic genomes. Chromosomes, chromatin, nucleosomes.
DNA replication. The Meselson and Sthal experiment. The replication fork and the semidiscontinuous synthesis of DNA. Coordinated synthesis of the leader and lagging strands. DNA polymerases in prokaryotes and eukaryotes. Replication origins. Regulation of replication initiation in prokaryotes and eukaryotes. Replication and cell cycle.
DNA recombination. Homologous and site-specific recombination. Transposition.
Gene organization in virus, prokaryotes and eukaryotes.
Transcription. Different types of RNA: mRNA, tRNA, rRNA, snRNA, scRNA.
Transcription of prokaryotic genes. RNA polymerase and promoters. Termination and anti-termination.
Transcription of eukaryotic genes. RNA polymerases and promoters. Transcription factors. Enhancers and silencers. Termination.
RNA processing. Processing of rRNA and tRNA. mRNA maturation and splicing. Self-splicing. Editing.
mRNA translation. tRNA as an adaptor: secondary and tertiary structure. Modified bases. The genetic code. The aminoacyl-tRNA synthetases and the identity rules.
The ribosome. The different steps of protein synthesis. Initiation, elongation and termination factors in prokaryotes and eukaryotes. The role of rRNA in protein synthesis. Antibiotic and protein synthesis.
Regulation of gene expression in prokaryotes. The operon. Structural genes and regulator genes. Induction and repression: the lac, trp, examples. Catabolite repression. Attenuation. Examples of regulation at the post-transcriptional level.
Regulation of gene expression in eukaryotes. Response elements and DNA binding protein domains. Different models for gene activation. DNA methylation and gene expression. Chromatin structure and transcription.
Experimental procedures
DNA analysis: digestion with restriction enzymes, restriction mapping, cloning vectors, DNA sequencing, PCR, Southern blotting, site-directed mutagenesis. Promoters analysis: footprinting and band-shift, reporter genes, mutations analysis. Transcripts analysis: northern blotting, 5’-race. mRNA purification by oligo-dT and cDNA libraries construction. Translation analysis: Cell-free systems, Western blot.

Laboratories (1 CFU, 8 hours):
Students will perform: extraction of plasmid DNA from bacteria, purification of the plasmid by affinity chromatography and determination of its concentration by spectrophotometric analysis; restriction enzymes digestion and analysis of the fragments by agarose gel electrophoresis; data analysis. Search for nucleic acid and protein sequences in the NCBI database, identification of a gene coding sequence, in silico restriction mapping and site-directed mutagenesis, sequence alignment using BLAST.

Development of the course and examination

Methods for assessing learning outcomes:
Evaluation is performed through an oral exam during which students will be asked to discuss about 3 different topics.

Criteria for assessing learning outcomes:

Questions aim at verifying the level of knowledge acquired by the students. They span the entire program: topics discussed during the lectures as well as topics subject of the laboratories.

Criteria for measuring learning outcomes:
The level of knowledge acquired by the students is measured with a mark between 0 and 30. In order to pass the exam the final mark must be between 18 and 30. The highest possible mark is 30/30 cum laude.

Criteria for conferring final mark:
The answer to each question is evaluated with a mark included between 0 and 10. The final mark is calculated as the sum of the 3 answers. 30/30 cum laude is attributed to students particularly able to discuss critically and with great competence about the different topics.

Recommended reading

Biologia molecolare del gene. J.D. Watson, T.A. Baker, S.P. Bell, A. Gann, M. Levine, R. Losick. Casa Editrice Zanichelli. VII edizione. 2015.
Biologia Molecolare. F. Amaldi, P. Benedetti, G. Pesole, P. Plevani. Casa Editrice Ambrosiana. II edizione. 2014.

MOLECULAR BIOLOGY (M-Z)

DAVIDE SARTINI

Seat Scienze
A.A. 2016/2017
Credits 8
Hours 64
Period 2^ semestre

Prerequisites

Students are supposed to have acquired principles of General and Inorganic Chemistry, Cytology, Organic Chemistry and Biochemistry.

Course contents

The course will include frontal lectures (7 CFU, 56 hours) and practical activities in experimental and informatic laboratories (1 CFU, 8 hours). Within DiSVA website, the Moodle platform will supply students with teaching materials of frontal lectures, experimental and informatic laboratory protocols and reservation forms to participate to practical activities.

Objectives of the course

Knowledge:
The course topics, covered during frontal lessons as well practical activities, will allow students to learn concepts about structure and function of nucleic acids, protein–DNA and protein-RNA interactions, molecular mechanisms underlying DNA replication, transcription, translation and RNA processing, and regulation of gene expression.

Ability to apply the knowledge:
Student will apply knowledges, acquired during the course, to learn other subjects such as Genetics and Developmental Biology. Student will also be able to perform basic procedures used for manipulation and analysis of nucleic acids, to find specific nucleic acid and protein sequences stored in databases available through web and to use specific softwares for restriction analysis and site-directed mutagenesis.

Program

Frontal lectures (7 CFU, 56 hours).
Nucleic acids. Nucleic acids as genetic material. Structure and physical and chemical properties of DNA and RNA. DNA topology. Organization of viral, prokaryotic and eukaryotic genomes. Chromosomes, chromatin and nucleosomes.
DNA replication. The Meselson and Stahl experiment. The replication fork. The semi-discontinuous

DNA replication The coordinated synthesis of both leading and lagging DNA strands. Prokaryotic and eukaryotic DNA polymerase. Replication origins. Regulation of DNA replication initiation in prokaryotes and eukaryotes. Replication and cell cycle.
Transcription. Different types of RNA molecules: mRNA, tRNA, rRNA, and snRNA. Transcription in prokaryotes. Transcription initiation: RNA polymerase and promoters. Intrinsic and Rho-dependent termination. Anti-termination. Transcription in eukaryotes. Transcription initiation: promoters and consensus sequences. RNA polymerase I, II and III. Transcription factors. Enhancers and silencers. Transcription termination. Processing of rRNA, tRNA and mRNA. Splicing: spliceosome, snRNA and snRNP. Self-splicing: group I and II introns. RNA editing.
Translation. tRNA as an adaptor molecule: secondary and tertiary structure. The genetic code. Aminoacyl-tRNA synthetase. The ribosome. Steps in protein synthesis. Initiation, elongation and termination factors in prokaryotes and eukaryotes. The role of rRNA in protein synthesis. Antibiotics and protein synthesis.
Regulation of gene expression in prokaryotes. The operon. Structural and regulatory genes. Induction and repression: lac and trp operons. Catabolite repression and attenuation. Regulation of gene expression in bacteriophage .
Regulation of gene expression in eukaryotes. Response elements. DNA binding domains. DNA methylation and gene expression. Chromatin structure and transcriptional activity.
Methods. Molecular cloning: restriction enzymes and cloning vectors. PCR and agarose gel electrophoresis. DNA sequencing. Blotting methods: Southern blot, Northern blot and Western blot. Site-directed mutagenesis. Purification of mRNA by oligo(dT)-cellulose chromatography. Genomic and cDNA libraries. Expression vectors and recombinant proteins.

Practical activities in experimental and informatic laboratories (1 CFU, 8 hours).
Isolation of plasmid DNA from bacterial cells. Evaluation of plasmid DNA concentration through spectrophotometric analysis. Digestion of plasmid DNA using restriction endonucleases. Separation of DNA fragments by agarose gel electrophoresis.
Use of nucleotide and aminoacid sequence databases availabe at NCBI. Identification of the coding sequence of a structural gene. Restriction map and site-directed mutagenesis through in silico analyses. BLAST as a tool for sequence allignment.

Development of the course and examination

Methods for assessing learning outcomes:
Learning assessment will be performed through an oral exam. During oral exam (30 minutes) each student will be asked 3 questions about topics within the program content.

Methods for assessing learning outcomes:
Oral exam questions will evaluate the knowledge of topics dealt with during frontal lectures as well as practical activities in experimental and informatic laboratories.

Criteria for measuring learning outcomes:
The final mark is expressed as a ratio. The exam is passed when the ratio is equal o more than 18/30. It is possible to attribute full mark with honour (30/30 cum laude).

Criteria for measuring learning outcomes:
Each answer will be assigned a score ranging from 0 to 10. The final result of the oral exam is calculated as sum of the scores obtained for each answer. Full mark with honour could be attributed if the student demonstrate mastery of the body of knowledge and high level communication skill.

Recommended reading

Biologia Molecolare, F. Amaldi, P. Benedetti, G. Pesole, P. Plevani. Casa Editrice Ambrosiana. II ediction. 2014.
Biologia molecolare del gene, J.D. Watson, T.A. Baker, S.P. Bell, A. Gann, M. Levine, R. Losick. Casa Editrice Zanichelli. VII ediction. 2015.

MOLECULAR BIOPHYSICS

FRANCESCO SPINOZZI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 1^ semestre

Prerequisites

Students are expected to have had basic courses in physics, chemistry, biochemistry and biology.

Course contents

The course includes theoretical lectures (5 credits, 40 hours) and x-ray laboratory practicals (1 credit, 8 hours). Course attendance, although not mandatory, is strongly recommended. Attendance laboratory practicals is mandatory.

Objectives of the course

Knowledge:
A better understanding of the physical principles that rule out the molecular processes in living systems, with emphasis on statistical thermodynamics, quantum mechanics, intermolecular forces and structure of water. Knowledge of the main techniques of strucural investigation of biological molecules based on X-ray and neutron scattering..

Ability to apply the knowledge:
Students should be able to identify the main forces that underlie a biomolecular process and that determine structure and stability of protein and lipid aggregates. They will be also able to perform X-ray diffraction experiments on aqueous dispersions of lipids, analyse the results and identify the lipid phase.

