**Dipartimento di Scienze della Vita e dell'Ambiente**

**Programs**

**2014/2015**

## ADVANCED MOLECULAR BIOLOGY

*ANNA LA TEANA*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 2^ semestre

**Prerequisites**

Molecular Biology, Genetics, Genetic Engineering

**Objectives of the course**

The aim of the course is to allow the students to acquire basic information concerning molecular

mechanisms involved in the regulation of gene expression at the different levels with a special interest in all post-transcriptional events. In addition, some of the experimental approaches most widely used for gene expression analysis will be described

**Program**

The different levels of regulation of gene expression.

Genomic rearrangements.

Epigenetic modifications: DNA 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.

Methods for gene expression analysis: northern blotting, RT-PCR, RNase protection. DNA microarrays. Reporter genes. Analysis of DNA and RNA-protein interaction: DNaseI footprinting, chemical probing, cross-linking. Analysis of protein-protein interactions: two-hybrid and three-hybrid systems, GST-pull down. Analysis of translation: cell-free systems, toe-printing, polysomal profiling.

**Recommended reading**

F. Amaldi et al., **"Biologia Molecolare"**, Casa Editrice Ambrosiana, I edition, 2011.

In addition, review articles from specialized Molecular Biology journals are provided during the course.

## ADVANCED TECHNIQUES OF ENVIRONMENTAL CHEMICAL ANALYSIS

*GIUSEPPE SCARPONI*

**Seat** Scienze
**A.A.** 2014/2015
**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, chromatography).

### Course contents

The course consists of theoretical lectures (5 credits, 40 hours) and field and laboratory practical work carried out individually (1 credit, 8 hours).

### Objectives of the course

Aims. The course enables students to acquire the theoretical fundamentals of the main advanced instrumental methods devoted to environmental analysis, and the technical/practical skills required to operate some of these.
Objectives. To acquire a sound knowledge of the fundamentals and the main environmental applications of the following chemical analytical methods: polarography/voltammetry, fluorimetry, atomic absorption spectrophotometry, mass spectrometry and hyphenated chromatographic techniques. To acquire knowledge also of the principles of quality control and of the accreditation of chemical analytical laboratories.

### Program

Content. Polarography and advanced voltammetric techniques (pulse techniques and stripping techniques, DPASV, SWASV). Fluorimetry and spectrofluorimetry. Atomic absorption spectrophotometry. Mass spectrometry. Gas chromatography-mass spectrometry (GC-MS, GC-MS-MS). Inductively coupled plasma mass spectrometry (ICP-MS). High resolution mass spectrometry (GC-HRMS, ICP-HSMS). Aerosol time-of-flight mass spectrometry (ATOFMS). MALDI-TOF mass spectrometry. Quality control and quality assurance. Traceability. Good laboratory practice. Accreditation. Examples of environmental applications: single particle analysis of atmospheric aerosol, determination of priority pollutants both organic (PAH, PCB, VOC, pesticides) and inorganic (As, Cr, Ni, Pb, Cd, Hg) in air, water, soil and organisms.
Field and laboratory exercises (1 credit, 9 hours/student). Collection of environmental samples (sea,

river, atmospheric particulate, snow, spring water). Determination of heavy metals in natural waters and aerosol by voltammentric techniques. Determination of pesticides and PAH by GC-MS. Other possible exercises based on instruments available from colleagues.

**Development of the course and examination**

The assessment method is an oral examination.

**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.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 1^ semestre

### Objectives of the course

The aim of this course is to provide students with the tools to understand and master algal biotechnology, a relatively new and booming field in the applied plant sciences. The focus will especially be on methodological approaches required to design, development and monitor large-scale algal cultures. In addition, case studies of commercial exploitation of algal biomass will be provided with the aim of being critically evaluated.

### Program

*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 sit*; 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*: methods of cultivation and commercial exploitation

*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, use for human and animal nutrition, use for CO2 sequestration and flue gas remediation, use for the treatment of waste water, use for the production of valuable chemical molecules.

*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**

Oral examination

**Recommended reading**

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

## ANALYSIS OF POLLUTANTS

*ANNA ANNIBALDI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 54
**Period** 1^ semestre

### Prerequisites

Knowledge on inorganic chemistry, organic chemistry and instrumental analytical chemistry.

### Course contents

Frontal lessons and practical exercises in field and in laboratory

### Objectives of the course

Knowledge of basic principles and application of advanced analytical techniques.
Knowledge of extraction methods and principal analytical methodologies for priority pollutants.
Ability to perform instrumental analysis on environmental matrices for pollutant analysis.

### Program

General part
- 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: coupling HPLC-MS and GC-MS.
Pollutants analysis
Dangerous and priority pollutants.
Emerging pollutants

### Development of the course and examination

Oral examination

**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, Zanichelli, Bologna, 1998.
- 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.

## ANALYTICAL CHEMISTRY FOR ENVIRONMENT AND SAFETY

*GIUSEPPE SCARPONI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 8
**Hours** 64
**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 (2 credits, 16 hours).

### Objectives of the course

*Aims.* The course enables students to acquire the theoretical fundamentals and the technical-practical abilities of main methodologies for chemical analysis, and their applications in environmental field. It allows also students to acquire the basic concepts on global changes and on local pollution.

*Objectives.* To acquire a sound knowledge of the chemical analytical methodologies of gravimetry, titrimetry, potentiometry, conductimetry, spectrophotometry (UV-Vis), as well as to acquire the basic knowledge of main global environmental changes and local chemical pollution. The student should also acquire the following professional skills: ability to carry out basic laboratory chemical analyses devoted to the analytical control of environmental matrices.

### Program

*Content*. 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. Local chemical pollution: atmospheric pollution and photochemical smog, acid rains.

*Laboratory exercises (2 credits, 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 Fe3+ in river water (standard addition method).

**Development of the course and examination**

The assessment method is a written classwork (open questions) and subsequent revision of the script. During the course of lectures it is also foregone the possibility of participating to "in itinere" written classwork.

**Recommended reading**

- *Lecture notes*

- D. A. Skoog, D. M. West, F. J. Holler , S. R. Crouch, *Fondamenti di chimica analitica*, 2a ediz., EdiSES, Napoli, 2005.

- 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.

## ANIMAL BIODIVERSITY

*CARLO CERRANO*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 7
**Hours** 56
**Period** 2^ semestre

### Prerequisites

It is recommended to pass the course of Basical Biology

### Objectives of the course

Aim of the course is the knowledge of animal biodiversity through a basical description of their organisation at cell and anatomical level. Reproductive strategy and ecology will be also considered.

The phylogenetic relationships among phyla will be outlined.

Finally some basic aspects of general zoology will be treated.

At the end of course, students should know animals at morphological level with details regarding their cellular organisation and anatomy, reproductive strategies and ecology.

Finally, he should know the basic aspects of general zoology.

### Program

Biodiversity

Animal architecture

Taxonomy and phylogeny

Unicellular Eukarya

Porifera

Cnidaria and Ctenophora

Platyhelminthes and Nemertea

Gnathifera and small Lophotrochozoa: Rotifera, Entoprocta, Ectoprocta, Brachiopoda, Phoronida

Mollusca

Annelida

Small Ecdisozoa: Nematoda, Onychiphora, Tardigrada

Arthropoda: Chelicerata, Myriapoda, Crustacea, Esapoda

Echinodermata

Cordata: Urochordata, Cephalochordata, Craniata

Agnatha, Chondrichthyes, Osteichthyes

Amphibia

Amniota: Reptilia and Mammalia

**Recommended reading**

Diversità animale 15/ed
Cleveland P. Hickman, Jr., S. Roberts, S. L. Keen, D. J. Eisenhour, A. Larson, H. Lanson, McGraw Hill

## APPLIED CHEMISTRY FOR ENVIRONMENTAL PROTECTON

*CRISTINA TRUZZI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 7
**Hours** 56
**Period** 2^ semestre

### Objectives of the course

Aims: to provide fundamental and essential bases and concepts for environmental protection and the prevention and reduction of environmental pollution, with particular regard to the prevention and control of atmospheric and water system pollution.

### Program

Topics
AIR AND GASES
- Atmospheric pollution: definition and legislation. Temporal and spatial scale of air pollution. Transport, diffusion and transformation of air pollutants. Workplace environmental exposure. Recognition of chemical hazards.
- Primary and secondary gaseous pollutants: classification according to their concentration, physical state, /sources of pollution; indoor air pollution. Compounds containing carbon, nitrogen, sulphur, halogens, toxic organic substances (HPA, VOC), ozone, asbestos, radon.
- Chemical fate of the gases present in trace amounts in polluted air. Particulate air pollution, including: definition and classification, removal processes, size distribution, effects on the environment.
- Units of concentration of air pollutants: interconversion exercises.
- Pollutant monitoring: direct and indirect methods. Systems for pollutant monitoring.
- Air pollutant abatement: characteristics, efficiency and applications. Pre-purification systems, filtration systems, electro-static precipitators, condensation systems, absorption systems, combustion systems, adsorption systems, bio-filtration systems

WATER
- Water pollutants: European and Italian legislation. Quality assurance in environmental analysis. Dangerous and priority pollutants. Metals: speciation, determination: Atomic Emission Spectroscopy (ICP-MS), voltammetric in-situ techniques.

POLYMERS and POLLUTION
Characteristic of “plastics”, degradation and elimination.
Recycling: definition of recycling types. Recycling tecniques.

URBAN WASTE
- Composition. Problems about solid urban waste and its disposal. Elimination, recovery.

### Development of the course and examination

Oral

**Recommended reading**

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

## APPLIED ECOTECHNOLOGY

*ANTONIO DELL'ANNO*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 9
**Hours** 81
**Period** 1^ semestre

### Objectives of the course

The course provides the students with the basic knowledge for planning interventions for the reduction of anthropogenic impact on natural ecosystems and on principles and advanced technologies applied for the environmental recovery and restoration

### Program

Basic principles for quality assessment, management and restoration of ecosystems; planning ecosystem remediation and restoration; in situ and ex situ technologies for environmental remediation; separation, transformation and immobilization processes of contaminants; chemical, physical and biological technologies; *biostimulation*, *bioagumentation*, kinetic models for assessing bioremediation performance; biotechnological applications in environmental remediation and restoration; use of microbial mats for environmental remediation and restoration; identification and containment of oil spills; treatments for biofouling containment; basic principles of biological wastewater treatment; sludge biotic index; sludge treatment and reuse; phytoremediation; principles for the treatment and management of solid wastes.

### Recommended reading

Duplicated 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.** 2014/2015
**Credits** 7
**Hours** 56
**Period** 2^ semestre

**Program**

Pollution and vulnerability of marine ecosystems, different types and sources of marine pollution, critical points of human impact in coastal ecosystems of the Mediterranean Sea and indicators of self-purification capacity of the sea.
Eutrophication, dystrophy, harmful algal blooms, mucilage: indicators and models of trophic state, strategies for the control and study of toxic algae. Pollution due to chemical contaminants: ecological effects of oil spills, control and recovery strategies of oil spills, plastic and micro-plastic pollution.
Non-conventional pollutants: pharmaceuticals and personal care products, sources and potential effects on marine organisms.
Microfouling and macrofouliung: technological applications of biofilms, methods of sampling and analysis of microbial biofilms, control strategies for biofouling.
Impact of trawling on marine habitats: methods and tools for the study of the trawling impact, direct and indirect ecological effects of trawling, by catch and ghost fishing.
Impact of intensive aquaculture: ecological effects of mariculture in the Mediterranean Sea and strategies to reduce the impact of offshore aquaculture.
Introduction of alien species: definition and sources of alien species, alien species in the Mediterranean Sea, the effects of invasions of alien species and strategies to mitigate the impact.
Climate change and multiple stressors of marine environment.
Marine food fraud: the study case of pangasius and halibut fish.
Environmental Restoration: transplant of seagrass meadows and coral reefs, technologies and guidelines for the
restoration of coral reefs. Criteria for the evaluation of the changes in the quality of the marine environment: biological
indicators and biotic indices. Normative criteria of evaluation of environmental quality (Marine Strategy)

Case studies: pollution in the Mediterranean Sea, eutrophication and mucilage in the Adriatic Sea, the disaster of Fukushima, the accidents of the large oil tankers and the case of Deep water Horizon, the invasion of alien species in the Black Sea, impact of fish farming in the Mediterranean Sea, the impact of trawling of bivalve mollusks in the lagoon systems, the restoration of seagrass meadows in Gabicce Mare, the impact of sunscreens on coral reefs.

**Development of the course and examination**

Oral

**Recommended reading**

Della Croce, Cattaneo Vietti, Danovaro - Ecologia e Protezione dell'ambiente marino costiero. UTET, 1997; Danovaro - Recupero ambientale: tecnologie bioremediation e biotecnologie. UTET, 2001; Marchetti - Ecologia Applicata. Città Studi, 1993; R. B. Clark. 2001. Marine Pollution. Oxford.

## APPLIED ZOOLOGY

*BARBARA CALCINAI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 54
**Period** 2^ semestre

**Prerequisites**

Good knowledge in zoology

**Objectives of the course**

The aim of the course is to provide theoretical, but also technical and practical information, for the application of organisms as bioindicators for the analysis, evaluation and management of aquatic habitats (particularly water currents and purification processes) and of the soil. In addition, I intend to provide a good basic understanding of the management of some hoofed mammals present in the territory.

**Program**

Theoretical lessons:

The concept of bioindicator and biomonitoring. The soil: definition, features and functions. Soil fauna: features and functions. Biomonitoring for the evaluation of the soil quality.

The lotic system, the characteristics of river ecosystems, the fauna of freshwaters: characteristics, adaptations and diversity. The biological indicators in freshwater; quality indexes: the system of saprobien; EBI index, new system (Star ICMi) for assessing the biological quality of rivers.