Soft skills:
The activity during the x-ray laboratory practicals, carried out in a working group, and the preparation of a laboratory report help to improve student's autonomy and communication skills.

Program

Contents (classroom lectures, 7 CFU, 56 hours):
Concepts of thermodynamics: free energy and chemical potential; Thermodynamic probability and entropy; Concepts of statistical thermodynamics; Concepts of quantum mechanics; Geometry of a polymeric chain; Some fundamentals of electrostatics; Intermolecular forces; The structure of the

water, hydration effects; Hydrophobic and hydrophilic molecules; Hydration of proteins; Debye-Hückel theory; Monte Carlo method; Molecular Dynamics method. X rays. The scattering vector. Atomic structure factors. Scattering from a mono-dimensional array of atoms. van Laue's conditions. Scattering from a 3D lattice. Electron density. Multiple isomorph replacement method. Powder diffraction. The Bragg law. Diffraction from lipid / water systems. Lipid phases. Small angle X-ray and neutron scattering. From factor and structure factor of proteins in solution.

Laboratory Practicals (1 CFU, 8 hours):
X-ray diffraction and lipid phases

Development of the course and examination

Methods for assessing learning outcomes:
The exam consists of an oral test, which also assesses the experimental report on x-ray laboratory practicals.

Criteria for assessing learning outcomes:
It will be assessed the student's ability to know the contribution of Molecular Biophysics in the quantitative description of relevant aspects regarding the structure and the transformation of biological molecules.

Criteria for measuring learning outcomes:
The final mark is expressed in a scale from 0 to 30. The exam is passed when the mark is greater than or equal to 18. Students can be awarded with the honour mark (30 cum laude).

Criteria for conferring final mark:
The final mark is attributed evaluating the oral test and taking into account the x-ray laboratory report. The honour mark is given when the student has demonstrated full mastery of the subject.

Recommended reading

Lecture notes.
R. Glaser, Biophysics, Springer
K.E. van Holde, W.C. Johnson, P.S. Ho, Principles of Physical Biochemistry, Prentice Hall.
M. Daune, Molecular Biophysics, Oxford University Press.

MOLECULAR GENETIC

MARCO BARUCCA

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 1^ semestre

Prerequisites

Knowledge of basal concepts of genetic and molecular biology.

Course contents

5 CFU of lectures are planned as well as 1 CFU including practical laboratory (carried out individually or in small groups) and preparation and presentation of scientific papers related to the topics covered during the lectures.

Objectives of the course

Knowledge
Students will have acquired the fundamental concepts about the structure, function and evolution of eukaryotic genomes and genes and knowledge on the molecular genetics of the antibodies, tumors and on the principles and strategies for identifying gene-disease in humans.

Ability to apply the knowledge:
At the end of the course, students will be able to understand the molecular dynamics related to the evolution of genes and genomes (including in cancer cells). They should also be able to understand and design strategies for the identification of gene-disease in humans.

Soft skills
Laboratory activities performed in group as well as the preparation and presentation of reports on scientific articles will contribute to improve the autonomy level as well as communication skills also arising from work in groups.

Program

- The ground-breaking importance of genome projects; background and organization of the Human Genome Projects and genome projects for model organisms; Functional Genomics.
- Eukaryotic genomes: nuclear and mitochondrial. Organization, distribution and function of polypeptide-encoding genes, tandemly repeated noncoding DNA, interspersed repetitive noncoding DNA, transposable elements and retrotransposons.

- Evolution of gene structure and duplicated genes; evolution of chromosomes and genomes; comparative genomics; evolution of human populations.
- Identifying Human Disease Genes: principles and strategies.
- Cancer Genetics.
- Immuno molecular genetics of vertebrates.
- Strategies and methods in Molecular Genetics

Development of the course and examination

Methods for assessing learning outcomes:
Oral exam after registration in the reserved area.

Criteria for assessing learning outcomes:
The oral examination is aimed at assessing the knowledge and understanding of Molecular Genetics and other subjects needed to resolve problems related to course objectives.

Criteria for measuring learning outcomes:
The final mark is assigned exclusively on the oral exam through questions at low, medium, and high difficulty related to three topics covered during the course. The exam is considered passed if the student demonstrates sufficient knowledge to each of the three topics. Laude is assigned if the student demonstrates full mastery of the subject.

Criteria for conferring final mark:
The final mark is assigned on the basis of the student's ability to provide answers that demonstrate mastery of the subject with clarity and with a relevant technical and scientific terminology. It will also evaluate the student's ability to link the topics covered during the course among themselves and with topics covered in other teachings already acquired by the student.

Recommended reading

Tom Strachan e Andrew P. Read, “Genetica umana molecolare” Zanichelli – Bologna
Slides provided during the course.

PHARMACOLOGY

STEFANO BOMPADRE

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 2^ semestre

Prerequisites

Knowledge of physics, chemistry, biochemistry and general physiology

Course contents

Lectures and e-learning.

Objectives of the course

Knowledge:
The course provides the basic knowledge of the active ingredients in the most common drugs, their mechanism of action and to possible side effects. Will also be given notions about the most common drugs of abuse, natural origin, and the methods of analysis in biological samples

Ability to apply the knowledge:
The student at the end of the course will be able to:
Describe the most common active ingredients in the major drug classes.
Explain the mechanism of action of the major drug classes.
Describe the most common adverse effects and drug interactions of the major drug classes and individual active ingredients within these classes.
Describe the most common drugs of abuse and the most commonly used techniques for the detection of drugs in biological samples

Program

Pharmacokinetics: routes of administration. absorption, distribution, metabolism and excretion. Transport across biological barriers.
Extrarenal and renal excretion of drugs. Pharmacokinetic parameters: bioavailability, apparent volume of distribution, plasma half-life, clearance.
Pharmacodynamics: receptors, mechanisms of action of the drugs: receptor sites, receptors and endogenous ligands. Concentration-response curves. Full agonists, partial agonists, inverse agonists, antagonists. Sensitization and tolerance to drugs. Therapeutic index. Principles of Pharmacogenetics and Pharmacogenomics.

Autonomic Nervous System Agents, adrenergics, cholinergics, dopaminergic agonists and antagonists. sedative-anxiolytics, general and local anesthetics, antidepressants, nonsteroidal anti-inflammatory drugs (NSAIDs). cardiac glycosides, ACE inhibitors. vasodilators, diuretics, calcium channel blockers, anticonvulsant, antiarrhythmic, penicillins, cephalosporins, tetracyclines, macrolides, aminoglycosides, fluoroquinolones, sulfonamides.
Most common drugs of abuse. Principles of most commonly used techniques for the detection of drugs and substances of abuse in biological samples

Development of the course and examination

Methods for assessing learning outcomes
The exam consists in a multiple choice test, to be completed in 30 min.

Criteria for assessing learning outcomes:
The student has to recognize the most common active principles, identifying the therapeutic class of drugs, the mechanism of action, and side effects.

Criteria for measuring learning outcomes:
The test consists of 32 questions with four possible answers. For every question answered correctly is awarded a point, -0,2 points for a wrong answer.

Criteria for conferring final mark:
The final grade is attributed out of thirty. The exam is passed when the rating is equal or greater than 18. It is possible the award of full marks with honors (30 e lode) for a rating equal or greater than 30.

Recommended reading

TITLE Le basi della Farmacologia
AUTHOR Clark, Finkel, Rey, Whalen
PUBLISHER Zanichelli

PHYSICS

FRANCESCO SPINOZZI

Seat Scienze
A.A. 2016/2017
Credits 8
Hours 64
Period 1^ semestre

Prerequisites

Basic mathematical concepts: representation on the Cartesian space, first and second order equations and systems, exponential and logarithmic functions, elementary goniometry functions.

Course contents

The course includes theoretical lectures (7 credits, 56 hours), classroom exercises (1 credit, 8 hours) e two laboratory practicals taken in small working groups (1 credit, 8 hours). Course attendance, although not mandatory, is strongly recommended. Attendance laboratory practicals is mandatory. For students who have been absent, recovery laboratory practicals will be planned.

Objectives of the course

Knowledge:
The course enables students to acquire a basic knowledge of Physics and to identify, understand and quantitatively describe natural phenomena. The course focuses on the basic theoretical and experimental Physics (mechanics, fluid properties, thermodynamics, electric and magnetic properties), which is needed to provide a robust scientific basis for interdisciplinary studies.

Ability to apply the knowledge:
Students should be able to know and to derive the physical laws necessary to describe basic phenomena involving movement, energy, thermal properties, electricity and magnetism. They should be able to apply the proper laws for solving numerical exercises and clearly communicate the procedure followed for finding their solution. Students should show to have understood the scientific method that they have followed during the experimental measurements and the critical interpretation of the the physical phenomena they observed during laboratory practicals.

Soft skills:
The activity during the laboratory practicals, carried out in a working group, and the preparation of laboratory reports help to improve student's autonomy and communication skills.

Program

Contents (classroom lectures, 7 CFU, 56 hours):
Scientific method. Base quantities, derived quantities and dimensions. Systems of units. Scalars and vectors. Vector operations. Position and displacement vectors. Average velocity and instantaneous velocity. Average acceleration and instantaneous acceleration. Straight uniform motion. Uniformly accelerated motion. Uniform circular motion. Non-uniform circular motion and angular velocity. Centripetal and tangential acceleration. Parabolic motion. Concept of force. Principle of inertia. Second law of dynamics. Third principle of dynamics. Weight force. Hooke's Law. Composition of forces. Contact forces. Tension of an ideal chord. Gravitational force. Other forces in nature. Static and dynamic friction. Examples of motions in the presence of friction. Non-inertial reference frame and apparent forces. Many-particles systems. Center of mass. Position, velocity and acceleration of the center of mass. Internal and external forces. Momentum. Principle of conservation of momentum. Basic examples for the conservation of momentum. Impulsive forces. Work. Kinetic energy theorem. Power. Scalar and vector fields. Conservative field. Potential energy. Principle of conservation of mechanical energy. Dissipative forces. Gravitational and elastic potential energy. Elastic and inelastic collisions. Moment of force. Static equilibrium. Basic examples of static equilibrium. Angular momentum and inertia. Principle of conservation of the angular momentum. Density and viscosity of a fluid. Pressure and Pascal's Principle. Stevin's law. Archimedes' principle. Fluids in stationary motion. Law of continuity. Bernoulli's theorem. Real fluids. Laminar motion. Poiseille's law. Thermal equilibrium. Temperature and temperature units. Thermodynamic coordinates. Thermodynamic states. Equation of state of perfect gases. Quasistatic process. Heat and work. Opposition pressure and work of expansion-compression. Specific heat at constant pressure and volume. Joule's experiment. First law of thermodynamics. Isochoric, isobaric and isothermal transformations. Adiabatic reversible transformation. Poisson's laws. Statements of the second law of thermodynamics. Carnot cycle. Efficiency of a Carnot cycle. Entropy. Inequality of Clausius. Free expansion of a gas. Entropy and disorder. Notable examples of thermodynamic cycles. Electric charge, electric field and electric potential. Gauss's law. Charged particles in an electric field. Conductors and insulators. Capacitors. Electricity and Ohm's law. Magnetic field and its properties. Charged particles in a magnetic field.

Laboratory Practicals (1 CFU, 8 hours):
Elongation of a helical spring and verification of Hooke's law. Quantitative relationships among physical quantities that describe a uniformly accelerated motion. Forces on an inclined plane. Determining the density of liquids. Action of atmospheric pressure. Archimedes' force as a function of the volume of a body.

Development of the course and examination

Methods for assessing learning outcomes:
The exam consists of a written test (or two partial tests) and an oral test. Students can not access the oral test without having passed the written test. Students who did not pass one of two partial tests during the course will take in the next scheduled exams a written test covering the content of the entire course.

Criteria for assessing learning outcomes:
All written test are constituted by three numerical exercises, each containing three or four questions. The written test is evaluated on the basis of the procedure that has been adopted and on the numerical results obtained. During the oral test the experimental report on laboratory practicals will be evaluated. It will be also assessed the student's ability to know the definition and the meaning of physical quantities and to formally derive the physical laws learned during the course.

Criteria for measuring learning outcomes:
The final mark is expressed in a scale from 0 to 30. The exam is passed when the mark is greater than or equal to 18. Students can be awarded with the honour mark (30 cum laude).

Criteria for conferring final mark:
The final mark is mainly attributed evaluating the oral test and taking into account in a non quantitative manner of the written test mark. The honour mark is given when the student has demonstrated full mastery of the subject.

Recommended reading

Lecture notes.
A. Giambattista, B. McCarthy Richardson, R. C. Richardson, "Fisica Generale. Principi e applicazioni", McGraw-Hill, second edition, 2012.
P. Pavan, F. Soramel, “Problemi di Fisica Risolti e Commentati”, Casa Editrice Amborsiana, third edition, 2007
Any physics text for university courses.

PHYSICS (A-L)

MARIA GRAZIA ORTORE

Seat Scienze
A.A. 2016/2017
Credits 8
Hours 64
Period 2^ semestre

Prerequisites

Basic mathematical concepts (representation on the Cartesian space, direct and inverse proportion, first and second order equations and systems, exponential and logarithmic functions, simple geometrical functions, elementary trigonometry); knowledge of basic concepts in Chemistry (atom, molecule, chemical bond).

Course contents

The course includes theoretical lectures (6 credits, 48 hours), classroom exercises (1 credit, 8 hours) e a Physics Practical Laboratory works, attended in small groups (1 credit, 8 hours). Course attendance, although not mandatory, is strongly recommended. Attendance to the Physics Practical Laboratory is mandatory. Many dates to attend Physics Practical Laboratory are available and can be booked via web in the e-learning platform dedicated to the students in the Department of Life and Environmental Science website.

Objectives of the course

Knowledge:
The course focuses on the study of matter, energy, forces, and their interaction in the world and universe around us. The course enables students to acquire the necessary competences on the physical basic laws and concepts (both theoretical and experimental), useful to describe and to understand the physical properties of the matter in the framework of the life and environmental sciences. The course presents the fundamentals of theoretical and experimental Physics (mechanics, fluid properties, thermodynamics, electric and specialties magnetic properties) necessary for graduate study in interdisciplinary disciplines requiring a strong scientific background.

Ability to apply the knowledge:
Students must acquire a rigorous, quantitative and analytic way of thinking and dealing with physical phenomena. In particular, students have to learn the laws of General Physics and to appropriately apply them to interpret the basic phenomena involving movement, energy and thermal, electrical and magnetic properties of matter. Also students have to know how properly use the units of the common physical quantities and know the conversion factors between homogeneous units. Students have to be able to apply the laws of Physics to solve numerical exercises and to communicate the method used to obtain their solution. Finally, students should be able to show understanding of the scientific method used to measure and critically interpret the physical

phenomena observed during practical laboratories.

Soft skills:
The activities carried on during the practical laboratories and laboratory reports’ compilation, developed in a working group, will stimulate and improve student's autonomy and communication skills. Moreover, the analysis of data collected during the experimental activities and the exercises performed to solve the physical problems will help the students to exploit the mathematical and statistical concepts learned in previous courses.

Program

Contents (classroom lectures, 6 CFU, 48 hours):
Introduction to Physics and its methods. Physical quantities and measurements. Concepts of space and time. Kinematics of a particle: definition of the position vector, velocity and acceleration. Trajectories and laws: uniform motion, uniformly accelerated rectilinear motion, circular motion, uniform circular motion. Dynamics: Newton's laws, notable examples of forces. Angular momentum and moment of a force, conservation of angular momentum. Centre of mass. Equilibrium of a rigid body and rotational dynamics. Work and energy. Conservation of mechanical energy. Non-conservative forces. Elastic and inelastic collisions. Fluid mechanics: definition of ideal fluid. Properties of fluids. Definition of pressure. Stevin's law. Archimedes' principle. Pascal's law. Continuity equation. Bernoulli's equation. Real fluids. Laminar motion. Poiseille’s law. Thermodynamics: Zeroth law of thermodynamics. Definition of absolute temperature. Specific heat. Heat capacity. State transformations. Latent heat of transformation. Thermodynamic systems: ideal gas and its equation of state. Heat, work and internal energy. Principles of thermodynamics. Reversible and irreversible thermodynamic processes: isochoric, isobaric, isothermal and adiabatic. Cyclic transformations and efficiency of thermodynamic machines. Carnot cycle and its efficiency. Entropy. Inequality of Clausius. Electric charge, electric field and electric potential. Charged particles in an electric field. Conductors and insulators. Capacitors. Electricity and Ohm’s laws. Magnetic field and its properties. Charged particles in a magnetic field. RC as equivalent circuit model for a patch of neural membrane.

Laboratory Practicals (1 CFU, 8 hours):
The aim of the practical laboratories is to teach students the principles and methods of measurement using the most common laboratory instruments, basic statistical processing, and data graphical representation. In particular, students will perform the following experiments: elongation of a helical spring and verification of Hooke's law; elongation of an elastic body; quantitative relationships between the physical quantities describing a uniformly accelerated motion; forces on a sloping plane; determination of liquids’ or solids’ mass densities; action of atmospheric pressure; Archimede's force as a function of the volume and the mass of a body. Each experiment will be carried out by groups of 5 students. At the end of the laboratory practice, each group will have to prepare a report on all the activities carried out in the laboratory, describing for each experiment the set-up and the data obtained, the executed calculations, the calculated analytical results (expressed with the correct number of significant digits) and the final discussion / interpretation.

Development of the course and examination

Methods for assessing learning outcomes:
The exam consists of a written test and an oral examination. The student does not have access to

the oral exam without having passed the written test. The written test consist of 3 exercises, each containing 2 or 3 questions, covering the content of the entire course. The test is approved when the student has successfully completed at least an exercise and a half (the corresponding vote should be higher than 15/30). During the course semester, there is also the opportunity for the student to take two per-itinere written tests (1st and 2nd per-itinere part), centred on the program treated until then. Each of the two per-itinere tests consists of 3 exercises each containing 2 or 3 questions. The result of a per-itinere test is mediated with the other, provided that the score of each of them is at least equal to 15/30. The students who do not pass one of two per-itinere tests will take the normal written test.

Criteria for assessing learning outcomes:
During the oral examination, the student's ability to learn the definition and meaning of physical quantities and to perform demonstrations of physical laws learned during the course will be evaluated. In addition, the group report on the experiments performed during the Laboratory practice will be also considered.

Criteria for measuring learning outcomes:
The final mark is expressed in a scale from 1 to 30. The exam is passed when the mark is greater than or equal to 18. Students can be awarded with the honour mark (30 cum laude).

Criteria for conferring final mark:
The final mark is mainly attributed evaluating the oral test and taking into account in a non quantitative manner of the written test mark. The honour mark is given when the student has demonstrated full mastery of the subject.