Native and allocton Crustaceans in Italian rivers.

The sludge biotic index (SBI) and its uses. Microfauna involved in the purification processes and its role in water purification.

Wildlife management; examples of conflicts between humans and wildlife; parameters and characteristics of a natural population, outline of census techniques of natural populations. Examples of management of wildlife: The red squirrel *vs* the gray squirrel, red squirrel conservation. The boar: biology and management. The roe deer: biology and management.

Practical lessons:

Application of the index of quality for the soil (QBS-ar); collection of organisms with Berlese's selector. Observation and identification of taxa used in the QBS-ar index.

Sampling of macroinvertebrates in rivers. Microscopic techniques of observation and recognition of the various taxa of macroinvertebrates. Calculation of biotic indexes.

Identification of the sludge microfauna (Protozoa). Calculation of the sludge biotic index (SBI).

**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 and other material, published and available on the net, made available and indicated by the teacher.

## AQUACULTURE, REPRODUCTION AND DEVELOPMENT OF ORNAMENTAL AND COMMERCIAL SPECIES

*IKE OLIVOTTO*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 7
**Hours** 56
**Period** 2^ semestre

**Course contents**

Laboratory: Setting up a marine tank and phyto and zooplankton cultures.

**Program**

- 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
  Introduction to some of the most common diseases
  Genetical improvement in aquaculture
  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

**Recommended reading**

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 Lt

## BIOCHEMICAL ANALYSIS

*ELISABETTA DAMIANI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 2^ semestre

### Prerequisites

Basic knowledge in Biochemistry and Human Anatomy is desirable.

### Objectives of the course

At the end of the course, students will have achieved an overall knowledge on the fundamental points necessary for understanding and carrying out the most common laboratory tests. Students will reach this goal through lectures on certain analytical methods, on laboratory tests and their general significance regarding the characterization and qualitative and quantitative determination of the principal classes of biomolecules of particular interest for biomedical diagnostics. This goal will be reached even through laboratory practicals. In addition, students will have gained a basic understanding of free radicals and antioxidants, their role in biological systems and the different methods used for investigating them.

### Program

Withdrawal, conservation and elimination of biological samples. Quality control in an analysis 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. Tumour markers. Routine hematology. Blood groups. Metabolism of bile pigments. Role of free radicals and antioxidants in biological systems.

### Recommended reading

At the end of each topic, handouts and powerpoint slides will be distributed by the lecturer.

## BIOCHEMISTRY (A-L)

*ANDREA ANTONINO SCIRE'*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 8
**Hours** 64
**Period** 1^ semestre

### Prerequisites

Basic knowledge of general and organic chemistry.

### Objectives of the course

The target of the course is to give a basic knowledge on the structure and function of the most important biological molecules and their role in the production and conversion of metabolic energy.

### Program

Fundamental organic molecules in living systems. Chemical bounds in biological chemistry. Amino acids, peptides and proteins. Tridimensional structure of proteins. Enzymes: basic concepts and kinetics, control strategies. *Carbohydrates and glycoconjugates.* Structure and function of structural and reserve lipids. Structure and function of biological membranes. Transduction of signals and molecular basis of the action of hormones. Bioenergetics: ATP and high energy compounds. Metabolism: basic concepts and objectives. Sugar metabolism: glycolysis, gluconeogenesis and phosphate pentose pathway. Glycogen metabolism. Citric acid cycle. Fatty acid catabolism: digestion, mobilization and transport, oxidation and ketone bodies formation. Amino acids oxidation and urea production. Oxidative phosphorylation and ATP synthesis. Fatty acids, triacylglycerols, cholesterol, steroids and phospholipids biosynthesis. Protein degradation.

### Development of the course and examination

Written examination.

### Recommended reading

J.M. Berg, J.L. Tymoczko e L. Stryer, “BIOCHIMICA”, 7th ed. Zanichelli.

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

## BIOCHEMISTRY (M-Z)

*TIZIANA BACCHETTI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 8
**Hours** 64
**Period** 1^ semestre

### Prerequisites

Basic knowledge of general and organic chemistry.

### Objectives of the course

The target of the course is to give a basic knowledge on the structure and function of the most important biological molecules and their role in the production and conversion of metabolic energy

### Program

Fundamental organic molecules in living systems. Chemical bounds in biological chemistry. Amino acids, peptides and proteins. Tridimensional structure of proteins. Enzymes: basic concepts and kinetics, control strategies. *Carbohydrates and glycoconjugates.* Structure and function of structural and reserve lipids. Structure and function of biological membranes. Transduction of signals and molecular basis of the action of hormones. Bioenergetics: ATP and high energy compounds. Metabolism: basic concepts and objectives. Sugar metabolism: glycolysis, gluconeogenesis and phosphate pentose pathway. Glycogen metabolism. Citric acid cycle. Fatty acid catabolism: digestion, mobilization and transport, oxidation and ketone bodies formation. Amino acids oxidation and urea production. Oxidative phosphorylation and ATP synthesis. Fatty acids, triacylglycerols, cholesterol, steroids and phospholipids biosynthesis. Protein degradation.

### Development of the course and examination

Written examination.

### Recommended reading

J.M. Berg, J.L. Tymoczko e L. Stryer, “BIOCHIMICA”, 7th 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.** 2014/2015
**Credits** 8
**Hours** 64
**Period** 1^ semestre

### Prerequisites

Knowledge in Chemistry and Biochemistry.

### Objectives of the course

The aim of the course is to give information on the strategies for the preparation and purification of proteins at industrial level and on the use of enzymes and proteins in the food, pharmaceutical and chemical industries.

### Program

Cells as factories for the production of proteins for biomedical and industrial applications.

Homogenization of tissues and cells on a laboratory and industrial scale. Main chromatographic techniques for the purification of proteins on a laboratory and industrial scale. Main spectroscopic techniques for the analysis of protein structure.

Sources for the extraction of proteins of industrial interest.

Purification strategies applied to industrial, therapeutic and analytical proteins. Proteins from animals, plants, and from mesophile and extremophile organisms. Protein production from genetically engineered organisms. Protein post-translational modification. Storage of biocatalysts.

Purification of exocellular and endocellular proteins. Scale-up of the protein extraction and purification process. Proteins as inclusion bodies: solubilization and refolding methods. Technical and economical implications in the choice of a strategy for protein purification.

Proteins and enzymes for industrial applications.

Immobilized enzymes, immobilization techniques, bioreactors.

Proteases: classification and industrial uses. Carbohydrases: applications of alpha-amylase, beta-amylase, glucoamylase, alpha-(1-6) glucosidase, and glucose isomerase. Enzymes able to hydrolize cellulose, emicellulose, and pectin. Lipases and their applications. Milk proteins. Enzymes and proteins for medical, pharmacological, analytical, and food applications. Microbial, viral,

pyrogenic and protein contaminants. Biosensors: principles and applications.

**Recommended reading**

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

Keith Wilson & John Walzer (Eds.), Principles and Techniques of Practical Biochemistry, Cambridge University Press, 2000.

Adrie J.J. Straathof and Patrick Adlercreutz (Edts.) Applied Biocatalysis. Harwood Academic Publishers

## BIOETHICS

*MASSIMILIANO MARINELLI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 54
**Period** 2^ semestre

**Course contents**

As it is well known, the term bioethics has been introduced for the first time by the American Oncologist Van Reasselaer Potter, of Dutch origins, in two studies respectively in 1970 and 1971.

Although Bioethics can be considered as a young science, it cultivates a very wide field of knowledge that ranges from medical issues, taking into account, for example, the issues related to euthanasia and assisted reproduction, to the ecology, dealing with environmental ethics, until to include the debate on the patentability and the interests of the animals as one of its specific subjects.

The areas of human conduct that fall within the bioethics are so numerous that it is necessary, as a preliminary point, to indicate which part of it the course intends to deal with.

Among the research activities conducted by the biological sciences today, the field of biotechnology is likely the suitable one to be investigated from an ethical point of view, so that we can define our bioethics as the ethics of biotechnology.

As part of the course, biotechnology will be considered not only as the set of technical procedures able to modify the structure and function of living organisms, for the production of biological materials useful in medicine, industry and agriculture, but, in the broadest sense, also as the technological use of new knowledge that arise from genetics, for the diagnosis and treatment of human disease.

For these reasons a special focus will be given to three main areas of observation:

1 The first area will be related to stem cell research with the problems associated with the status of the human embryo and therapeutic cloning.

2 The second area will be referred to the analysis the ethical issues connected with the relationship with animals and with the creation and use of genetically modified animals in experimental research.

3 In the third area focus will be on the ethical matters arising from scientific advances in the genetics filed, analyzing all major programs of scientific research: the Human Genome Project, Genetic Engineering, Gene Therapy, and the most recent acquisitions in the Pharmacogenomics and genetic testing.

Before analyzing the ethical implications arising from these fields of biotechnology, it will be necessary, however, to conduct a synthetic recognition of the fundamental ethical questions.

The course will provide, therefore, basic notions about the nature of ethics, the history of bioethics and their relationship with the biology and with biotechnology, considered as a scientific paradigm and a social apparatus.

The aim of the course is to introduce the students to the ethical inquiry within biotechnology, in order to raise their awareness and sense of accountability in their profession.

**Program**

Introduction to ethical inquiry

The nature of ethics

The fundamental concepts of moral action

Ethical pluralism

History and principles of bioethics

Bioethics according to Potter

Jonas and the principle responsibility

The Principle of Precaution

The perspectives within bioethics

The themes of bioethics

The principles of bioethics

Ethical and legal considerations on the use of biotechnology

- The age of biotechnology

- Characteristics of biotechnology research

Ethical issues on the use of human stem cells

- Regenerative Medicine and Biology

- The status of the human embryo

- Therapeutic cloning

Human Genome Project, genetic engineering, gene therapy

Genetic testing: prediction of human destiny?

Pharmacogenetics and Pharmacogenomics and drug testing

Genetic Rare Diseases Orphan drugs

The testing of drugs

Animals in Biology

Animal testing

Genetically modified animals: their interests and their use

Conscience objection

Bioethical aspects of genetic testing and Pharmacogenomics / Pharmacogenetics

Personalized Medicine and Biology

**Development of the course and examination**

Oral

**Recommended reading**

Reichlin M, *Etica della vita, nuovi paradigmi morali*, Bruno Mondadori, 2008

Rodotà S., Tallacchini M., ( a cura di ) Trattato di Biodiritto, Ambito e Fonti del Biodiritto Giuffrè 2010

Comitato Nazionale per la Bioetica, *considerazioni etiche e giuridiche sull'impiego delle biotecnologie*, 30 novembre 2001.

Comitato Nazionale per la Bioetica, Il *principio di precauzione, profili bioetici, filosofici, giuridici*, 18 giugno 2004.

Comitato Nazionale per la Bioetica, *dalla farmacogenetica alla farmacogenomica*, 21 aprile 2006.

Comitato Nazionale per la Bioetica, *Metodologie alternative, comitati etici e obiezione di coscienza alla sperimentazione animale*, 18 dicembre 2009

Comitato Nazionale per la Bioetica, Comitato Nazionale per la Biosicurezza, le Biotecnologie e le Scienze della Vita, *Test Genetici e Medicina Personalizzata* 15 luglio 2010

Marinelli M. Introduzione alla medicina narrativa, Edizioni Tecnostampa, 2008.

## BIOINFORMATICS

*MARCO BARUCCA*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 1^ semestre

### Prerequisites

General knowledge of genetics, biochemistry and molecular biology.

### Objectives of the course

The course students will gain a broad interdisciplinary knowledge of bioinformatics, including the ability to use a wide range of basic bioinformatics software and software packages.

### Program

Introduction to software for application in biology. Public biological sequence databases: history, catalog of current databases, organisation 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

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.

### 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

## BIOLOGICAL AND ECOLOGICAL RISK

*FRANCESCO REGOLI*

**Seat** Scienze
**A.A.** 2014/2015
**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.

### Objectives of the course

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.

### 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).

**Recommended reading**

Provided material and scientific literature suggested on specific topics.

## BIOMEDICAL BACTERIOLOGY

*FRANCESCA BIAVASCO*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 1^ semestre

### Program

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 defences, survival in the host cells. Evolution of bacterial pathogens. Pathogenicity and Resistance Islands. Transmission routes of bacterial diseases, zoonoses
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 pathologies. Enterobacteriacee (Escherichia coli, Salmonella, Shigella, Yersinia and others), pseudomonads and other nonfermenting bacilli, vibrios and Aeromonas; Campylobacter, 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 (Borrelia, Treponema and Leptospira); rickettsiae, chlamydiae, mycoplasms,legionellae.
Laboratory practice: isolation and identification of different bacterial species from biological samples.

### Development of the course and examination

Oral

### 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 approach. ASM press; Whashington, DC
Madigan, Martinko, Stahl, Clark. Brock - Biologia dei microrganismi-vol. 3, Microbiologia biomedica. Ed. Pearson Italia.
Wiley, Sherwood, Woolverton. Prescott 3 - Microbiologia medica. Ed. McGraw-Hill.

## BIOMEDICAL LABORATORY SAFETY

*LORY SANTARELLI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 54
**Period** 1^ semestre

### Prerequisites

None

### Objectives of the course

The course aims at teaching students basic notions, also with reference to current laws and regulations, allowing the management of health and safety in biomedical laboratories; self-reliance in prevention activities; verification and control of procedures regarding hygiene at the workplace and environmental safety; awareness of physical, chemical and biological risk factors related to the main work cycles; appropriate application of basic techniques for sampling and analysing of environmental pollutants.