Recommended reading

Lecture notes.
A. Giambattista, B. McCarthy Richardson, R. C. Richardson, "Fisica Generale. Principi e applicazioni", McGraw-Hill, second edition, 2012.
Fisica. Vol. 1: Meccanica e termodinamica. -Ferrari V., Luci C., Mariani C.- Idelson-Gnocchi
Fundamentals of Physics – D. Halliday, R. Resnick), J. Walker- Wiley

PHYSICS (M-Z)

PAOLO MARIANI

Seat Scienze
A.A. 2016/2017
Credits 8
Hours 64
Period 2^ semestre

Prerequisites

Basic mathematical concepts (representation on the Cartesian space, direct and inverse proportion, first and second order equations and systems, exponential and logarithmic functions, simple geometrical functions, elementary trigonometry); knowledge of basic concepts in Chemistry (atom, molecule, chemical bond).

Course contents

The course includes theoretical lectures (6 credits, 48 hours), classroom exercises (1 credit, 8 hours) e two Physics Laboratory practicals taken in small working groups (1 credit, 8 hours). Course attendance, although not mandatory, is strongly recommended. Attendance to the Physics Laboratory practical is mandatory. For students who have been absent, recovery Physics Laboratory practicals will be planned at the end of course semester.

Objectives of the course

Knowledge:
The course is concerned with the study of matter, energy, forces, and their interaction in the world and universe around us. The course enables students to acquire the necessary competences on the physical basic laws and concepts (both theoretical and experimental) useful to describe and to understand the physical properties of the matter in the frame of the life and environmental sciences. The course is focused on the basic theoretical and experimental Physics (mechanics, fluid properties, thermodynamics, electric and magnetic properties) and covers the broad fundamentals necessary for graduate study in interdisciplinary specialties requiring a strong scientific background.

Ability to apply the knowledge:
The student must acquire a rigorous and analytic way of thinking and dealing with physical phenomena. In particular, it should have a basic knowledge of the laws of General Physics and it should be able to apply them appropriately to interpret the basic phenomena involving movement, energy and thermal, electrical and magnetic properties of matter, to properly use the units of the common physical quantities and to know the conversion factors between homogeneous units. In addition, the student should be able to apply the laws of Physics to solve numerical exercises and must be able to clearly communicate the process used to arrive at their solution. Finally, the student should be able to show understanding of the scientific method used to measure and interpret critically the physical phenomena observed during laboratory experiments.

Soft skills:
The activity during the laboratory practicals and the preparation of laboratory reports, carried out in a working group, will help to improve student's autonomy and communication skills. Moreover, the analysis of data collected by the students during the experimental activities and the exercise performed to solve the physical problems will help the student to improve the ability to use the already learned mathematical and statistical concepts.

Program

Contents (classroom lectures, 6 CFU, 48 hours):
Scientific method. Base quantities, derived quantities and dimensions. Systems of units. Scalars and vectors. Vector operations. Position and displacement vectors. Average velocity and instantaneous velocity. Average acceleration and instantaneous acceleration. Straight uniform motion. Uniformly accelerated motion. Uniform circular motion. Non-uniform circular motion and angular velocity. Centripetal and tangential acceleration. Parabolic motion. Concept of force. Principle of inertia. Second law of dynamics. Third principle of dynamics. Weight force. Hooke’s Law. Composition of forces. Contact forces. Tension of an ideal chord. Gravitational force. Other forces in nature. Static and dynamic friction. Examples of motions in the presence of friction. Non-inertial reference frame and apparent forces. Many-particles systems. Center of mass. Position, velocity and acceleration of the center of mass. Internal and external forces. Momentum. Principle of conservation of momentum. Basic examples for the conservation of momentum. Impulsive forces. Work. Kinetic energy theorem. Power. Scalar and vector fields. Conservative field. Potential energy. Principle of conservation of mechanical energy. Dissipative forces. Gravitational and elastic potential energy. Elastic and inelastic collisions. Moment of force. Static equilibrium. Basic examples of static equilibrium. Angular momentum and inertia. Principle of conservation of the angular momentum. Density and viscosity of a fluid. Pressure and Pascal’s Principle. Stevin’s law. Archimedes’ principle. Fluids in stationary motion. Law of continuity. Bernoulli’s theorem. Real fluids. Laminar motion. Poiseille’s law. Thermal equilibrium. Temperature and temperature units. Thermodynamic coordinates. Thermodynamic states. Equation of state of perfect gases. Quasistatic process. Heat and work. Opposition pressure and work of expansion-compression. Specific heat at constant pressure and volume. Joule’s experiment. First law of thermodynamics. Isochoric, isobaric and isothermal transformations. Adiabatic reversible transformation. Poisson’s laws. Statements of the second law of thermodynamics. Carnot cycle. Efficiency of a Carnot cycle. Entropy. Inequality of Clausius. Free expansion of a gas. Entropy and disorder. Notable examples of thermodynamic cycles. Electric charge, electric field and electric potential. Gauss’s law. Charged particles in an electric field. Conductors and insulators. Capacitors. Electricity and Ohm’s law. Magnetic field and its properties. Charged particles in a magnetic field.

Laboratory Practicals (1 CFU, 8 hours):
The aim of the laboratory practicals is to learn the principles and methods of measurement through the use of the most common laboratory instruments and statistical processing and representation of the obtained data. In particular, the following experiments will be considered: elongation of a helical spring and verification of Hooke's law; elongation of an elastic body; quantitative relationships between the physical quantities that describe a uniformly accelerated motion; forces on an inclined plane; determination of density of liquids or solids; action of atmospheric pressure; Archimede's force as a function of the volume and the mass of a body. Each experiment will be done in groups of 5 students. At the end of the laboratory practice, each group will have to prepare a report on all the activities carried out in the laboratory, describing for each experiment the set-up and the data obtained, the executed calculations, the calculated analytical results (expressed with the correct number of significant digits) and the final discussion / interpretation.

Development of the course and examination

Methods for assessing learning outcomes:
The exam consists of a written test and an oral examination. The student does not have access to the oral exam without having passed the written test. The written test consist of 3 exercises, each containing 2 or 3 questions, covering the content of the entire course. The test is approved when the student has successfully completed at least an exercise and a half (the corresponding vote should be higher than 15/30). During the course semester, there is also the opportunity for the student to take two per-itinere written tests (1st and 2nd per-itinere part), centred on the program treated until then. Each of the two per-itinere tests consists of 3 exercises each containing 2 or 3 questions. The result of a per-itinere test is mediated with the other, provided that the score of each of them is at least equal to 15/30. The students who do not pass one of two per-itinere tests will take the normal written test.

Criteria for assessing learning outcomes:
During the oral examination, the student's ability to learn the definition and meaning of physical quantities and to perform demonstrations of physical laws learned during the course will be evaluated. In addition, the group report on the experiments performed during the Laboratory practice will be also considered.

Criteria for measuring learning outcomes:
The final mark is expressed in a scale from 1 to 30. The exam is passed when the mark is greater than or equal to 18. Students can be awarded with the honour mark (30 cum laude).

Criteria for conferring final mark:
The final mark is mainly attributed evaluating the oral test and taking into account in a non quantitative manner of the written test mark. The honour mark is given when the student has demonstrated full mastery of the subject.

Recommended reading

Lecture notes.
A. Giambattista, B. McCarthy Richardson, R. C. Richardson, "Fisica Generale. Principi e applicazioni", McGraw-Hill, second edition, 2012.
P. Pavan, F. Soramel, “Problemi di Fisica Risolti e Commentati”, Casa Editrice Amborsiana, third edition, 2007
Any physics text for university courses.

PHYSIOLOGY OF MARINE ANIMALS

ROSAMARIA FIORINI

Seat Scienze
A.A. 2016/2017
Credits 7
Hours 56
Period 2^ semestre

Prerequisites

To follow the course of Marine Animal Physiology, students must have knowledge of Physics, Comparative Anatomy, Biochemistry and General Physiology.

Course contents

The course includes theoretical (6 credits, 48hours) and practical lessons (1 credit, 8 hours). An e-learning platform is also available and it includes the didactic material.

Objectives of the course

Knowledge:
At the end of the course students will have a complete view of the physiological mechanisms and the adaptive strategies that allow the survival of the animals in the marine environment.

Ability to apply the knowledge:
Students will be able to use the concepts learned in order to elucidate the evolution of the different physiological mechanisms in marine animals

Program

- Osmoregulation in aqueous environments
- Structure and function of biological membranes
- Fluorescence spectroscopy
- Respiratory gas exchange
- Muscles and movement
- Food intake and digestion
- Excretion
- Energy production
- Environment adaptation
- Endocrine system

Development of the course and examination

Methods for assessing learning outcomes:
PowerPoint presentation of a research article of marine animal physiology, chosen by the student, and oral exam with questions on the program.

Criteria for assessing learning outcomes:
The student must show synthesis capabilities in organizing PowerPoint presentation and he must be able to correctly expose the fundamental concepts of marine animal physiology in the oral exam.

Criteria for measuring learning outcomes:
Successful completion of the examination will lead to grades ranging from 18 to 30, and 30 cum laude. The exam is passed when the grade is more than or equal to 18.

Criteria for conferring final mark:
The final grade is given by summing the evaluations of the PowerPoint presentation and of the oral exam. The laude is assigned when students demonstrate full mastery of the subject.

Recommended reading

Poli A,. Fabbri E. “Fisiologia degli animali marini” EdiSES 2012.
Somero G.N., Hochachka P.W. “ Biochemical Adaptation, mechanism and process in physiological evolution “, Oxford University Press.
Dantzler W.H. “ Comparative Physiology “, Oxford University Press

PHYSIOLOGY OF NUTRITION

ROSAMARIA FIORINI

Seat Scienze
A.A. 2016/2017
Credits 7
Hours 56
Period 2^ semestre

Prerequisites

To follow the course of Nutrition Physiology, students must have knowledge of Biochemistry and General Physiology.

Course contents

The course includes theoretical (6 credits, 48hours) and practical lessons (1 credit, 8 hours). An e-learning platform is also available and it includes the didactic material.

Objectives of the course

Knowledge: at the end of the course students will acquire knowledge of the digestive functions, their connection with energy metabolism and the endocrine and nervous control mechanisms of food and water homeostasis.

Ability to apply the knowledge: The student will be able to integrate the acquired knowledge and to deepen and continually develop new skills.

Program

Taste and Smell
Gustatory and olfactory sensory structures. Central integration of various sensory informations.
Central control of homeostasis
The central role of the hypothalamus. Control of body mass and feeding. Control of the circulating liquids and liquid intake.
Digestion and absorption
Nervous and hormonal control of intestinal function. Gastrointestinal motility. Absorptions and secretions of the gastrointestinal system.
Energy metabolism
Principles of cellular energy. Energy balance. Metabolic adaptations. Neuroendocrine control of energy metabolism.

Development of the course and examination

Methods for assessing learning outcomes: oral exam with questions on the program.

Criteria for assessing learning outcomes: the student must be able to expose and integrate the basic concepts presented in the lectures.

Criteria for measuring learning outcomes:
Successful completion of the examination will lead to grades ranging from 18 to 30, and 30 cum laude

Criteria for conferring final mark:
The final grade is given by evaluation of the responses to each question. Laude is assigned when students demonstrate full mastery of the subject.

Recommended reading

Silverthorn “Fisiologia”, Casa Editrice Pearson, Italia, 2013.

PLANT PHYSIOLOGY (A-L)

MARIO GIORDANO

Seat Scienze
A.A. 2016/2017
Credits 8
Hours 64
Period 1^ semestre

Prerequisites

The student must be able to conduct literature searches
Sufficient knowledge of English to understand scientific literature
Basic knowledge of chemistry, biochemistry and physical-chemistry
Knowledge of plant cytology, structural organization of plants and algae and of their phylogenetic relationships

Course contents

The course will comprise 7 credits (56 hours) of theoretical classes and 1 credit (8 hours) of practical classes. The practical will consist of individual and group exercises in the form of oral discussions, of seminars, and of resolution of numerical problems. Students will also have to analyze and discuss scientific papers on fundamental aspect of plant physiology in class.
Crucial references will be made available on the e-learning platform. The course will be taught by Prof. Giordano and Prof. Norici, who will conduct their teaching on very strict coordination.

Objectives of the course

Knowledge:
The course will allow the students to acquire basic knowledge on the physiology of photosynthetic organisms, with special attention to the integration of the information for the various parts of the program.
A conspicuous part of the curse will be devoted to photosynthesis in all its aspects. Subsequently, the student will be called to the comprehension of the interaction of various metabolic pathway for the use of photosynthate and of the regulatory processed mediated by hormones and photoreceptors.

Ability to apply the knowledge:
At the end of the course, in addition to mastering the basic concepts in plant physiology, the student will be able to independently and creatively analyze the primary literature sources and employ them within scientific projects.

Soft skill:
The highly interactive nature of the course will lead the student to develop skills in verbal and written scientific communication and in the critical analyses of literature.

Program

Contents (frontal lectures, 7 CFU, 56 hours):
General principles of photosynthesis and of its evolution in relation to environmental changes over Earth history
Capture and use of light radiation: general properties of molecules involved in light capture. The process of light absorption. Photosynthetic pigments. Structure of antennae and energy transfer within antennae. Connections between antennae and reaction centers. Structure and function of reaction center of anoxigenic and oxigenic photosynthetic organisms. Electron transport (cyclic and non cyclic) in anoxigenic and oxigenic photosynthetic organisms.
Chemosmotic theory and ATP synthesis
Use of inorganic carbon for the synthesis of organic matter: Ribulose bisphosphate carboxylase/oxygenase; structure, catalysis, regulation. Calvin cycle. Photorespiration. C4 photosynthesis. CAM plants. Energetic consideration on organic biosynthesis.
Biosynthesis and degradation of starch and sucrose: the hexose phosphate pool. Triose phosphates synthesized in the chloroplast build up the pool of hexose phosphates in the cytosol. Pi translocator. Chloroplast starch synthesis during the day and degradation during the night.
Translocation in the phloem. Pathways and patterns of translocation. Materials translocated. The pressure-flow model for phloem transport. Phloem loading and unloading. Sink-to-Source transition. Photosynthate distribution: allocation and partitioning.
Water transport processes. Diffusion and osmosis. Water potential in plant cells. Water status of a plant. Water in the soil and absorption by roots. Water transport through xylem. Water movement from the leaf to the atmosphere.
Plant hormones: auxin, gibberellins, cytokinins, ethylene, abscisic acid.
Red and blue light responses. Photochemical and biochemical properties of phytochrome. Characteristics of phytochrome induced responses. Structure and function. Circadian rhythms. Ecological functions. Blue-light photoreceptors and photophysiology of the responses. Stomatal movements and morphogenesis.

Development of the course and examination

Methods for assessing learning outcomes:
The exam will be written. Two hours and a half will be given for its completion. It will be constituted by open questions, schematic representation of key concepts, calculations and multiple-choice questions.

Criteria for assessing learning outcomes:
The acquisition of knowledge will be assessed on the basis of the ability to identify the main concepts, describe them exhaustively and with appropriate terminology and non-stereotypical expressions and apply them in schematic representations and calculations.

Criteria for measuring learning outcomes:
The open questions will be evaluated based on the matching of the answer to the question, completeness of the answer, clarity and appropriateness of terminology, ability to select the important aspects of the matter at hand.
In the schematic representation, the students must graphically represent a concept. Also in this case, the evaluation will be based on the ability to make the important aspects emerge and to

represent them exhaustively and clearly.
Calculations will be evaluated based on the correctness of the result and of the procedure followed (a brief text description of the procedure will be requested). Multiple-choice questions will comprise 5 answers. A point will be attributed if all correct answers will be indicated.

Criteria for conferring final mark:
The open questions will contribute to the final score for 40%; the marks obtained for schematic representation and calcultaion exercises will constitute 30% of the final score; the multiple choice question will attribute 30% of the final score.

Recommended reading

Buchanan, Gruissem and Jones. Biochimica e Biologia molecolare delle Piante. Zanichelli
Taiz and Zeiger. Plant Physiology Sinauer Assoc
Scientific papers that will be indicated during the course

PLANT PHYSIOLOGY (M-Z)

ALESSANDRA NORICI

Seat Scienze
A.A. 2016/2017
Credits 8
Hours 64
Period 1^ semestre

Prerequisites

The student must be able to conduct literature searches
Sufficient knowledge of English to understand scientific literature
Basic knowledge of chemistry, biochemistry and physical-chemistry
Knowledge of plant cytology, structural organization of plants and algae and of their phylogenetic relationships

Course contents

The course will comprise 7 credits (56 hours) of theoretical classes and 1 credit (8 hours) of practical classes. The practical will consist of individual and group exercises in the form of oral discussions, of seminars, and of resolution of numerical problems. Students will also have to analyze and discuss scientific papers on fundamental aspect of plant physiology in class.
Crucial references will be made available on the e-learning platform. The course will be taught by Prof. Giordano and Prof. Norici, who will conduct their teaching on very strict coordination.

Objectives of the course

Knowledge:
The course will allow the students to acquire basic knowledge on the physiology of photosynthetic organisms, with special attention to the integration of the information for the various parts of the program.
A conspicuous part of the curse will be devoted to photosynthesis in all its aspects. Subsequently, the student will be called to the comprehension of the interaction of various metabolic pathway for the use of photosynthate and of the regulatory processed mediated by hormones and photoreceptors.

Ability to apply the knowledge:
At the end of the course, in addition to mastering the basic concepts in plant physiology, the student will be able to independently and creatively analyze the primary literature sources and employ them within scientific projects.

Soft skill:
The highly interactive nature of the course will lead the student to develop skills in verbal and written scientific communication and in the critical analyses of literature.

Program

Contents (frontal lectures, 7 CFU, 56 hours):
General principles of photosynthesis and of its evolution in relation to environmental changes over Earth history
Capture and use of light radiation: general properties of molecules involved in light capture. The process of light absorption. Photosynthetic pigments. Structure of antennae and energy transfer within antennae. Connections between antennae and reaction centers. Structure and function of reaction center of anoxigenic and oxigenic photosynthetic organisms. Electron transport (cyclic and non cyclic) in anoxigenic and oxigenic photosynthetic organisms.
Chemosmotic theory and ATP synthesis
Use of inorganic carbon for the synthesis of organic matter: Ribulose bisphosphate carboxylase/oxygenase; structure, catalysis, regulation. Calvin cycle. Photorespiration. C4 photosynthesis. CAM plants. Energetic consideration on organic biosynthesis.
Biosynthesis and degradation of starch and sucrose: the hexose phosphate pool. Triose phosphates synthesized in the chloroplast build up the pool of hexose phosphates in the cytosol. Pi translocator. Chloroplast starch synthesis during the day and degradation during the night.
Translocation in the phloem. Pathways and patterns of translocation. Materials translocated. The pressure-flow model for phloem transport. Phloem loading and unloading. Sink-to-Source transition. Photosynthate distribution: allocation and partitioning.
Water transport processes. Diffusion and osmosis. Water potential in plant cells. Water status of a plant. Water in the soil and absorption by roots. Water transport through xylem. Water movement from the leaf to the atmosphere.
Plant hormones: auxin, gibberellins, cytokinins, ethylene, abscisic acid.
Red and blue light responses. Photochemical and biochemical properties of phytochrome. Characteristics of phytochrome induced responses. Structure and function. Circadian rhythms. Ecological functions. Blue-light photoreceptors and photophysiology of the responses. Stomatal movements and morphogenesis.