### Program

Legal framework of health protection in the workplace
The concept of workplace health hazard: risk from carcinogenic, chemical, biological, and physical agents; the workplace microenvironment
Occupational hazards in the biomedical laboratory
Environmental and biological monitoring in the workplace
Surveillance by health authorities
Main occupational pathologies
General first-aid principles at the workplace.

### Recommended reading

ENVIRONMENTAL SAFETY - by Alessandro Medici- Università di Ferrara anno edizione: 2003 - Casa Editrice La Tribuna – Piacenza;

OCCUPATIONAL MEDICINE Luigi Ambrosi; Vito Foà anno edizione 2003 Edizioni : UTET C.so Raffaello 28-10125-Torino.

OCCUPATIONAL MEDICINE AND INDUSTRIAL HYGIENE MANUAL Lorenzo Alessio;Pietro Apostoli edizione 2010 Nuova Libraria S.p.A. Piccin Padova

## BIOMEDICAL LABORATORY SAFETY

*ERNESTA PIERAGOSTINI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 54
**Period** 1^ semestre

### Objectives of the course

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

### Program

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
HELATH SURVEILLANCE
LABORATORY WASTE MANAGEMENT
BASIC FIRST AID INFORMATION FOR THE WORKERS

### Development of the course and examination

written and oral

### 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.** 2014/2015
**Credits** 6
**Hours** 54
**Period** 1^ semestre

### Prerequisites

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

### Course contents

The course enables a thorough knowledge of Virology through discussion of the following topics concerning:

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, Arboviruses, Rhabdoviruses, Arenaviruses, Hantaviruses, Filoviruses, Picornaviruses, Reoviruses, Coronaviruses, Retroviruses and HIV); Hepatitis Viruses.

### Objectives of the course

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.

### Program

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 pathogenesis and vaccine); the part two deals with the specific virus families and human pathogens focusing on their distinctive characteristics, i.e. structure, biology, pathonenetic mechanisms, epidemiology treatment and prevention.

**Recommended reading**

1. Antonelli G., Clementi M. Principi di Virologia Medica. Casa Editrice Ambrosiana last edition
2. Patrick Murray  Ken Rosenthal  G. Kobayashi  M. Pfaller: Medical Microbiology Editore: C.V. Mosby (Last Edition)

## BIOMOLECULAR NANOTECHNOLOGIES

*SAMUELE RINALDI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 8
**Hours** 64
**Period** 2^ semestre

### Prerequisites

The student must have at least a basic knowledge of organic chemistry and biochemistry.

### Objectives of the course

The course is directed to give students basic knowledge about the most important concepts of nanotechnologies, the methodological approaches to the “bottom-up” construction of functional nanostructures and a general overlook on their applications. In particular, nanostructures based on fullerenes, carbon nanotubes, nanoparticles, nanowires, foldamers, nanomaterials and nanodevices useful in the fields of diagnostic, biosensoristic, drug delivery and nanomedicine will be considered. Moreover, basic notions on high resolution microscopies and on spectroscopies for structural determination will be given.
The laboratory’s experiences will focus on the synthesis of various nanoparticles, on the verification of their magnetic and optical properties, and on the analysis, by means of the scanning electron microscope, of commercial carbon nanotubes and of the particles themselves.

### Program

1) Introduction
Basic definitions. What is a nanostructure. The nanoscale. Examples of natural nanostructures. Examples of nanostructure-based applications already in use. Approaches to nanostructures: top-down and bottom-up.

2) The laws of the nanoworld and the eyes to observe it
Physical, chemical, optical and electric properties within the nanodimensions. Non-covalent interactions. Background of high resolution microscopies: TEM, SEM, STM, AFM.

3) Fullerenes
The allotropic states of carbon. Fullerenes: definitions, syntheses, properties, chemical reactivity, functionalizations. Examples of applications.

4) Carbon nanotubes
SWNT and MWNT nanotubes: definitions, syntheses, properties, chemical reactivity, covalent and non-covalent functionalizations. Examples of applications.

5) Nanoparticles, nanowires and q-dots
Nanoparticles: definitions, syntheses, properties, examples of applications. Nanowires: definitions, syntheses, properties, examples of applications. Q-dots: optical properties and examples of applications.

6) Other eyes for the nanoworld
Background of spectroscopies for the structural determination of proteins, peptides and theirs analogues: single crystal X-ray diffraction, nuclear magnetic resonance (NMR), circular dichroism (CD) and infrared spectroscopy (IR).

7) Peptides and foldamers
Revision of the structural features of natural amino acids, peptides and proteins.
Folding-determining forces. The folding process. Foldamers: definitions, structures, properties and applications of foldamers derived from -amino acids mimetics, from -, - and -amino acids and from -amino acids mimetics. Amphiphilic foldamers with antimicrobial activity and as SP-C mimetics.

8) Laboratory
Synthesis of fluorescent Ag and CdSe nanoparticles. Synthesis of a ferrofluid based on superparamagnetic -Fe3O4 nanoparticles. Imaging of the nanoparticles synthesized by the students and of commercial carbon nanotubes by means of the scanning electron microscope.

**Development of the course and examination**

oral

**Recommended reading**

Handoutswill be distributed in class.

## BIOORGANIC

*MARIO ORENA*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 8
**Hours** 72
**Period** 2^ semestre

**Prerequisites**

Fundamentals of organic chemistry

**Objectives of the course**

The course is an introduction to peptides, peptidomimetics and carbohydrates. In addition, simple syntheses of nucleosides and nucleotides will be introduced.

**Program**

Part I: Selectivity in organic reactions

Regio- and stereoselection. Stereo chemical and conformational descriptors.

Methods for controlling stereochemistry.

Stereo controlled electrophilic additions.

Stereo controlled nucleophilic additions.

Anchimeric effect.

Stereo controlled aldol reactions.

Stereo controlled enzymatic reactions.

Single and double asymmetric induction.

Stereo controlled chemical and chemo-enzymatic synthesis of bioactive compounds.

Part II: Chemistry of amino acids and oligopeptides

Amino acids: ionisation and pKa. Synthesis and their derivatives. Identification of N- and C-terminus. Edman degradation.

Principles of peptide synthesis: Protecting groups, protection and deprotection methods. Orthogonal protecting groups. Formation of a peptide bond. Polymeric supports and linkers in SSPS.

Comparison between t-Boc and Fmoc methodology; coupling methods. Synthesis of cyclic peptides.

Part III: Chemistry of glucose and its derivatives. Synthesis of polysaccharides.

Part IV: Chemistry of nucleosides and nucleotides. Synthetic approaches to nucleic acids.

Part V: Spectroscopy of biological membranes.

**Development of the course and examination**

Oral

**Recommended reading**

R.J. Simmonds, “Chemistry of Biomolecules, An Introduction”, RSC Press, 2007

P.M. Dewick, “Medicinal Natural Products”, Wiley, 2004

Santagada-Caliendo, “Peptidi e peptidomimetici”, Piccin, 2008

J. McMurry, T. Begley, Chimica bio-organica , Zanichelli, 2007

## BIOTECHNOLOGY OF MICROORGANISMS

*MAURIZIO CIANI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 8
**Hours** 64
**Period** 1^ semestre

### Objectives of the course

At the end of the course the student should know metabolic and physiological aspects of microorganisms during fermentative processes. Moreover, the student should know the modality of microbial growth and the principal fermentation parameters. Laboratory experience should permit the student to calculate the growth and fermentation parameters end describe simple fermentation 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. Monitoring of microorganisms during fermentation processes: dependent and independent culture methods.
Bioreactors: design, operation and applications. Agitation and aeration technology,; measurements and regulations of principal fermentation parameters; fermentation plant (fundamental and auxiliary equipments, modality of sterilization. Product recovery. Killer character in yeasts. Cell immobilization

### Development of the course and examination

Oral

### 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.** 2014/2015
**Credits** 8
**Hours** 72
**Period** 1^ semestre

### Prerequisites

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

### Objectives of the course

Aim of this course is to provide students with basic knowledge plant biology, both in the general and in systematic aspects. The structure and function of cells, tissues and organs of plant organisms will be presented. Finally, the main groups of plant organisms (algae, fungi and land plants) will be treated in terms of morphological, anatomical and reproductive traits.

### Program

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 (Opisthokonta, Amoebozoa, Rhizaria, Archaeplastida, Chromalveolata, Excavata).
Algae. General characteristics, morphological and reproductive traits of main algal groups (Rhodophyta, Chlorophyta, Haptophyta, Cryptophyta, Dinophyta, Stramenopili, Euglenophyta).
Terrestrial 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); Angiosperms: (Monocotyledones and Dicotyledones) reproduction and life cycle; flowers, seeds, fruits.
Morphology and anatomy of Spermatophyta. Tissues and organs: meristematic and adult tissues; morphological and anatomical characteristics of roots, stem and leaves.
Fungi: general characteristics and life cycles of Chytridiomycota, Zygomycota, Ascomycota, Basidiomycota. Lichenes and Micorrhizae.

### Development of the course and examination

Oral

**Recommended reading**

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

## BOTANY (M-Z)

*FABIO RINDI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 8
**Hours** 64
**Period** 1^ semestre

### Prerequisites

basic knowledge of general biology and cell biology

### Course contents

class lectures and lab practicals

### Objectives of the course

Aims of the course is to provide a good general knowledge of plants, algae and fungi. The diversity of these organisms will be illustrated and the features of each group will be described in detail, emphasizing evolutionary aspects, reproduction, life histories and ecology. The phylogenetic relationships of the main plant and algal groups will be illustrated in detail. For the land plants the characteristics of organs and tissues will be described, emphasizing their functional significance and their adaptations to terrestrial environments.

### Program

Introduction to botany. Features of photosynthetic organisms. Systems of classification.
Cyanobacteria: general features, morphology and ecology.
Endosymbiosis, evolution of plastids and origin of photosynthetic eukaryotes.
Eukaryotic algae: general features, life histories and ecology of the main groups (Rhodophyta, Chlorophyta, Streptophyta, Heterokontophyta, Dinophyta, Haptophyta, Cryptophyta, Euglenophyta).
Introduction to land plants. Adaptations to terrestrial life. Evolutionary innovations appearing in the land plants.
Characteristics of the plant cell: cell wall, plastids, vacuole.
The tissues of the vascular plants: primary and secondary meristematic tissues; permanent tissues (dermal tissues, ground tissues, vascular tissues).
Structure of the root.
Structure of the stem.
Structure of the leaf.
Bryophytes: mosses and liverworts; general features, reproduction and life history.
Pteridophytes: lycopods, horsetails and ferns; general features, reproduction and life history.

The seed plants: general features, reproduction and life history. Gymnosperms (conifers, cycads, Ginkgo). Angiosperms: flower, seed and fruit. Differences between Monocots and Dicots. Features of the main families of Angiosperms of the Italian flora (Asteraceae, Lamiaceae, Fabaceae, Brassicaceae, Fagaceae, Rosaceae, Orchidaceae, Poaceae).
Fungi: morphological features, ecology and life histories of Zygomycota, Ascomycota and Basidiomycota.

**Development of the course and examination**

an intermediate written exam (based on the first part of the program) and a final oral exam. The overall mark will be calculated as average of the marks of the two exams.

**Recommended reading**

Pasqua G., Abbate G., Forni C. Botanica generale e diversità vegetale. Piccin Nuova Libreria.

Other useful texts:
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:
Plants Portal of Wikipedia: http://en.wikipedia.org/wiki/Portal:Plants
Atlas of Botany of the University of Torino: http://www.atlantebotanica.unito.it/page.asp
Acta Plantarum - Flora of the regions of Italy: http://www.actaplantarum.org/
AlgaeBase: http://www.algaebase.org/

## CELLULAR BIOTECHNOLOGY

*ADRIANA CANAPA*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 1^ semestre

### Program

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

### Development of the course and examination

Oral

### Recommended reading

Handouts will be provided during the course.

## CHARACTERIZATION OF INDUSTRIAL EMISSIONS

*MARIA LETIZIA RUELLO*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 1^ semestre

### Course contents

The course will consist of lectures and tutorials. The presentations used during the lessons, accompanied by bibliography and site links will be made available to students.The course is for students who want practical knowledge about how Industrial Emission Characterization and Monitoring (CEM) is conducted, and how the data is analyzed from different types of monitoring programs.

After completing the course, students will have
- a basic understanding of CEM System and Operation
- learned about both practical and theoretical aspects of emission assessment through studies of field methods and applied statistics, as well as national and international laws and policies

### Objectives of the course

Upon completion of the course, students should know how to:
- to make distinctions between the different type of CEM systems
- understand how the most common analyzers work
- plan basic emission monitoring programs and field experiments
- apply theoretical and practical knowledge about sampling in both air and water matrices
- 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
- apply national and international emission surveillance systems

### Program

Air emission monitoring programs: Fundamentals; Production lines to continuously monitoring; 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.

**Development of the course and examination**

The examination will consist of written and oral presentation of specific topics of the course (in the form of characterization/monitoring project awarded at the end of the course).

**Recommended reading**

National and European. Technical regulation:
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?login=marialetiziaruello

Supplementary reading
http://ec.europa.eu/environment/industry/stationary/ippc/index.htm
http://eippcb.jrc.ec.europa.eu/
http://aia.minambiente.it/
http://www.arpa.marche.it/index.php/ippc
http://www2.arpalombardia.it/siti/arpalombardia/imprese/emissioni/SME/Pagine/SME.aspx
http://www.reti.regione.lombardia.it/cs/Satellite?c=Page&childpagename=DG_Reti/DGLayout&cid=1213367

## CHEMICAL ANALYSYS OF FOODS

*CRISTINA TRUZZI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 1^ semestre

### Prerequisites

Knowledge of the topics of the courses on General and inorganic chemistry, Organic chemistry, Instrumental analytical chemistry

### Objectives of the course

Knowledge of the fundamentals of main chemical analytical techniques applied in the field of food analysis, with examples concerning the principal groups of foods/beverages and the most important chemical determinations (from a nutritional point of view or with the aim of checking for the presence of undesired substances).