Development of the course and examination

Methods for assessing learning outcomes:
The exam will be written. Two hours and a half will be given for its completion. It will be constituted by open questions, schematic representation of key concepts, calculations and multiple-choice questions.

Criteria for assessing learning outcomes:
The acquisition of knowledge will be assessed on the basis of the ability to identify the main concepts, describe them exhaustively and with appropriate terminology and non-stereotypical expressions and apply them in schematic representations and calculations.

Criteria for measuring learning outcomes:
The open questions will be evaluated based on the matching of the answer to the question, completeness of the answer, clarity and appropriateness of terminology, ability to select the important aspects of the matter at hand.
In the schematic representation, the students must graphically represent a concept. Also in this case, the evaluation will be based on the ability to make the important aspects emerge and to

represent them exhaustively and clearly.
Calculations will be evaluated based on the correctness of the result and of the procedure followed (a brief text description of the procedure will be requested). Multiple-choice questions will comprise 5 answers. A point will be attributed if all correct answers will be indicated.

Criteria for conferring final mark:
The open questions will contribute to the final score for 40%; the marks obtained for schematic representation and calcultaion exercises will constitute 30% of the final score; the multiple choice question will attribute 30% of the final score.

Recommended reading

Buchanan, Gruissem and Jones. Biochimica e Biologia molecolare delle Piante. Zanichelli
Taiz and Zeiger. Plant Physiology Sinauer Assoc
Scientific papers that will be indicated during the course.

REGIONAL AND ENVIRONMENTAL ECONOMICS

FRANCO SOTTE

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 2^ semestre

Prerequisites

The course does not require any special requirements

Objectives of the course

The student will learn the basics of the relationship between territory and economic and social development. The course illustrates how social science has gradually moved from a mechanistic and reductionist approach to an evolutionary one. With reference to the Italian case and in particular of the Marches one, the course analyzes the peculiar evolutionary process since the World War II until today. It focuses in general on the localization of economic activities and social and sustainable development.

Program

1. Introduction to the economy of the territory;
2. The localization of economic activities;
3. Localization and functions of the city;
4. Traditional theories of regional development;
5. The originality of the Italian case;
6. Modern theories of regional development;
7. Rural areas and local development

Development of the course and examination

Written with two tests: one with open and the second with closed answers

Recommended reading

Aurelio Bruzzo, Analisi economica del territorio. Letture sulla scienza economica regionale, Edizione 3: ISBN 978-88-548-8098-6, Aracne editrice, Roma, Capitoli da 1 a 9

REMOTE SENSING

MARCO PELLEGRINI

Seat Scienze
A.A. 2016/2017
Credits 2
Hours 16
Period 2^ semestre

Prerequisites

Basic knowledge of Mathematics and Physics.

Course contents

The course includes theoretical lectures (2 credits, 16 hours). Interactive teaching-learning experiences and numerical-practical exercises are planned. Course attendance, although not mandatory, is strongly recommended.

Objectives of the course

Knowledge:
The course enables students to acquire and practice the fundamental knowledge of remote sensing together with its main applications.

Ability to apply the knowledge:
The student will also acquire the following professional skills: the ability of description of the main physical phenomena regulating the interaction between electromagnetic radiation and matter (atmosphere, ocean and soil), for a better understanding of the connection with different environmental issues.

Soft Skills:
The course helps to improve the capacity of analysis and synthesis of information and the communication skills of the students.

Program

Part 1: passive remote sensing. Definition of remote sensing and brief historical review. Elements of a remote sensing system. Energy sources and radiation. Electromagnetic spectrum. Black-body laws. Emission spectrum of the Sun and the Earth. Radiative budget of the Earth. Electromagnetic energy-matter interactions (atmosphere, land surface): reflection, transmission and refraction. Scattering and absorption. Atmospheric windows. Spectral reflectance. Emissivity. Radiance temperature. Multispectral and thermal sensors: Energy collected by a sensor. Passive microwave sensors. Multispectral sensors. Types of scan. Temporal, spatial, spectral and radiometric resolution. Thermal infrared and microwave sensors. Radiometric calibration.

Satellites and orbits. Geostationary and Sun-synchronous orbits. Satellite constellations. Satellites for land resources monitoring. Satellites for weather forecasting.

Part 2: active remote sensing. LIDARs and RADARs. Features of a radar system. Radar equation. Doppler’s effect. Polarimetric radar. Main applications of active remote sensing: meteorology, altimetry, environmental monitoring, air traffic control.

In addition, practical experiences aiming at a better understanding of the physical laws introduced during lectures, image data processing and GIS (Geographic Information System) basics are planned.

Development of the course and examination

Methods for assessing learning outcomes:
The assessment of learning is through an oral interview. The exam consists of three questions regarding course content, which may also include the use of knowledge acquired during interactive classroom activities.

Criteria for assessing learning outcomes:
During the interview, knowledge about course topics, mathematical formalism and communication ability are evaluated.

Criteria for measuring learning outcomes:
During the interview, the autonomous capacity of the student to set up and solve the problems is evaluated. The ability to properly and appropriately use technologies and strategies of remote sensing is also evaluated.

Criteria for conferring final mark:
The certification of the suitability of the knowledge is assigned to students who demonstrate sufficient knowledge of theory and technologies of remote sensing.

Recommended reading

- Lecture notes;
- Documentation about “Diffusione e sperimentazione della cartografia, del telerilevamento e dei sistemi informativi geografici, come tecnologie didattiche applicate allo studio del territorio e dell'ambiente” Research Project (written in Italian), available online at http://dipsa.unibo.it/catgis/teler.html.
Project’s website: http://dipsa.unibo.it/catgis/index.html;
- Brivio Pietro A., Giovanni Lechi, Eugenio Zilioli, “Principi e metodi di telerilevamento”, Città Studi, 2006.

REPRODUCTIVE BIOLOGY OF MARINE ORGANISMS

GIORGIA GIOACCHINI

Seat Scienze
A.A. 2016/2017
Credits 7
Hours 56
Period 1^ semestre

Prerequisites

Basic Knowledge of Developmental Biology, Cell biology, Molecular Biology, Comparative anatomy and Zoology.

Course contents

Lectures (6 credits, 48 hours) and practical laboratory work with small groups of students are planned (1 credit, 8 hours). Lectures and practical activities are supported in e-learning mode that contains teaching materials, instructions for laboratory practice, reservation for laboratory exercises

Objectives of the course

Knowledge:
The course aims at providing a complete and updated overview on the basic knowledge and application of the most recent reproductive biology achievements together with the reproductive biotechnologies for the aquaculture industry. The student will acquire in-depth knowledge on the topic of neuro-endocrine and molecular mechanisms that regulate maturation of gametes, as well as the of the hypothalamic-pituitary gonadal axis function. The course would also increase the knowledge of the molecular and cellular basis of the quality of gametes and on the functional and morphological alterations induced by stress, pollution, climate change, photoperiod or hormonal treatments. The course is also intended that students acquire in-depth knowledge of the necessary methodologies for the study of life cycles and to assess the state of the populations that inhabit our seas. The contents presented during the lectures will be tested in the laboratory practices during which the students can test the knowledge acquired in class by applying an interdisciplinary approach.

Ability to apply the knowledge:
The acquisition of concepts on reproductive toxicology and molecular toxicology techniques will provide the student with a set of tools for assessing the presence of endocrine disruptors in the field of environmental monitoring and their impact on biodiversity.
The student will be able to apply their knowledge in the aquaculture sector as a possible solution to the over-exploitation of natural resources.
The contents presented in the class will be tested in a series of practical laboratory in which students will test the acquired knowledge regarding gamete quality

Soft skills:
The execution of laboratory observations of the student contributes to: improve the overall vision of the process, sharpen communication skills that comes from teamwork, and enhance learning ability in autonomy and to improve the ability to draw conclusions.

Program

Content (lectures, 6 credits, 48 hours):
Introduction to Biology of Reproduction of aquatic organisms
Endocrinology of reproduction: hypothalamus-pituitary-gonadal axis
Hormones, receptors and molecular mechanisms involved in the control of reproduction
Pineal gland and reproduction
Energy reserves and reproduction
Reproduction and stress: the hypothalamic-pituitary-adrenal axis
Sexual determination and puberty
Cell cycle germline.
Vitellogenesis: hormonal control of vitellogenin synthesis.
Reproductive Toxicology: a new tool for environmental monitoring.
Captive breeding: Biotechnology of reproduction of farmed organisms

Development of the course and examination

Methods for assessing learning outcomes:
The final grade is given asking at least three questions of the above program.

Criteria for assessing learning outcomes:
In the oral exam, the student must demonstrate knowledge regarding the basis of the endocrine control of reproduction, and the molecular mechanisms at the basis of the quality of gametes and embryos. In the exam, students must demonstrate the acquirement of specialized knowledge on the general aspects of the reproduction of aquatic organisms

Criteria for measuring learning outcomes:
The final mark is awarded out of thirty. The exam is passed when the grade is greater than or equal to 18. It is expected to be awarded the highest marks with honors (30 cum laude).

Criteria for conferring final mark:
The rating is made up of the sum of the score reported in the individual questions that will take into account the understanding of the subjects (40%), the ability to link the different processes that occur during reproduction (40%) and the appropriateness of the technical language (20%). Praise is attributed when the score exceeds the value 30, and at the same time, the student has demonstrated full mastery of the subject.