### Program

Generality on food sample collection and treatment. Laboratory techniques and classic and instrumental analytical methodologies application for food analysis. Chemical analyses of main food groups both from animal and plant origin (meat, eggs, fish, milk, honey, vegetables, fruits). Analysis of beverages. Determination of the main substances of nutritional importance and of general characterization (e.g. water, dry residue, ashes, nitrogen from protein and non protein origin, sugars, fats, acidity, vitamins). Determination of contaminants (e.g. pesticide residues, polycyclic aromatic hydrocarbons, polychlorobiphenyls, toxic metals).

### Recommended reading

- Copy of slides available

- 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.
- P. Cappelli, V. Vannucchi: *Chimica degli alimenti – Conservazione e trasformazioni*, Zanichelli, Bologna, 2005.
- F. Tateo: *Analisi dei prodotti alimentari*, Chiriotti Editore, Pinerolo, 1978.

## CHEMICAL RISK AND GREEN CHEMISTRY

*SAMUELE RINALDI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 8
**Hours** 64
**Period** 1^ semestre

### Prerequisites

The student must have at least a basic knowledge of chemical laws, nomenclature and mechanisms of organic chemistry.

### Objectives of the course

The course aims to give students the knowledge about the chemical risk for health and safety. Moreover, the students will learn how to assess the chemical risk, especially with respect to the health risk, using both environmental measurements and algorithms. The different features, the choice and use of various protective equipment will also be described. The students will learn the ideas at the basis of green chemistry, how to assess the efficiency of a reaction and how the green chemistry approaches the prevention of pollution and chemical risk.

### Program

Introduction: legal and toxicological definitions. The old directives on chemical risk and classification of chemical agents. The new directives on marketing and classification of chemicals: REACH and GHS-CLP. 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. The chemical risk in the laboratory. Collective protection equipment of laboratories.
Green chemistry principles. The green chemistry metrics and the classical ones. The organic chemistry seen from the green chemistry viewpoint. Reactions with catalytic rather than stoichiometric reagents. The solvent problem: new solvents, biphasic reactions, reactions in ionic liquids.

### Development of the course and examination

Oral

**Recommended reading**

- Powerpoint slides will be provided by the teacher.
- Legislation related to chemical risk (provided by the teacher).
- Green Chemistry: An Introductory Text
M. Lancaster, The Royal Society of Chemistry, Cambridge, UK, 2002.
- Green Chemistry Theory and Practice
P. C. Anastas, J. C. Warner, Oxford University Press, New York, 1998.
- Green Chemistry and Catalysis
R. A. Sheldon, I. Arends, U. Hanefeld, Wiley-VCH, 2007.

## CHEMISTRY I (A-L)

*ROBERTA GALEAZZI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 8
**Hours** 64
**Period** Corso annuale

### Prerequisites

Basic knowledge of mathematic and physic

### Objectives of the course

At the end of the course, the student will know and will be able to apply the fundamental principles of chemistry, such as nomenclature, molecular structure, acids and bases properties, pH of solution, i.e. the basic knowledge to understand the biological courses for which Chemistry is required.

### 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. Cynetic theory. Physical equilibria. Solutions. Chemical equilibria. Acids and bases. Ionic equilibria in solution. Electrochemistry.

### Development of the course and examination

Written text

### 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.** 2014/2015
**Credits** 8
**Hours** 64
**Period** Corso annuale

### Prerequisites

Basic knowledge of mathematic, physic and chemistry

### Objectives of the course

At the end of the course, the student will know and will be able to apply the fundamental principles of chemistry, such as nomenclature, molecular structure, acids and bases properties, pH of solution, exchanges of energy, etc.

### Program

Introduction to chemistry. Atomic theory. Atomic mass unit and mole. 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. Cynetic. Physical equilibria. solutions. Chemical equilibria. Acids and bases. Ionic equilibria in solution. Electrochemistry.

### Development of the course and examination

written examination with multiple choice questions, questions on nomenclature, stoichiometry exercises and open-ended question

### Recommended reading

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

## CHEMISTRY II (A-L)

*MARIO ORENA*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 8
**Hours** 64
**Period** 1^ semestre

### Prerequisites

The course requires a deep knowledge of molecular structure, chemical bonds and chemical thermodynamics

### Objectives of the course

The aim of the course is to evidence the relationship between structure and reactivity of organic compounds present in biological systems, with the aim to introduce students to the understanding of their action and transformations

### Program

Part I: Molecular structure and thermodynamics

1. Introduction to Structure and Models of Bonding

2. Strain and Stability

3. Solutions and Non-Covalent Binding Forces

4. Molecular Recognition and Supra molecular Chemistry

5. Acid-Base Chemistry

6. Stereochemistry

Part II: Reactivity, kinetics and mechanisms

1. Energy Surfaces and Kinetic Analyses

2. Experiments Related to Thermodynamics and Kinetics

3. Catalysis

Part III: Organic Reaction Mechanisms

1. Reactions Involving Additions and / or Eliminations

2. Substitutions at Aliphatic Centers

3. Rearrangements

4. Transformations in polyfunctional compounds

**Recommended reading**

E.V. Anslyn, D.A. Dougherty - Modern Physical Organic Chemistry, University Science Books, 2012

F.A. Carey, R.J. Sundberg - Advanced Organic Chemistry, A, Springer, 2008.

## CHEMISTRY II (M-Z)

*GIOVANNA MOBBILI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 8
**Hours** 64
**Period** 1^ semestre

### Prerequisites

The course requires the knowledge gained from Chemistry I lessons, concerning in particular molecular structure, chemical bond theory, thermodynamics and kinetics

### Course contents

frontal lessons in which molecular models are used.

### Objectives of the course

The student will acquire a basic knowledge on the structure and properties of organic compounds, with particular emphasis on natural organic substances of biochemical interest. The purpose of this module is in fact to ensure the basis for the application of the general principles of chemistry to macromolecules and to processes of biological interest

### Program

General aspects of organic chemistry: bond formation, in particular in molecules containing carbon, representation of organic structures, resonance theory.
Fundamentals of chemical reactivity, basics for understanding the reactions that occur in biology: symbols and definitions relating to the writing of reactions, mechanisms involved in the reactions of organic compounds, classification of reactions, thermodynamic aspects of organic reactions, kinetics of organic reactions, acids and bases, nucleophiles and electrophiles.
Organic compounds as "building blocks" of living systems: alkanes, alkenes, alkynes, alkyl halides, alcohols and thiols, ethers and epoxides, amines, aldehydes and ketones, carboxylic acids and their derivatives, aromatic compounds. The properties of organic compounds will be studied with the aim of ensuring the basis for the application of the general principles of organic chemistry to macromolecules and to biological processes.
Isomerism and Stereochemistry: constitutional isomers and stereoisomers, chirality, nomenclature of stereoisomers, optical activity, separation of enantiomers through the use of enzymes. Stereoisomerism in biology and molecular recognition

**Development of the course and examination**

Written examination with multiple choice questions, open-ended question and exercises.

**Recommended reading**

Janice Gorzynski Smith – Fondamenti di Chimica Organica – McGraw-Hill, 2009

## COMBINED COURSE BIOINFORMATICS - BIOINFORMATICS MODULE 1

*MARCO BARUCCA*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 1^ semestre

### Prerequisites

General knowledge of genetics, biochemistry and molecular biology.

### Objectives of the course

The course students will gain a broad interdisciplinary knowledge of bioinformatics, including the ability to use a wide range of basic bioinformatics software and software packages.

### Program

Introduction to software for application in biology. Public biological sequence databases: history, catalog of current databases, organisation 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

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.

### 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

## COMBINED COURSE BIOINFORMATICS - BIOINFORMATICS MODULE 2

*PAOLO MARIANI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 4
**Hours** 32
**Period** 1^ semestre

### Prerequisites

General knowledge of gene structure and protein structure. Basic mathematical, chemical and physical concepts.

### Objectives of the course

The course of Bioinformatics exemplifies the way traditional scientific and engineering disciplines are being transformed to face the challenges arising from the revolutionary developments in the life sciences. The course is in particular concerned with the analysis of biological information; providing tools and techniques for the interpretation of data. Current programs and the principles that underlie them will be discussed. The course is divided in 2 modules, the first being related to the sequence analysis and the second concerning the protein structure prediction problem. In both cases, the more commonly used softwares available on the Web will be discussed and analysed.

The course students will gain a broad interdisciplinary knowledge of bioinformatics, including the ability to use a wide range of basic bioinformatics software and software packages available on the Web.

### Program

Introduction to software for application in biology. Public biological sequence databases: history, catalog of current databases, organisation 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. Analysis of single protein sequences: from compositional analysis to 3-D 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. Patterns, profiles and their extensions: generating an accurate description of a sequence motif and testing for its presence in a test sequence. Putting it all together: getting the most out of molecular sequence data.

The practical work will be performed at the Informatics Laboratory of the Faculty.

**Recommended reading**

Arthur M. Lesk "Introduction to Bioinformatics", Oxford University Press
Attwood & Parry-Smith "Introduction to Bioinformatics" [Longman Higher Education; ISBN 0582327881];
Higgins and Taylor "Bioinformatics: Sequence Structure and Databanks" [Oxford University Press; ISBN 0199637903]
Baxevanis and Ouellette "Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins" [Wiley-Interscience; ISBN 0471478784]
D.W. Mount, Bioinformatics: sequence and genome analysis, Cold Spring Harbor Lab. Press.

## COMBINED COURSE CHEMISTRY - GENERAL CHEMISTRY (MODULE)

*ELISABETTA GIORGINI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 1^ semestre

### Prerequisites

Basic knowledge of mathematic, physic and chemistry

### Objectives of the course

At the end of the course, the student will know and will be able to apply the fundamental principles of chemistry, such as nomenclature, molecular structure, acids and bases properties, pH of solution, exchanges of energy, etc.

### Program

introduction to chemistry. Atomic theory. Atomic mass unit and mole. 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. Cynetic. Physical equilibria. solutions. Chemical equilibria. Acids and bases. Ionic equilibria in solution. Electrochemistry.

### Development of the course and examination

written examination with multiple choice questions, questions on nomenclature, stoichiometry exercises

### Recommended reading

Elementi di chimica, L. Palmisano, M. Schiavello, Edisef

## COMBINED COURSE CHEMISTRY - ORGANIC CHEMISTRY (MODULE)

*GIOVANNA MOBBILI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 2^ semestre

### Prerequisites

The course requires the knowledge gained from General Chemistry Module, concerning in particular molecular structure, chemical bond theory, thermodynamics and kinetics

### Course contents

Frontal lessons

### Objectives of the course

The organic chemistry aims at providing an understanding of all the classes of organic compounds (hydrocarbons and functional compounds), particularly those of major industrial use and with a certain environmental impact.

### Program

Aliphatic and aromatic hydrocarbons. Functional groups: aliphatic and aromatic halides, alcohols, phenols, ethers, ketones and aldehydes, carboxylic and dicarboxylic acids and their derivatives: esters, acyl halides, amides, anhydrides. Amines. Diazo and azo compounds. Epoxides. Heterocycles.

### Development of the course and examination

Written examination with multiple choice questions, open-ended question and exercises.

### Recommended reading

Janice Gorzynski Smith – Fondamenti di Chimica Organica – McGraw-Hill

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

*PAOLO MIGANI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 2^ semestre

**Course contents**

The Laboratory course will be accomplished through training sessions, with both theoretical and practical inputs.

**Program**

Session n.1 Theory and practice on the preparation of laboratory solutions at given concentration.

How to prepare a set of solutions for a common laboratory measurement, focusing on

-how the handle salts and other substances of common use in the biological laboratory and the safety rules to follow;

-theory and practice of the analytical weighing scale;

-theory and practice of the use of the common laboratory glassware for making solutions and measure their volume.

Session n.2 The pH of solutions.

The pH of biological solutions, in theory and practice. The glass electrode and potentiometric measurements. How to make a buffer solution and how to adjust its pH.

Session n.3 Spectrophotometry in theory and practice, for analysis and quantitative measurements.

Basic principles and technology of the UV-Vis absorption spectrophotometer. Analysis of the spectrum of a light–adsorbing substance and measurements of the protein content of a solution. Focus on

-the interaction of the light at different wavelengths with substances in solutions; the monochromator, the light detectors and how to make measurements of the adsorbed light;

-the Lambert-Beer law; how to construct an absorbance vs concentration standard curve and make a practical use of it.

Session n.4 Measurements on the enzyme activity.

The principles of the enzyme activity and how to make in vitro measurements of it, in theory and practice. Focus on

-the Michaelis-Menten approach to the enzyme kinetics and the construction of the corresponding equation;

-the detection of kinetic parameters of an enzyme by spectrophotometry, in practice.

Session n. 5 Histochemistry and immunohistochemistry.

Principles of in vitro histochemistry. Methods for the solubilization and detection of cell components from tissue samples. Histology treatments for the image detection of cell components in slices from tissue samples. Fixation, inclusion and sectioning. Microtomes and cryo-microtomes (cryostats). Histochemical reactions on thin slices. Image detection of cell components in thin slices by purified antibodies.

Session n. 6 Electrophysiology as measurements of electric potentials in biology.

Principles and practice of the electric fields and their potentials. Instruments for measurements of potential differences, macro and microelectrodes, extra and intracellular measurements. Focus on

-detection of a lesion potential in muscle, as rough example of intra-extracellular potential difference;

-detection of a compound action potential in a mixed nerve.

Session n. 7. Direct methods for the study of the basic structure and functions of the Nervous System.