Recommended reading

Reading articles from the following journals: Aquaculture, Fish Physiology Biochemistry, Fish and shell fish immunology, Aquatic Toxicology, Biology of reproduction

Slides of the lectures available on the Moodle platform

REPRODUCTIVE BIOTECHNOLOGIES

OLIANA CARNEVALI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 1^ semestre

Prerequisites

Basic Knowledge of Developmental Biology, Genetic, Cell biology, Molecular Biology.

Course contents

Lectures (5 credits, 40 hours) and practical laboratory work with small groups of students are planned (1 credit, 8 hours). Lectures and practical activities are supported in e-learning mode that contains teaching materials, instructions for laboratory practice, reservation for laboratory exercises.

Objectives of the course

Knowledge:
The course aims at providing a complete and updated overview on the basic knowledge and application of the most recent reproductive biotechnologies. The student will acquire in-depth knowledge on the topic of neuro-endocrine and molecular mechanisms that regulate the differentiation and maturation of gametes, as well as the functional alterations of the hypothalamic-pituitary gonadal axis underlying infertility.
The course would also increase the knowledge of the molecular and cellular basis of the quality of gametes, the technical information on medically assisted procreation methods and notes on pre-implantation genetic diagnosis. The contents presented during the lectures will be tested in the laboratory practices during which the students can test the knowledge acquired in class following an interdisciplinary approach.

Ability to apply the knowledge:
The contents presented in the class will be tested in a series of practical laboratory in which students will test the acquired knowledge regarding gamete quality

Soft skills:
The execution of laboratory observations of the student contributes to: improve the overall vision of the process, sharpen communication skills that comes from teamwork, and enhance learning ability in autonomy and to improve the ability to draw conclusions.

Program

Content (lectures, 5 CFU, 40 hours):
Introduction to the biotechnology of reproduction: history and concepts
Hypothalamic-pituitary-gonadal axis
Physiological alterations and pathogenesis of the reproductive axis
Folliculogenesis and regulation of oocyte maturation, markers for the assessment of ovarian reserve.
Sperm quality assessment
Assisted Reproductive Technology (ART): preparation of gametes, intrauterine insemination (UII), in vitro fertilization (FIVET) and Intracytoplasmatic Sperm Injection (ICSI) and embryo transfer.
Preimplantation diagnosis methods
Cryopreservation of gametes and embryos

Development of the course and examination

Methods for assessing learning outcomes:
Oral examination
The final grade is given asking at least three questions of the above program.

Criteria for assessing learning outcomes:
In the oral exam, the student must demonstrate knowledge regarding the basis of the endocrine control of reproduction, and the molecular mechanisms at the basis of the quality of gametes and embryos. In the exam, students must demonstrate the acquirement of specialized knowledge on the general aspects of male and female infertility and of assisted reproductive technologies

Criteria for measuring learning outcomes:
The final mark is awarded out of thirty. The exam is passed when the grade is greater than or equal to 18. It is expected to be awarded the highest marks with honors (30 cum laude).

Criteria for conferring final mark:
The rating is made up of the sum of the score reported in the individual questions that will take into account the understanding of the subjects (40%), the ability to link the different processes that occur during reproduction (40%) and the appropriateness of the technical language (20%). Praise is attributed when the score exceeds the value 30, and at the same time, the student has demonstrated full mastery of the subject.

Recommended reading

Reading articles from the following journals: Nature; Nature Genetics; Nature Reviews Genetics; Nature Reviews Nature Medicine; Nature Biotechnology; Science; Cell; Biology of Reproduction, Human reproduction, Stem Cells, Cell Stem Cell, PLOS Genetics
Slides of the lectures available on the Moodle platform

SANITARY EMERGENCIES

ERICA ADRARIO

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 2^ semestre

Prerequisites

The realization of a catastrophe or a collective accident determines as part of a community, a more or less precise and more or less rapid response: the rescue.
This answer can vary in form and intensity in relation to the seriousness of the consequences of left on the environment, but must always be of sanitary nature as the amplitude of the damage material is added the presence of victims.
That said, the student must have a basic knowledge of physics, chemistry, anatomy and physiology.

Course contents

There will be lectures and practical exercises cardiopulmonary resuscitation on a dummy.
At the front course it is complemented by a teaching activity carried out by students in groups with supervision of the teacher prepare arguments to be exhibited in the classroom with other students.

Objectives of the course

Knowledge
The course aims to provide students with the essentials and knowledge with regard the organization of relief efforts during natural disasters and non-tactical and logistical aspects organization of the materials, as well as basic rescue techniques through the activation of chain of emergency.
The recognition of health situations in emergency and urgency.

Ability to apply the knowledge
The student in particular conditions will be able to activate the relief and start a CPR (Cardiopulmonary Resuscitation) and use a defibrillator.

Program

The answer to the catastrophe
Rescue organization
tactical and logistical aspects
rescue personnel

Structures and their functioning
Evacuation
Rescue basic techniques
Sorting and classification of victims
Current organization of emergency assistance in Italy and particularly in the Marche region.
Emergency-urgent
Anatomy and physiology of major organs and systems.
major diseases
Chain of Survival Management
BLSD (Basic Life Support defibrillation)
Defibrillation: appliances and their management.

Development of the course and examination

Methods for assessing learning outcomes:
Oral examination on the topics covered

Criteria for assessing learning outcomes:
The student will demonstrate knowledge of the topics covered as well as the management of a health alarm via the activation of the rescue and management of the event waiting for help.

Criteria for measuring learning outcomes:
The final grade is given thirty

Criteria for measuring learning outcomes:
The rating is assigned based on the candidate's knowledge evaluated on two questions.

Recommended reading

R.Noto, P.Huguenard, A.Larcan :Medicina delle catastrofi- Masson
IRC:BLS-D ,basic life support, early defibrillation. 5° ed.
M.Chiaranda:Urgenze ed Emergenze-Istituzioni- Piccin

STATISTICS FOR EXPERIMENTAL SCIENCES

GIUSEPPE SCARPONI

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 1^ semestre

Prerequisites

Knowledge of the topics of the courses on Mathematics and Informatics.

Course contents

The course consists of theoretical lectures (6 credits, 48 hours) and computer laboratory pratical work carried out at small groups of 2-3 students. An e-learning didactic activity is available in parallel to the normal frontal course. It includes: the didactic material, the self-assessment tests, data and instructions for the experimental exercises, booking for the experimental exercises in the computer laboratory, attendances to lectures and laboratory exercises, results of examinations.

Objectives of the course

Knowledge:
The course enables students to acquire the theoretical and methodological fundamentals of univariate and multivariate statistical analysis as applied to the study of experimental sciences. In particular, the student should know the fundamentals of statistics, the hypothesis testing, the analysis of variance and the procedures of cluster analysis, principal component analysis, nearest neighbour rule, canonical variate analysis (discriminant analysis).

Ability to apply the knowledge:
At the end of the course, the student should have acquired the ability of performing the computer procedures required for data statistical analysis using commercial statistical packages, as well as to interpret correctly the results obtained.

Soft skills:
The execution of experimental exercises (alone or in-group), as well as the discussion of the results obtained, contribute to improve for the student the degree of judgement autonomy in general, the communicative capacity (which derives also from the teamwork), and the ability to draw conclusions from experimental data.

Program

Content (lectures, 5 CFU, 40 hours). Theoretical and methodological fundamentals of the main techniques of univariate and multivariate statistical analysis as applied to the study of experimental sciences. Data and data distribution. Descriptive statistics. Normal distribution. Inference. Confidence interval. Hypothesis testing. Analysis of variance. Linear regression. Multivariate data and information. Ungrouped data analysis: cluster analysis, principal component analysis (PCA). Grouped data analysis: k nearest neighbour rule (KNN), canonical variate analysis (CVA), discrimination and classification. Examples of case studies referred to biological, archaeological (paleobiological) and chemical problems. Computer laboratory activity for the study of a few real cases considered during the course.

Laboratory exercises (1 CFU, 8 hours/student). Computer exercises are carried out in small groups (2-3 students/computer). Used statistical packages are the following: Unistat, SIMCA, S-Plus, Parvus, Statgraphics. Exercise n. 1: Histograms, Frequency tables, Summary statistics, Confidence interval, Hypothesis testing. Ex. n. 2: Cluster analysis I. Ex. n. 3: Cluster analysis II, Method of k nearest neighbour rule (KNN). Ex. n. 4: Principal component analysis (PCA). Ex. n. 5: Canonical variate analysis (CVA) (or Discriminant analysis).

Development of the course and examination

Methods for assessing learning outcomes:
The assessment method is a written classwork (open questions) and subsequent revision/discussion of the script. Thirty open questions are provided for the examination. These include also exercises on hypothesis tests and questions on the interpretation of results obtained from the analysis of a case study obtained using one of the statistical packages used during the course. To each question a score included between zero and one is assigned. To the sum obtained other two points are added to obtain the final result of the written classwork. The exam is passed when the final score is higher or equal to 18. During the course of lectures it is also foregone the possibility of participating to “in itinere” written classwork (1st and 2nd partial test). The result of a partial test may be mediated with the other provided the obtained score be at least 15. In case of negative or unsatisfactory result in one of the two partial tests, it can be retrieved in the immediately following session.

Criteria for assessing learning outcomes:
In the written classwork, the student will have to demonstrate to have acquired a sound knowledge of basics and methods of the univariate statistics (data distributions, inference, hypothesis testing) and multivariate statistics (cluster analysis, principal component analysis, k nearest neighbour rule, canonical variate analysis). The capacity to apply the acquired knowledge is assessed also through the written answers to the questions related to the exercises on the hypothesis tests and on the case study presented in the “practical” part of the written classwork.