Focus on physiological observation with the maximum preservation of system integrity. Basic concepts on the reflex arc in Vertebrates, nociceptive and stretch reflex, mechanical and chemical stimulation. Spatial and temporal summation in the stimulus/response activity.

Session n. 8 Registration of mechanical parameters in biology.

Focus on principles and practice for recording and storage of mechanical parameters in biology. Direct and indirect recording on a kymograph. Muscle contraction. Nervous command of the

muscle contraction, as studied in isolated neuromuscolar preparation; isometric and isotonic myograms.

Session n. 9 In vitro studies of physiological and pharmacological effects.

Focus on measurements on isolated organs in vitro. Recording of the heart's basic automatic activity. Studies on the modulation of the mechanical parameters of the cardiac contraction by physiological and pharmacological agents.

**Development of the course and examination**

Oral

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

*STEFANIA GORBI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 2^ semestre

### Prerequisites

A good knowledge of cellular biology, histology, physics and chemistry are important requisites for this course.

### Objectives of the course

The course includes lectures and practical exercises in the laboratory; students will learn to make laboratory experiments and present the experimental data.
At the end of the course the student will acquire a theoretical knowledge base of some different methodologies and techniques which are used in biological research.

### Program

Preparation of laboratory solutions, dilutions and biological buffers: safety precautions, use of pipettes and micropipettes.
Biological solutions: pH definition and preparation of buffer solutions.
Centrifugation and cell fractionation.
Spectrophotometric and spectrofluorimetric techniques. Spectrum of absorption and analysis of protein concentration by the Lowry method. Enzymatic activities: Michaelis-Menten equation, practical use of spectrophotometric methods to measure the enzyme activities.
Use of the microscope: optical and fluorescence microscope, electron microscope. Histochemical techniques: histochemical and immunohistochemical reactions on micro-tissue sections and staining for the visualization of cellular components.
Applications of electrophoresis: electrophoretic techniques for the separation, purification and visualization of molecules with biological interest.

### Development of the course and examination

Oral

**Recommended reading**

Books and scientific literature will be suggested at the beginning of the course.

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

*GIUSEPPE SCARPONI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 1^ semestre

### Prerequisites

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

### Objectives of the course

Aims. The course enables students to acquire the theoretical and methodological fundamentals, as well as the informatic techniques of univariate and multivariate statistical analysis as applied to the study of experimental sciences.
Objectives. At the end 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) as well as acquire the ability of performing the related informatic procedures for data analysis using commercial statistical packages.

### Program

Content. Theoretical and methodological fundamentals of the main techniques of univariate and multivariate statistical analysis as applied to the study of experimental sciences. Hypothesis testing. Analysis of variance. 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, archeological (paleobiological) and chemical problems. Computer laboratory activity for the study of a few real cases considered during the course.

### Development of the course and examination

The assessment method is a theoretical-practical written test.

### Recommended reading

O. Vitali. Statistica per le Scienze Applicate. Vol. 2. Cacucci Editore, Bari, 1993.
O. Vitali. Principi di Statistica. Cacucci Editore, Bari, 2003.
R.R. Sokal, F.J. Rohlf. Biometry. The Principles and Practice of Statistics in Biological Research, W.H. Freeman, San Francisco, 1995.
W.J. Krzanowski. Principles of Multivariate Analysis. A User's Perspective, Revised edition, Oxford University Press, 2000.
I.T. Jolliffe. Principal Component Analysis, Seconda ediz., 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.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 1^ semestre

### Prerequisites

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

### Objectives of the course

Aims. The course enables students to acquire the theoretical and methodological fundamentals, as well as the informatic techniques of univariate and multivariate statistical analysis as applied to the study of experimental sciences.
Objectives. At the end 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) as well as acquire the ability of performing the related informatic procedures for data analysis using commercial statistical packages.

### Program

Content. Theoretical and methodological fundamentals of the main techniques of univariate and multivariate statistical analysis as applied to the study of experimental sciences. Hypothesis testing. Analysis of variance. 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, archeological (paleobiological) and chemical problems. Computer laboratory activity for the study of a few real cases considered during the course.

### Development of the course and examination

The assessment method is a theoretical-practical written test.

### Recommended reading

Appunti di lezioni

O. Vitali. Statistica per le Scienze Applicate. Vol. 2. Cacucci Editore, Bari, 1993.
O. Vitali. Principi di Statistica. Cacucci Editore, Bari, 2003.
R.R. Sokal, F.J. Rohlf. Biometry. The Principles and Practice of Statistics in Biological Research, W.H. Freeman, San Francisco, 1995.

W.J. Krzanowski. Principles of Multivariate Analysis. A User's Perspective, Revised edition, Oxford University Press, 2000.
I.T. Jolliffe. Principal Component Analysis, Seconda ediz., Springer-Verlag, New York, 2002.

## COMBINED COURSE: BIOMOLECULAR TECHNOLOGIES - APPLIED GENETIC (MODULE)

*DAVIDE BIZZARO*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 2^ semestre

### Prerequisites

Cytology And Histology, Genetics, Molecular Biology, Biochemistry

### Objectives of the course

New trends in genetics, epigenetics and their potential applications.

### Program

- Introduction to quantitative genetics - Genetic improvement.
- Epigenetic mechanisms of gene regulation, Imprinting, Histonic code ecc...
- New trends in genomics and transcriptomics.
- Stem cells: from the undifferentiated to the differentiate status. Induced pluripotent stem cells: new insights in cell reprogramming.
- Genetics of infertility. Biotechnology applied to Reproductive Medicine.
- Preimplantational and Prenatal Genetic diagnosis.
- Molecular Genetics of Insecticide Resistance.

The course will highlight some topics through an interactive discussion about recent discoveries in the form of Journal Club and little discussion and working groups of students.

### Development of the course and examination

Oral, slides presentation, about 30 minutes.

### Recommended reading

Lettura e discussione di articoli dalle seguenti riviste: Nature; Nature Genetics; Nature Reviews Genetics; Nature Reviews Molecular Cell biology; Nature Medicine; Nature Biotecnology; Science; Cell; Trends in Genetics; Trends in Cell Biology; Trends in Biotecnology; Annual Review of Genetics; Current Biology; Current Opinion in Genetics and Development; Genome Biology; Genome Research; BioTechniques; Bioinformatics, Biology of Reproduction, Human reproduction,

Stem Cells, Cell Stem Cell, PLOS Genetics
JD Watson, BIOLOGIA MOLECOLARE DEL GENE, Zanichelli
LH Hartwell. GENETICA: dall'analisi formale alla genomica Mc Graw-Hill
Gibson and Muse, INTRODUZIONE ALLA GENOMICA Zanichelli

## COMBINED COURSE: GEOLOGICAL AND CLIMATIC RISK - CLIMATIC RISK (MODULE)

*PETER WADHAMS*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 2^ semestre

### Prerequisites

none; it is advisable a good knowledge of climatology and meteorology, physics and math

### Course contents

The course is designed 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.

### Objectives of the course

By the end of the course, the student will be expected to know the climatic, atmospheric and marine phenomena potentially hazardous, and basic methods of monitoring and forecasting

### 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.

**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, 3rd 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: GEOLOGICAL AND CLIMATIC RISK - GEOLOGIC RISK (MODULE)

*MASSIMO SARTI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 1^ semestre

**Objectives of the course**

Learn about the geological risk agents including technical monitoring and forecasting of extreme events

**Program**

Seismic risk:

- Earthquakes
- Liquefaction of the soil under seismic conditions; case studies

- Tsunami, case studies

- Large earthquakes in history, case studies

- Earthquake monitoring and forecasting

Volcanic risk:

- The volcanoes

- Italian volcanism,

- case studies

- monitoring and forecasting volcanic

Landslide risk:

- Landslides and avalanches

- Large landslides in history, case studies,

- Monitoring and forecasting slope stability

- Floods, case studies

Geomorphological risk:

- Coastal erosion, some examples of intervention

**Development of the course and examination**

Oral

**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.

## COMBINED COURSE: LEGISLATION AND ENVIRONMENTAL MONITORING - ENVIRONMENTAL CHEMICAL MONITORING (MODULE)

*ANNA ANNIBALDI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 2^ semestre

### Prerequisites

Knowledge of the topics of the courses on physic and instrumental analytical chemistry

### Course contents

Frontal lessons and practice exercises in laboratory.

### Objectives of the course

To know the principal techniques of environmental chemical monitoring of air, water and soil according to regulations in force

### Program

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 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

Water monitoring (fresh, marine and coastal, lakes and rivers): general aspects and regulations in force (WFD). 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
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
Principal extraction methods of pollutants from environmental samples (liquid and solid)
Principal instrumental analytical techniques for pollutant monitoring (AAS, spectrophotometric analysis and chromatographic techniques.

**Development of the course and examination**

Oral examination

**Recommended reading**

- Copy of slides available
- R. Cozzi, P. Protti, T. Ruaro, Elementi di analisi chimica strumentale, Zanichelli, Bologna, 1998.
- 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

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

*ALESSANDRA NEGRI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 52
**Period** 2^ semestre

**Prerequisites**

marine geology

**Program**

- Genesis of sediment and its role in global cycles.
- The sediments and sedimentary rocks.
- Terrigenous rocks and sediments: components and classifications. Texture, grain size, porosity, shape, and roundness.
- Carbonate rocks and sediments: components and classifications.
- A special case: the evaporites. Genesis and sedimentary patterns.
- Sedimentary processes: Sediment transport .. Gravitative sedimentation in particular turbidity currents
- Sediments and climate
- The sedimentary structures. Small and large scale structures.
- The sedimentary environments, classifications, Walther's Law
- Deltaic environment. the different types of delta as function of : river, wave and tide.
- Coastal environment. The longitudinal and transverse movements of the sand on a beach. Problems connected with the protection and restoration of beaches.
- Marine environments from the platform to the deep sea. The different areas of sedimentation and the influence of the surface of the carbonate compensation. The different types of sediments and their characteristics. A special case of terrigenous sediments: the turbidites. The Bouma sequence in turbiditic deposits. Fans and submarine turbidite facies associations.

Applicative aspects.

- Methods of sampling and analysis of sediments.
- Processing and presentation of grain size data: particle size distribution curves and statistical parameters.
- Processing and analysis of sedimentological charts.
- Meaning and interpretation of sedimentary structures.
- Recognition of the major sedimentary rocks.

the study of modern sediments such as sand mud (silt) and clay, and the processes that result in their deposition through time.

**Recommended reading**

1. Franco Ricci Lucchi Sedimentologia, Pitagora editore
2. Franco Ricci Lucchi, Sedimentografia, Zanichelli
3. Franco Ricci Lucchi I Ritmi del Mare Nuova Italia Scientifica editore.

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

*PIERPAOLO FALCO*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 1^ semestre

### Prerequisites

None, it is strongly advisable a good knowledge of math and physics

### Objectives of the course

By the end of the course, the student will know the basic mechanisms and processes of the physical oceanography which rule the circulation and the main physical properties of the sea, as well as to describe the main characteristics of the oceans, of the Mediterranean Sea, of the Adriatic Sea.

### Program

Basic concepts:
- Historical developments. Main marine characteristics. Main math operators and their physical meaning. Boundary conditions. Operators.
Marine Dynamics:
- The equations of motion. Friction and turbulence. Equations of motion with viscosity. Geostrophic computations. Response of the upper ocean to winds. Deep circulation. Numerical models. Periodic motions. Coastal processes.
Descriptive oceanography:
- Instruments and methods of measurements. Main climatologic characteristics of oceans and Mediterranean Sea. Variability at different spatial and time scales.

### Recommended reading

R.H. Stewart, "**Introduction To Physical Oceanography**", Texas A & M University, pdf freely downloadable

S. Pond and G.L. Pickard, "**Introductory Dynamical Oceanography"**, Pergamon Press.

Open University Course Team, "**Ocean Circulation"**, Butterworth-Heinemann.

G.L. Pickard and W.J. Emery, "**Descriptive Physical Oceanography",** Butterworth-Heinemann.

## CONSERVATION OF NATURE AND ITS RESOURCES

*ANTONIO PUSCEDDU*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 1^ semestre

### Prerequisites

None

### Objectives of the course

The course aims at providing the students with the knowledge of the ecological principles and guidelines for the conservation and management of marine ecosystems, with a particular focus on the methods and criteria for siting, sizing and the sustainable management of marine protected areas

### Program

Introduction to the basic principles of conservation and management of marine ecosystems. Ecological integrity and vulnerability of marine coastal environments; ; extinctions, invasions and species substitutions; guidelines for the conservation of marine ecosystems: habitat and species conservation; threatened, rare and endemic species; definition of a marine protected area (MPA): siting and management criteria; MPA typologies; Italian national legislation for MPAs; selection and siting of MPAs: social, economical and ecological criteria; zonation of MPAs; creation and adaptive management of MPAs; control and monitoring MPAs: prohibitions, limitations, surveillance. Reserve effects: buffer, refuge and trophic cascades. The cultural significance of MPAs.

### Recommended reading

- DELLA CROCE, CATTANEO VIETTI, DANOVARO, Ecologia e Protezione dell'ambiente marino costiero, UTET, 1998.

- S. GUBBAY, Marine Protected Areas: Principles and Techniques for Management, Chapman & Hall , NY, 1995.

- R.B. PRIMACK, L. CAROTENUTO, CONSERVAZIONE DELLA NATURA , Zanichelli, Bologna, 2003.

## CONSERVATION OF NATURE AND ITS RESOURCES

*ANTONIO PUSCEDDU*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 1^ semestre

### Prerequisites

None

### Objectives of the course

The course aims at providing the students with the ecological principles of conservation and management of nature and its resources, with a special focus on methods and criteria and guidelines for the siting, sizing and sustainable management of protected areas (including seascape) and natural parks

### Program

Introduction to the protection, conservation and management of nature and its resources. Biodiversity conservation principles. Economical and social values of biodiversity. Threatens to biodiversity: loss, vulnerability to extinctions and invasions. Protection, conservation and monitoring of natural habitats; Protected areas (PA) and parks. PA typologies Selection, creation and siting of PAs; management plans of PAs; PAs zonation; Reserve effects. Principles of ecosystem management and restoration; Protection and Climate Change; Principles of Integrated Coastal Zone Management

### Recommended reading

Primack R.B., Carotenuto L. - **Conservazione della Natura**, **Zanichelli**, 2003

## CYTOGENETICS

*MASSIMO GIOVANNOTTI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 54
**Period** 2^ semestre

### Prerequisites

Basic knowledge of genetics and cytology.

### Objectives of the course

At the end of the course the students will have to know: structure, chemical composition, shape, classification and function of eukaryotic chromosomes; types of chromosome abnormalities and their effects; standard and molecular cytogenetic techniques most commonly used on both human and animal chromosomes.

### Program

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; structure and function of centromere; structure and function of telomeres; 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 – Fragile sites - Cytogenetic mutagenesis – Elements of cancer cytogenetics – Elements of prenatal cytogenetics – 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.

**Development of the course and examination**

Oral

**Recommended reading**

MacGregor H.C. – An introduction to Animal Cytogenetics – Chapman & Hall

Mandrioli M. – Principi di citogenetica – Mucchi Editore

Magistrelli R. – Elementi di Citogenetica – CLUA

Colombo R., Olmo E. – Biologia della Cellula – Edi-Ermes (chapters 9 and 10).

Hartwell, Hood, Goldberg, Reynolds, Silver, Veres – Genetica: dall'analisi formale alla genomica – McGraw-Hill (chapters: 17.2.5, 18)

## CYTOLOGY AND HISTOLOGY (A-L)

*ADRIANA CANAPA*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 8
**Hours** 64
**Period** 1^ semestre

### Objectives of the course

At the end of the course the student will know in depth the composition and structure of the cell organelles; the cell cycle and its functional steps, mitosis and meiosis. Moreover he will acquire the knowledge of the differentiations of the animal tissues, with special reference to the human histology

### 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 body 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: Epithelial tissue and glands; connective tissues (cells and fundamental substance; connectives, cartilage, bone, blood); muscular tissue (smooth, striated, cardiac); nervous tissue and neuroglia.

### Development of the course and examination

Oral

### Recommended reading

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

## CYTOLOGY AND HISTOLOGY (M-Z)

*ETTORE OLMO*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 8
**Hours** 64
**Period** 1^ semestre

### Objectives of the course

At the end of the course the student will know in depth the composition and structure of the cell organelles; the cell cycle and its functional steps, mitosis and meiosis. Moreover he will acquire the knowledge of the differentiations of the animal tissues, with special reference to the human histology and of the basic principle of the chordates' embryonic development.

### Program

Cytology: General properties of living organisms; the level of organization of living organisms: virus, prokaryotes and 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 body 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.

### Development of the course and examination

Oral

### Recommended reading

R.Colombo e E. Olmo, Biologia: Cellula e Tessuti, EdiErmes seconda edizione.

## DEVELOPMENTAL BIOLOGY

*OLIANA CARNEVALI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 8
**Hours** 72
**Period** 1^ semestre

**Program**

An introduction to animal development: history and concepts
Gametogenesis: primordial germinal cell . Gametes structures, development and functions of gametes
Cellular communication
Fertilization
Cleavage, blastula formation, gastrulation
Neurulation, the neural crest and its derivatives
Molecular basis of cell migration and cell-cell adhesion.
Epigenesis: the guiding principle of the development
Cellular differentiation
Sex determination: Chromosomal sex determination, Environmental sex determination
Primordial germinal cells Chromosome x inactivation
Axis specification, anterior e posterior polarity. Maternal and zygotic genes involved in the axis specification.
The origin of axis specification in Drosophila (gap e Pair rule genes). Polarity genes and homeotic genes.
Role of Homeotic genes in mammals development
Apoptosi: Programmed cell dead., Ced 4-3-4-9 in C. elegans and their equivalent in mammals (Bcl2, Apaf-1 e caspase 9).
Receptor mediated apoptosis.
Autophagy
Hormones as mediator of development: Amphibian and Insect metamorphosis

**Development of the course and examination**

Oral

**Recommended reading**

Biologia dello sviluppo, Andreuccetti et al.,2009,Ed. McGraw-Hill

Biologia dello sviluppo. Giudice, Augusti-Tocco, Campanella 2010, Ed.Piccin

Biologia dello sviluppo Gilbert 3° Ed Zanichelli

## DIAGNOSTIC MICROBIOLOGY

*ELEONORA GIOVANETTI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 7
**Hours** 56
**Period** 1^ semestre

### Prerequisites

Basic knowledge of General Microbiology and Bacteriology.

### Objectives of the course

At the end of the course students will have to know the molecular and classical methods and procedures used in the diagnosis of main microbial diseases

### Program

Principles and methods in the laboratory diagnosis of infectious diseases. Principles and methods in molecular diagnosis. Principles and methods of the serological diagnosis. The role of the Diagnostic Microbiology laboratory in the diagnosis of community and nosocomial infections, perinatal infections, sexually transmitted diseases, and infections of the immunocompromised patient. Laboratory diagnosis of the infections caused by mycobacteria, anaerobic bacteria, spirochetes, chlamydiae, rickettsiae, and mycoplasmas. Laboratory diagnosis of viral, protozoal, and fungal infections. Microbiological analysis of blood, stool, urine, sputum, throat swab, and cerebrospinal fluid specimens. Laboratory diagnosis of infections related to the development of microbial biofilms. Laboratory diagnosis of hepatitis and HIV infections. Laboratory diagnosis of prion diseases.

### Development of the course and examination

Oral

### Recommended reading

J. Keith Struthers, Roger P. Westran. Clinical Bacteriology. ASM Press.

R. Cevenini, V. Sembri. Microbiologia e Microbiologia Clinica. Piccin Editore.

## DISASTER RISK REDUCTION

*FAUSTO MARINCIONI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 7
**Hours** 56
**Period** 1^ semestre

### Objectives of the course

This course introduce the students to the subject of Disaster Risk Reduction including the principles of emergency planning. Discussion of concepts and best practices for reducing disaster risks through systematic analysis and management of the causal factors of disasters (e.g. reducing exposure to hazards, lessening vulnerability of people and property, sustainable management of land and the environment, or improving preparedness for adverse events). Methods and problems related to the design, test, assessment and distribution of an emergency plan. This will include scenarios and simulations, warning and evacuation, search and rescue, as well as recovery and reconstruction. Special attention will be given to emergency communications and the role of information technologies. Finally, issues connected with international emergencies and the new emerging risks will be discussed.

### Program

Scope and objective of Disaster Risk Reduction. Historical evolution of emergency management. The political and cultural dimension of disaster prevention and management. Risk and safety. Planning tools. Cartographic and analytical methods. The emergency plan and its activation. The Italian national emergency management system. Risk management

### Development of the course and examination

Oral

### Recommended reading

Course materials are available online through the website of the Department of Life and Environmental Sciences (password required). The teacher makes a large use of multimedia supports.

## DISASTERS AND EMERGENCY MANAGEMENT

*FAUSTO MARINCIONI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 7
**Hours** 56
**Period** 1^ semestre

### Objectives of the course

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.

### Program

Risk perception and disaster response Culture, ethics and disasters
Evil nature or bad environmental management
Safety, risk and the cost/benefits ratio Emergencies and crisis (the alteration of the normal societal functions)
The spatial and temporal dimension of disasters

Extreme events and their impacts
Energy sources of hazards
Natural, technological and social disasters The socio-economic impact

Disaster forecast, planning and management Disaster forecast and prevention techniques
Emergency planning and management
The recovery and reconstruction
The lesson of disasters: past, present and future

### Recommended reading

Course materials are available online through the website of the Department of Life and Environmental Sciences (password required). The teacher makes a large use of multimedia supports.

Calamità Naturali. David E. Alexander Pitagora Editrice, Bologna 1990

## ECOLOGY (A-L)

*ANTONIO PUSCEDDU*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 7
**Hours** 56
**Period** 2^ semestre

### Prerequisites

None

### Objectives of the course

The course aims at providing students with the basic knowledge about the structure and functioning of ecosystems and the relationships between organisms and the environment. The course includes basics of population dynamics and the analysis of biotic and abiotic factors that regulate temporal and spatial fluctuations of natural populations.

### Program

Ecosystems properties; the energy flux; 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; r and K dichotomy; competition and predation; basic mathematical models of competition and predation; ecological niche; successions; biodiversity and ecosystem functioning relationships

### 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. 48

R.R. Ricklefs, **ECOLOGIA**, Zanichelli, Bologna, 1997

## ECOLOGY (M-Z)

*SILVIA BIANCHELLI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 7
**Hours** 56
**Period** 2^ semestre

### Prerequisites

None

### Objectives of the course

The course aims at providing students with the basic knowledge about the structure and functioning of ecosystems and the relationships between organisms and the environment. The course includes basics of population dynamics and the analysis of biotic and abiotic factors that regulate temporal and spatial fluctuations of natural populations.

### Program

Ecosystems properties; the energy flux; 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; r and K dichotomy; competition and predation; basic mathematical models of competition and predation; ecological niche; successions; biodiversity and ecosystem functioning relationships

### 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

## ECOPHYSIOLOGY OF ALGAE

*MARIO GIORDANO*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 7
**Hours** 56
**Period** 1^ semestre

### Prerequisites

-Literature search skills
-Sufficient knowledge of the English language to allow comprehension of the scientific literature
-Thorough knowledge of chemistry, biochemistry and physical-chemistry, and plant/algae cytology
-Basic knowledge of algae and plant structure and of their phylogenetic relationships

### Objectives of the course

The student will acquire the notions necessary to distinguish the main functional algal groups and will be introduced to the mechanisms through which algae interact with the environment. In addition to this the student will acquire the ability to independently and creatively analyze primary sources of information and to use them in a scientific/reserach context.

### Program

Competition for resources:
C: the inorganic cC system in solution; CO2 acquisition (CO2 concentrating mechanisms) and interplay of C with the other nutrients
N, S, P and trace nutrients: uptake, assimilation and metabolic interactions
Light: physics of light in the ocean; light capture, conversion of electromagnetic energy to chemical energy, vertical zonation
Substrate: survival in the intertidal zone
Allelopathy: exclusion and defence mechanisms in algae
Phytoplankton and Global Climate Change:
Physiological responses to elevated CO2, temperature and UV
Morphology and Function:
Size and shape: effects on the physiology of phytoplankton, allometry
Applicative aspects:
Algal cultures; biotechnological uses of algae
Phytoplankton evolution:
Endosymbiotic theory; interactions between the environment and the evolution of phytoplankton

**Recommended reading**

Buchanan, Gruissem and Jones (2004). Biochimica e Biologia molecolare delle Piante. Zanichelli

Falkowski e Raven (1997). Aquatic Photosynthesis. Blackwell

Lobban and Harrison (1996). Seaweed Ecology and Physiology. Cambridge University Press

Dring (1982) Biology of Marine Plants. E. Arnold

Knoll (2004). Life on a Young Planet: the First Three Billion Years of Evolution on Earth. Princeton University Press

## ECOTOXICOLOGY AND ENVIRONMENTAL IMPACT ASSESSMENT (Regoli)

*MAURA BENEDETTI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 9
**Hours** 81
**Period** 1^ semestre

### Prerequisites

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

### Objectives of the course

The Course of Ecotoxicology and Environmental Impact Assessment 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 aim to prepare students will on quality standards, the integrated complexity between development of productive activities and environmental protection, management options and environmental impact assessment, remediation and monitoring of polluted areas. 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. The course will also prepare students on normative guidelines and environmental impact assessment, general and economical issues in the use and preservation of resources, industrial risks and dangerous substances. Conflicting interests will be addressed with examples for urban traffic, electromagnetic fields, activities related to management and development of harbour areas, dredging and disposal of sediments, remediation of polluted areas, coastal erosion and use of sediments. Practical examples will include guidelines, management strategies, technical applications and sampling strategies. At the end of the Course the student should have the capability to: 1. Describe main characteristics of chemicals and environmental distribution pathways. 2. Know topics related to biomagnification, use of bioindicator organisms and biomarker analyses. 3. Describe fundamentals and general principles of environmental impact assessment in industrialized and developing countries. 4. Apply conceptual criteria for defining quality criteria in different environmental matrices. 5. Apply criteria for environmental impact of atmospheric pollution, electromagnetic exposure, vehicular traffic, management of coastal areas, dredging, remediation and coastal erosion.

### Program

The Course of Ecotoxicology is based on both theoretical lessons and practical exercitations.

Lessons will cover the following topics:

- Introduction and definition of ecotoxicology, distribution of chemicals in the environment and factors which affect their toxicity. - Toxicity Tests, general procedures, interpretation and applicability of results; examples of most commonly used tests for waters and sediments. - Ecotoxicological approach in the marine environment; biomonitoring, biological resources and impact assessment. - Choice of bioindicator organisms. - Biological effects of chemicals, biomarkers at molecular cellular level with diagnostic and prognostic value. Effect and exposure biomarkers. - 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 in the marine environment. – Liver pathology and chemical carcinogenesis. – Biological and environmental factors which influence responses of biomarkers, basal levels, species sensitivity, adaptation mechanisms. – Case studies of ecotoxicological applications.