Criteria for measuring learning outcomes:
The final mark is attributed in thirtieths. Successful completion of the examination will lead to grades ranging from 18 to 30, and 30 with laud.

Criteria for conferring final mark:
The final mark is attributed by summing the scores obtained on the 30 questions of the written classwork (after its public revision/discussion) and adding two points to the sum. The laud is attributed when the score obtained by the previous sum exceeds the value 30 and contemporaneously the student demonstrates complete mastery of the matter.

Recommended reading

Lecture notes
O. Vitali. Statistica per le Scienze Applicate. Vol. 2. Cacucci Editore, Bari, 1993.
O. Vitali. Principi di Statistica. Cacucci Editore, Bari, 2003.
M.C. Whitlock, D. Schluter. Analisi statistica dei dati biologici. Zanichelli, Bologna, 2010.
W.W. Daniel. Biostatistica. Edises, Napoli, 1996.
R.R. Sokal, F.J. Rohlf. Biometry. The Principles and Practice of Statistics in Biological Research, W.H. Freeman, San Francisco, 1995.
G. Norman, D. Steiner. Biostatistica. Seconda ediz., Casa Editrice Ambrosiana, Milano, 2015.
W.J. Krzanowski. Principles of Multivariate Analysis. A User’s Perspective, Second edition, Oxford University Press, 2000.
I.T. Jolliffe. Principal Component Analysis, Second edition, Springer-Verlag, New York, 2002.

UNDERWATER SCIENTIFIC METHODOLOGY

CARLO CERRANO

Seat Scienze
A.A. 2016/2017
Credits 6
Hours 48
Period 2^ semestre

Prerequisites

Basic knowledge in zoology and marine biology and a first level diving certificate are recommended.

Course contents

The course presents the main diving scientific techniques applied to the study of the marine environment. The aspects taken into account are: the anatomy and physiology of divers, underwater breathing systems, diving technique, equipment for scientific diving, underwater surveys, sampling techniques, specificity of scientific diving. Lectures (3 credits, 24 hours) and practical training in the field (3 credits, 24 hours) will be furnished.

Objectives of the course

Knowledge:
The scope of the course is to offer to the students the acquisition of the theoretical and practical knowledge on the study of marine environment by direct exploration.

Ability to apply the knowledge:
At the end of the course the students know the optimal technique and the main methodologies to be applied for specific case studies, regarding research, monitoring and conservation issues.

Soft skills:
The field activities help improve the students' learning and checking abilities of the skills acquired through the practical application of the taught methods. The peculiarity of the practical activities requires developing good skills of interaction and coordination within a workgroup. The dives conducted during the exercises, if requested and if deemed appropriate by the teacher, will be certified as scientific diving and thus to contribute to the achievement of the European scientific diver certification, facilitating international mobility of the student regarding this field.

Program

Content of the lectures (3 credits, 24 hours):
Physiological effects of diving on man; Diving equipment: Mixed gas diving, Protective systems, Communication systems, Transport systems, Cave diving. Destructive sampling techniques: Scraping, Panels, Water dredges, nets, traps. Non destructive sampling techniques: Frames and transects, Video and photo surveys, visual-census. Volunteers and monitoring project. Transplants techniques. Underwater microsensors. Field activities (3 credits, 24 hours): Field activities are scheduled to teach directly underwater some of the studied techniques.

Development of the course and examination

Methods for assessing learning outcomes:
The level of the preparation of the students will be evaluated through an oral exam. As for the theoretical part, the student must demonstrate that they have acquired the basic knowledge presented during the course; with regard to the practical part, the student will be asked to conceptually apply the methods learned in the field to specific case studies.

Criteria for assessing learning outcomes:
The assessing of learning will take into account the level of knowledge acquired, exposed during the oral exam, referring to lectures and to the practical training.

Criteria for measuring learning outcomes
The final mark is awarded out of thirty. The exam is passed when the grade is greater than or equal to 18. It is expected to be awarded the highest marks with honors (30 cum laude).

riteria for conferring the final mark:
The final grade is mainly allocated according to the ability to set the answer complete and schematic, to the level of knowledge and the exposition of the proper terminology.

Recommended reading

Notes taken during the lecturers and powerpoint presentations handed out by the lecturers.

ZOOLOGY (A-L)

CARLO CERRANO

Seat Scienze
A.A. 2016/2017
Credits 8
Hours 64
Period 1^ semestre

Prerequisites

Il volume “Zoologia” (16° edizione), Hickman, Jr., S. Roberts, S. L. Keen, D. J. Eisenhour, A. Larson, H. Lanson, McGraw-Hill integrato dalle dispense messe a disposizione dal docente.

Course contents

Lectures (7 credits, 56 hours) and practical training (1 credit, 8 hours).

Objectives of the course

Knowledge:
Students acquire a good knowledge of the biodiversity of animals by means of detailed descriptions of their morphological organization at the cellular and anatomical level; phylogenetic relationships among phyla, reproductive strategies and ecology will be also treated for each taxon. Finally, some topics of general zoology will be treated in its basic aspects.

Ability to apply the knowledge:
The students can identify animals locating them in the main taxonomic categories thanks to the knowledge acquired on morphology and on details regarding the cell structure and internal anatomy, the life and reproductive strategies. The students know the environments in which the animals live and the phylogenetic relationships among phyla.

Soft skills:
Photo and video materials showed during lectures and museum samples discussed during laboratory activities stimulate students' capacity of observation, reasoning and drawing conclusions.

Program

Content of the lectures (7 credits, 56 hours):
Introduction: Biodiversity; ontogeny, bauplan, body cavity; embryonic development; principles of classification and phylogeny; unicellular eukaryotes. Metazoans; Porifera; cnidarians; ctenophores; platyhelminthes; Nemertea; Gnatiferan and Lofotrocozoa and minor groups; Mollusks; Annelids; Nematodes, Ecdysozoa; Arthropods; Echinoderms; Chordata; Craniata; Agnata, Chondrichthyes,

Osteichthyes Amphibians, Amniotes, "no bird" Reptiles; Birds, Mammals.
Laboratory practicals (1 credit, 8 hours):
Metazoan morphology and comparisons among the different taxa.

Development of the course and examination

Methods for assessing learning outcomes:
The exam consists of an oral test on the theoretical and the practical parts. The students must demonstrate that they have acquired the basic knowledge presented during the course; moreover, with regard to the practical part, the students have to be able to apply the theoretical knowledge to identify and describe one organism chooses by the lectures. The students have to be able to describe the morphology and discuss the morphological adaptations.

Criteria for assessing learning outcomes:
The level of knowledge acquired, exposed during the oral test, referring to lectures and to the practical parts, will be evaluated to assess the students' preparation.

Criteria for measuring learning outcomes
The final mark is assigned as a fraction of 30. The exam is successfully passed when the mark is equal to or higher than 18/30. The highest mark can be assigned cum laude.

Criteria for conferring final mark:
The final mark is given considering the levels of knowledge acquired and shown during the oral test, and it is conferred considering the theoretical and practical parts.

Recommended reading

Notes taken during the lecturers and powerpoint presentations handed out by the lecturers.
Further reading:
Zoologia (16° edizione), Hickman, Jr., S. Roberts, S. L. Keen, D. J. Eisenhour, A. Larson, H. Lanson, McGraw-Hill

ZOOLOGY (M-Z)

STEFANIA PUCE

Seat Scienze
A.A. 2016/2017
Credits 8
Hours 64
Period 1^ semestre

Prerequisites

The course of Cytology and Histology is strongly recommended.

Course contents

Lectures (7 credits, 56 hours) and practical training (1 credit, 8 hours).

Objectives of the course

Knowledge:
Students acquire a good knowledge of the biodiversity of animals by means of detailed descriptions of their morphological organization at the cellular and anatomical level; phylogenetic relationships among phyla, reproductive strategies and ecology will be also treated for each taxon. Finally, some topics of general zoology will be treated in its basic aspects.

Ability to apply the knowledge:
The students can identify animals locating them in the main taxonomic categories thanks to the knowledge acquired on morphology and on details regarding the cell structure and internal anatomy, the life and reproductive strategies. The students know the environments in which the animals live and the phylogenetic relationships among phyla.

Soft skills:
Photo and video materials showed during lectures and museum samples discussed during laboratory activities stimulate students' capacity of observation, reasoning and drawing conclusions.

Program

Content of the lectures (7 credits, 56 hours):
Introduction: Biodiversity; ontogeny, bauplan, body cavity; embryonic development; principles of classification and phylogeny; unicellular eukaryotes. Metazoans; Porifera; cnidarians; ctenophores; platyhelminthes; Nemertea; Gnatiferan and Lofotrocozoa and minor groups; Mollusks; Annelids; Nematodes, Ecdysozoa; Arthropods; Echinoderms; Chordata; Craniata; Agnata, Chondrichthyes, Osteichthyes Amphibians, Amniotes, "no bird" Reptiles; Birds, Mammals.

Laboratory practicals (1 credit, 8 hours):
Metazoan morphology and comparisons among the different taxa.

Development of the course and examination

Methods for assessing learning outcomes:
The exam consists of an oral test on the theoretical and the practical parts. The students must demonstrate that they have acquired the basic knowledge presented during the course; moreover, with regard to the practical part, the students have to be able to apply the theoretical knowledge to identify and describe one organism chooses by the lectures. The students have to be able to describe the morphology and discuss the morphological adaptations.

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Recommended reading

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Further reading:
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