During the practical exercitations students will plan a monitoring program, with the choice of more appropriate species and biomarkers. The main methodologies will be presented and measured, including a brief discussion of obtained results

**Recommended reading**

Provided material and scientific literature suggested on specific topics.

Fundamentals of Aquatic Toxicology. Edited by Gary M. Rand, Taylor & Francis 1995

Biomarkers in Marine Organisms: a practical approach. Edited by Garrigues et al., Elsevier 2001

Dragaggi Portuali – Aspetti Tecnico Scientifici per la salvaguardia ambientale nelle attività di movimentazione dei fondali marini. Pellegrini et al., Quaderni ICRAM

## EMERGENCY MANAGEMENT

*SUSANNA BALDUCCI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 2^ semestre

### Program

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.

### Development of the course and examination

Oral

### Recommended reading

- Lecture notes.
- “La nuova protezione civile”, 1a edition 2013, Maggioli Editore

## ENERGETIC RESOURCES AND ALTERNATIVE ENERGIES

*PAOLO PRINCIPI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 1^ semestre

**Prerequisites**

taken the exam of Environmental Technical Physic

**Objectives of the course**

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.

**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), examples in the word.

Solar thermal

Collector types, flat plate and evacuated solar collectors, air and water technologies, efficiency, environmental benefits.

Solar pond

Basic system principles, advantages, disadvantages, efficiency, thermal and electricity generation, desalination, applications in developing countries.

Photovoltaic

Photovoltaic effect, solar cells, stand alone and grid connected systems. The italian program.

Hydropower

Assessment of hydropower availability, overview of hydropower technologies.

Wind power

Assessment of wind power availability, technologies for electricity generation, wind farms, onshore and offshore, Italian and European examples.

Tidal and wave power

Assessment of tidal and wave power availability, technologies, examples in the word.

Geothermal

Assessment of available geothermal energy, technologies for thermal and electric power generation, environmental impacts.

Biomass

assessment of biomass availability, technologies for electric production.

Hydrogen fuel cells

Hydrogen as renewable energy, fuel cell technology.

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**

oral

**Recommended reading**

download pdf files from web pages teacher
handouts for specific topics

## ENVIRONMENT AND CIVIL PROTECTION LEGISLATION

*RAFFAELE CHITARRONI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 1^ semestre

### Prerequisites

None

### Objectives of the course

The course intends to deepen the student's knowledge of the national and international legislation on the subject of Civil and Environmental Protection. At the same time, the structures, organization and functioning of the "public administration" linked to the discussed subject matter will be reviewed. Theoretical and practical exercises will be developed to help students familiarize with the administrative procedures and activities of environmental judicial police.

### Program

Legal definition of the term environment and environmental right: the international scenery, the European and the Italian legislative framework. Environmental protection in the Constitution. The origins of the environmental right. The different levels of environmental management. Environmental Impact Assessment. The notion of environmental damage. Administrative and criminal legislation about the environment.
Rights and legislation in civil protection. The protection of the public and private safety. declaration of the state of emergency. Legislative orders of civil protection.

### Recommended reading

Eugenio Benacci: Compendio di diritto dell’ambiente, Casa Editrice “Ed. Simone”.

## ENVIRONMENT REMEDIATION TECHNIQUES

*FRANCESCA BEOLCHINI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 54
**Period** 2^ semestre

### Prerequisites

None

### Objectives of the course

At the end of the course the student will be able to manage main processes for wastewater treatment and contaminated soil bioremediation

### Program

*Basic skills*. Material balances. Theoretical models for reactors. *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.

### Recommended reading

Metcalf & Eddy, 1991. Wastewater engineering: treatment, disposal, reuse. McGraw Hill.

EPA/540/R-95/534a. Bioventing principles and practice. Environmental Protection Development September 1995

## ENVIRONMENTAL ETHICS AND MONITORING

*CRISTINA GAMBI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 7
**Hours** 63
**Period** 2^ semestre

**Prerequisites**

None

**Program**

General principles on environmental legislation and monitoring

Environmental monitoring within International and European laws

Analysis of the EU Framework Directive for Water and the Marine Strategy.

Environmental monitoring within the Italian laws

Types of monitoring activities and relative purposes

Regulation of fishing and hunting activities

Evolution of the environmental protection in Europe and in Italy

Marine Protected Areas (MPAs): current legislation

Economy and Management in MPAs: monitoring and regulation of fishing and tourism.

Scientific research and monitoring in MPAs.

Evolution of environmental ethics

Theories of Environmental Ethics

Environmental Ethics and Global Changes

**Development of the course and examination**

Oral

## ENVIRONMENTAL MICROBIOLOGY

*FRANCESCA COMITINI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 7
**Hours** 56
**Period** 1^ semestre

### Course contents

For the third year the course is of 6 CFU per 54 hours

### Objectives of the course

At the end of the course the student should know the basic metabolic and physiological aspects of micro-organisms and the techniques for their cultivation. Moreover, the student should know the role and the modalities of study of micro-organisms in the different ecological niches and their application in the recycle of biomass waste and in the remediation processes.

### Program

Prokaryotes and eukaryotes: principles of microbial nutrition and metabolism. Microbial techniques: microscopy techniques, media for micro-organisms cultivation, sterilization techniques, techniques for micro-organisms cultivation. Microbial ecology: methodological approach to study micro-organisms in the environment (samples, isolation enrichment procedures, identification). Cultivable and non-cultivable micro-organisms. Microbial growth. Metabolic diversity of microorganisms. Microorganisms in the biogeochemical cycles (carbon, nitrogen and sulphur). Role of micro-organisms in the recycle of biomass waste and remediation of processes.

### Development of the course and examination

Oral

### Recommended reading

Biavati, Sorlini Microbiologia agroambientale CEA Ambrosiana, 2008

Brock Biologia dei microrganismi vol. 1-2 Microbiologia generale, Microbiologia ambientale e industriale Pearson Ed. 2012

## ENVIRONMENTAL SUSTAINABILITY

*ANTONIO DELL'ANNO*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 8
**Hours** 64
**Period** 2^ semestre

**Objectives of the course**

Provide the basic principles and the most recent approaches for managing complex and inter-disciplinary issues needed to answer environmental sustainability objectives

**Program**

**Definition and basic concepts:**

The concept of environmental sustainability: problems and definitions. Ecological sustainability. Sustainable development. Contrasting hypotheses. Analysis of the growing anthropogenic impact. Applications. Sustainability of environmental impact. Carrying capacity. The ecological management. Services provided by ecosystems. Evaluation of the natural capital. The key ecological paradigms (resistance, resilience, emerging properties and ecosystem borders) in the eco-sustainable of the environment. Ecosystem functioning.

**Global change and global ecology:**

Degradation of terrestrial ecosystem and of the landscape. Erosion in developing countries. Other forms of environmental degradation. Desertification, natural and anthropogenic deserts. Deforestation, typologies of forests, ecological role of forests. Environmental destruction. Human ecology. Human populations and urban growth. Air pollution. Water and ocean pollution.

**Case studies:**

Anthropogenic impact and climate change; Air quality: the case of the Amazon forest. Water cycle and water resources. Availability and quality of water: the case of NY. Agriculture and sustainable yields. Biological resources. Food quality and the sustainability of fisheries. The case of the management of fisheries in W-Africa. 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. Model of sustainable development of forest resources: the case of Canadian forests. Effects o the application of the "precautionary principle". Sustainability and

conservation, sustainability and environmental recovery. Actions in USA.

**Strategic approach to the use of the natural resources:**

Analysis of multiple impacts in the multiple environmental dimensions. Indicators of sustainable development. Sustainable use of the resources. Ecological footprint. *Footprint* and Emergy. Planning the use of resources. Recycling and re-use. Sustainable management of biological resources (renewable). *Driving forces*, pressure, environmental health. Agriculture, Constructions, Energy, Use of non-renewable resources. Indicators of development. Definitions and individuation of the priority resources. Strategies for the abatement of the impact due to the use of resources.

**Environmental sustainability:**

Ecological approach in the political and social decisions. Impact of economical transformation and globalization of ecosystems. Cost-benefit analysis of these actions. Perspectives for the 2050, Global *carrying capacity* of the Earth. Biophysical characterization. Ecology of the world health. Then problem of disparities. Competitions and conflicts. Ecological priorities and prognosis.

**Development of the course and examination**

Oral

**Recommended reading**

Duplicated lecture notes

G. Bologna (2008) Manuale della sostenibilità. Idee, concetti, nuove discipline capaci di futuro. Saggistica e manuali, Edizioni Ambiente.

J. Lemons, L. Westra, R. Goodland (1998) Ecological sustainability and integrity: concepts and approaches. Kluwer academic Publishers.

C. H. Southwick (1996) Global ecology in human perspective. Oxford university Press

N. Chambers, C. Simmons, M. Wackernagel (2000) Sharing nature’s interest: ecological footprints as an indicator of sustainability. Earthscan, London and Sterlin, VA.

## ENVIRONMENTAL TECHNICAL PHYSICS

*PAOLO PRINCIPI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 7
**Hours** 56
**Period** 2^ semestre

**Prerequisites**

Physics and Mathematics

**Objectives of the course**

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. 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.

**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, thermohygrometric 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.

RENEWBLE ENERGIES: solar energy, solar thermal collector, solar collector efficiency,. Wind Speed  Distribution

**Development of the course and examination**

Written and oral exam will be given at the end of course at scheduled time.

**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.** 2014/2015
**Credits** 6
**Hours** 54
**Period** 1^ semestre

**Objectives of the course**

At the end of the course the student should have the ability to analyze the animal behaviour following the scientific method.

**Program**

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

**Recommended reading**

Alcock, Etologia, un approccio evolutivo. Zanichelli

## EVOLUTIONARY BIOLOGY OF MARINE VERTEBRATES

*VINCENZO CAPUTO BARUCCHI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 2^ semestre

**Prerequisites**

A basic knowledge of genetics, zoology and ecology is required

**Objectives of the course**

At the end of the formative way the student will have to know the main experimental and analytical methods to evaluate how some biological processes like mutation, selection, migration and drift produce evolutionary change. Furthermore the student will have to master some software packages for the phylogenetic reconstruction.

**Program**

1) The coming of the modern evolutionary thought. Darwin and the natural selection; the neodarwinism and the “new synthesis”; phyletic gradualism vs punctuated equilibria; the neutral theory of molecular evolution.

2) Classification and evolution. Definitions and examples of taxonomic characters (morphological vs molecular; general vs special adaptations); taxonomic schools (numerical taxonomy, cladistics and evolutionary taxonomy); softwares for phylogenetic reconstruction (PAUP, PHYLIP).

3) Microevolution. The Hardy-Weinberg principle; gene flow and drift; species concepts; geographic variation and speciation; speciation in marine environment; stock concepts and fishery management; bases of biogeography.

4) Macroevolution. Omeotic genes and body plan organisation; 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 ricolonisation of aquatic environment from terrestrial ancestors: origin and evolution; biological and ecological traits of extant species and conservation problems.

**Development of the course and examination**

Oral

**Recommended reading**

Balletto E., 1995. Zoologia evolutiva. Zanichelli.
Berta A., Sumich J. L., 2001. Marine mammals. Evolutionary biology. Academic Press.
Freeman S., Herron J. C., 2004. Evolutionary analysis. Third edition. Prentice Hall.
Ridley M., 2006. Evoluzione. Mc Graw-Hill.
Pough F.H. et al., 2014. Zoologia dei Vertebrati, nona edizione. Pearsin Ed.
Futuyma D.J., 2008. L'evoluzione. Zanichelli, Bologna.

## FERMENTATION BIOTECHNOLOGY

*MAURIZIO CIANI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 2^ semestre

### Objectives of the course

The aim of the course is the achievement of theoretical competences and expertise related to the main microbial industrial process. In particular, it will evaluate the role of microorganisms and the phases of the production process related to the main biotechnology processes.

### Program

Micro-organisms and technologies of the industrial processes: microbial biomass, biofuel, primary and secondary metabolites, industrial fermentation.
Production of microbial starter, single cell protein ( SCP) and single cell oil (SCO), biofuel: bioethanol and biodiesel. Biodiesel: biomass e valorization of by-products. Bioethanol: biomasses, pretreatments procedures, fermentation process. Main fermentation industries: winemaking and brewing process. Micro-organisms involved in environmental biotechnological processes: wastewater treatment: aerobic and anaerobic wastewater processes. Composting processes, recycle of biomass. Bioremediation of water and bioremediation of contaminated sites.

### Development of the course and examination

Oral

### 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 del vino. A cura di di Vincenzini, M., Romano, P. e Farris G.A. CEA Editrice 2005

## FIELD SURVEYING AND GEOLOGIC CARTOGRAPHY (MODULE)

*MASSIMO SARTI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 2^ semestre

### Course contents

The course aims to provide students with knowledge of the methodologies needed for each activity of surveying, mapping and collection of geological data. Nowadays, because of limited budgets, health and safety constraints, and early specialization, few universities emphasize field skills. The quality of geological mapping may have declined, but the geological map is still the principal element in any commercial assessment, whether related to engineering, precious metals, or hydrocarbons.

### Program

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, schistosity, cleavage.
Mappable geological structures: folds elements and faults planes.

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.

Reading geological maps and sections

Geological maps, geological sections, their reading and interpretation
Significance of geological maps interpretation.
Detecting and recording information for specific surveys.

**Development of the course and examination**

Field tutorials

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.

**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 Ed.
G. Cremonini (1995) – Rilevamento Geologico. Realizzazione ed interpretazione delle carte geologiche. Pitagora Ed.
A.V. Damiani (1984) – Geologia sul terreno e Rilevamento geologico. Zanichelli Ed.
D.A.V. Stow (2005) – Sedimentary rocks in the field. A colour guide. Manson publishing Ed.
B. Simpson (1992) – Lettura delle carte geologiche – Flaccovio Ed.
M. Tucker (1995) – Sedimentary rocks in the field. Wiley Ed.

## FIRE PREVENTION AND INDUSTRIAL RISK CONTROL

*DINO POGGIALI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 2^ semestre

**Prerequisites**

Base knowledge on organic and inorganic chemical

**Objectives of the course**

Recognize the risks of fire in work places and life ambients and identify safety measures to apply for prevent fire losses and limit the effects on people and envoirement

**Program**

**A-GOALS AND FOUNDATIONS OF FIRE PREVENTION**: What is to prevent fires, The process of combustion, burning of combustible materials, solid liquid and gaseous ignition processes, products and effects of Combustion, The development and spread of combustion: mathematical models , The explosions of steam, gas and dust and explosive atmospheres (ATEX), fire risk analysis, fire prevention measures to reduce the likelihood of fire, measures for fire prevention

**B-TECHNOLOGY OF EQUIPMENT AND FACILITIES FOR FIRE PROTECTION**: Fire integrity of structures - compartment, reaction to fire materials, Distances security systems emergency exits.

**C- TECHNOLOGY FOR FIRE PROTECTION:** automatic fire detection systems and fire alarm, fire extinguishing substances and portable fire extinguishers, Means and plants with extinction fixed firefighting teams and emergency planning

**D-TECHNICAL RULES OF FIRE PREVENTION AND THEIR APPLICATION**: Key elements of law on fire prevention and fire safety in workplaces

**E- FIRE SAFETY ENGINEERING**: theory and exercises

**F-APPLICATIONS**: Exercises for solving problems arising from the implementation of technical criteria of fire prevention on specific practical examples

**Development of the course and examination**

Orale

**Recommended reading**

Poggiali-Zuccaro “Analisi del rischio incendio” EPC Libri

Calciolai - Ponticelli "Resistenza al fuoco delle costruzioni" Collana Antincendio e Sicurezza - UTET SCIENZE TECNICHE

Paola -  Monopoli "Pianificazione delle emergenze nei luoghi di lavoro" Collana Antincendio e Sicurezza - UTET SCIENZE TECNICHE

## FOOD BIOCHEMISTRY

*TIZIANA BACCHETTI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 2^ semestre

**Prerequisites**

Basic biochemistry knowledge

**Objectives of the course**

The aim of the course is to give students the tools to know:

- the main nutritional compounds in food and the reactions in which they are involved during food: processing and storage.

- the biochemical mechanisms that regulate digestion, absorption and metabolic utilization of nutrients

- the molecular basis of the main diseases associated with wrong eating habits.

**Program**

FOOD COMPOSITION AND NUTRITIONAL CHARACTERISTICS
- Food Carbohydrates: monosaccharides, disaccharides, oligosaccharides, polysaccarides, non-starch polysaccarides, vegetable fiber, artificial and non-carbohydrate sweeteners, prebiotics and probiotics.
- Food Lipids, fatty acids (saturated, unsaturated, essential fatty acids), hydrogenation and vegetable oils, lipid peroxidation, animal and vegetable sterols
- Food Proteins, evaluation of protein quality
- Vitamins and their physiological importance
- Phytonutrients and their physiological functions
- Alcoholic beverages
- Minerals
- Food additives and flavourings
- Novel foods and functional foods

ALTERATIONS DURING FOOD PROCESSING
Maillard reaction, non-enzymatic browning reaction and nutritional effects. Fatty acids hydrogenation and lipid peroxidation. Protein degradation.

FOOD AND HEALTH
- The molecular basis of the main diseases associated with wrong eating habits

**Recommended reading**

Paolo Cabras , Aldo Martelli. "Chimica degli alimenti" Ed.Piccin-Nuova Libraria

Ivo Cozzani, Enrico Dainese "Biochmica degli Alimenti e della Nutrizione" Ed. Piccin-Nuova Libraria

Costantini, Cannella, Tomassi. "Fondamenti di Nutrizione Umana " Ed.Pensiero scientifico

## FOOD MICROBIOLOGY

*FRANCESCA COMITINI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 2^ semestre

**Prerequisites**

GENERAL MICROBIOLOGY AND BIOCHEMISTRY

**Objectives of the course**

INVOLVMENT OF MICROORGANISM IN THE FOOD SCIENCE

**Program**

Introduction to food microbiology:

1. role of the mo in food
2. food contamination: indicators of quality and safety

Microbial ecology of food:
3.food as a habitat for the mo

Microbial starter cultures:
4. the virtuous mo
5. probiotics: characteristics and role in food
6. the selection of mo
7. the natural starter

Pathogens of food:
8. the microbial spoilage
9. infections in food matrix
10. main pathogenic bacteria and fungi in food

Fermented food:
11. dairy microbiology

12. lactic acid bacteria

13. milk and yogurt
14. probiotics, prebiotics and spoilage of milk
15. cheese
16. butter

Microbiology of meats:
17. non-fermented meat products
18. fermented sausages
19. microbiology of eggs, sauces, spices, prepared foods

20. the HACCP system

21. the role of bacteriophages in food microbiology

Lab exercises:

Enumeration of microbial populations from food

Yogurt: microbial counts under the microscope

Mold counts in sausages

Microbioological control of the air and surfaces

HACCP plan simulation

**Recommended reading**

GALLI VOLONTERIO AM, MICROBIOLOGIA DEGLI ALIMENTI, CASA ED. CEA

## FORECASTING AND PREVENTION OF NATURAL DISASTER

*MAURIZIO FERRETTI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 9
**Hours** 81
**Period** Corso annuale

**Prerequisites**

meteorological and geological courses

**Objectives of the course**

basic knowledge for risk forecast and management

**Program**

**Operative chain for hydrogeological risk forecast**

Nowcasting : meteorological satellite and radar

Forecast numerical models: global circulation and limited area models

Meteorological maps interpretation

**Landslide Risk.**

Marche geological overview

Landslide triggering factors: case studies

Precipitation amount and related landslide investigation for forecast soil effects

Triggering rainfall thresholds

Landslide forecast models: physical based and empirical models

Italian case studies

CF Marche activities

**Hydraulic risk**

Rainfall-Runoff process

Temporal and spatial scale

Rainfall spatial estimation methods

Precipitation data analysis and precipitation intensity-duration curves

Hydrological modelling

Rainfall thresholds definition for runoff scenarios

Hydraulic modelling introduction

**Fire risk**

Integrated telecontrol and monitoring systems

Risk management. Fire extinguishing activities.

Planning and prevention

**Sismic risk.**

Seismogenesis

Seismological precursors

Monitoring system and data dissemination

Prevention

Case studies and hazard scenarios

**Volcanic risk.**

Volcanology

Volcanic precursors

Prevention

Case studies and hazard scenarios

**Recommended reading**

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);

## FUNDAMENTALS OF BIOLOGY

*MARIA ASSUNTA BISCOTTI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 7
**Hours** 63
**Period** 2^ semestre

### Program

General characteristics of living matter. The cell theory. Chemical composition of living matter. The biological importance of water. The major classes of organic compounds: carbohydrates, lipids, proteins, nucleic acids. Main methods to study the cells, the compound microscope, and 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. Cellular communication: synaptic, endocrine and neuroendocrine signaling.

Flow of information in living matter. DNA replication, transcription in prokaryotes and eukaryotes. Maturation of mRNA, rRNA and tRNA. The apparatus of translation: tRNA and ribosomes, the genetic code, translation in prokaryotes and eukaryotes. Post-translational modifications and post-synthetic destiny 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. The Mendel's laws of the transmission of hereditary characters. Autosomal dominant inheritance, autosomal recessive inheritance, sex-linked inheritance. Non-Mendelian inheritance. Asexual reproduction. Sexual reproduction: spermatogenesis, oogenesis. Ovarian cycle. Uterine cycle. Fertilization. An outline of embryology.

### Recommended reading

Chieffi et al. Biologia & Genetica. Edises; Colombo R. Olmo E Biologia della cellula. Edi-ermes

## FUNDAMENTALS OF EARTH SCIENCES

*ALESSANDRA NEGRI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 1^ semestre

**Program**

Weather major endogenous (volcanoes and earthquakes) - The minerals of the rocks: recognition, 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.

**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 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.

**The Orogenesis**

The oceans of the past. Plate tectonics and orogeny. 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

**Development of the course and examination**

Practical exercises and comments to problems through reading scientific articles

Using the compass by geologist

Introduction to the description and recognition of sedimentary rocks, magmatic, metamorphic. Using the magnifying glass (10x)

**Recommended reading**

Capire la Terra - Frank Press & Raymond Siever (Zanichelli);
Scienze della Terra - Pompeo Casati (Città Studi Edizioni)

## FUNDAMENTALS OF ECOLOGICAL SYSTEMS ANALYSIS

*ANTONIO PUSCEDDU*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 8
**Hours** 64
**Period** 2^ semestre

### Prerequisites

None

### Objectives of the course

The course aims at providing students with the basic knowledge about the structure and functioning of ecological systems, the relationships between organisms and the environment, the methods for the analysis of ecosystems.

The course includes basics of population dynamics, the analysis of biotic and abiotic factors that regulate temporal and spatial fluctuations of natural populations, the description and functioning of some of the most important ecosystems on Earth.

### Program

Ecosystems properties; the energy flux; 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; r and K dichotomy; competition and predation; basic mathematical models of competition and predation; ecological niche; successions; biodiversity and ecosystem functioning relationships; sampling methods; experimental designs for ecosystem analysis; examples of natural ecosystems.

### 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. 48

## FUNDAMENTALS OF ENVIRONMENTAL IMPACT ASSESSMENT

*STEFANIA GORBI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 1^ semestre

### Prerequisites

A good knowledge of ecotoxicology and ecological processes are important requisites for this course

### Objectives of the course

The Course is aimed to prepare students for defining quality standards, the integrated complexity between development of productive activities and environmental protection, management options and environmental impact assessment, remediation and monitoring of polluted areas, with particular concern to the marine environment.
At the end of the course the student should have the capability to:
- Describe fundamentals and general principles of environmental impact assessment.
- Apply criteria for environmental management of coastal areas, dredging, remediation and coastal erosion.
- Know the main European policies regarding the environmental management and marine pollution prevention.
- 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.
- Quality standard for the environment; formulation, technical aspects and critical points in setting limits for quality standards. Determination of the Quality Standards for the marine environment.
- 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).
- Economy and normative restrictions to prevent, limit, monitor and remediate environmental pollution in marine environment.
- Environmental management systems: EMAS CE 761/01 and UNI EN ISO 14001/04 regulations.

- Management of contaminated marine sediment: analytical procedures to characterized their quality.
- Marine Strategy Framework Directive 2008/56/CE for a Good Marine Environmental Status
- Practical examples on management options and technical approaches in dredging and disposal of sediments.
- Remediation of contaminated marine area

**Development of the course and examination**

Oral

**Recommended reading**

Books and scientific literature will be suggested at the beginning of the course.

## FUNDAMENTALS OF OCEANOGRAPHY, METEOROLOGY AND CLIMATOLOGY

*FRANCESCO BOCCANERA*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 1^ semestre

**Prerequisites**

physiscs and mathematic courses

**Objectives of the course**

The course aims to provide the basic knowledge of dynamics and thermodynamic of geophysical fluids, in order to understand the relevant processes and the mutual interactions

**Program**

Introduction to atmospheric 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; tidal forcing

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 and oceans

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

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).

**Development of the course and examination**

oral examination at the end of the course

**Recommended reading**

teacher's lecture notes
JM Wallace, PV Hobbs: Atmospheric Science II ed., Academic Press
RV Rohli, AJ Vega, Climatology, Jones and Bartlett Publishers
S. Pond, GL Pickard, Introductory Dynamic Oceanography, II ed., Pergamon Press

## GENERAL MICROBIOLOGY

*FRANCESCA BIAVASCO*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 8
**Hours** 72
**Period** 2^ semestre

**Program**

The Microbial World. 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, 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 genetics: bacterial DNA replication; mobile genetic elements (plasmids, insertion sequences, transposons, gene cassettes). 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. Microscopy, preparation and staining of specimens. Cultivation of microorganisms: selection of medium and atmosphere; pure cultures; measurement of growth, the growth curve.
Control of microbial growth. Disinfection and sterilization. Antibiotics: general features, mechanisms of action and resistance. Disk diffusion susceptibility test.
Microbial and microorganism-host interactions. Microbial communities. Symbiotic interactions: commensalism, mutualism, parasitism. Microbial biofilms. Pathogenicity and virulence: adhesiveness, invasiveness and toxin production. Basic nonspecific and specific human body defences: antigens and antibodies, cells involved in the immune response, vaccines.

**Development of the course and examination**

Oral

**Recommended reading**

-Willey, Sherwood, Woolverton. Prescott - volume 1, Microbiologia generale. Ed. McGraw-Hill.
-Madigan, Martinko, Stahl, Clark. Brock-Biologia dei microrganismi – volume1, Microbiologia generale. Ed. Pearson.
-Dehò e Galli. Biologia dei microrganismi. Casa Editrice Ambrosiana.
-Schaechter, Ingraham, Neidhardt “Microbiologia”. Zanichelli

## GENERAL PHYSIOLOGY (A-L)

*PAOLO MIGANI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 9
**Hours** 72
**Period** 2^ semestre

### Prerequisites

To follow the course of General Physiology, students must have a knowledge of Mathematics, Physics, Chemistry and Comparative Anatomy, at the level of the corresponding courses in the Faculty program. Some basic Biochemistry would be beneficial.

### Objectives of the course

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 (with special reference to Vertebrates);

• how to use Physics and Physical Chemistry knowledge for the study of animal organs and apparatuses;

• the understanding of the main research methods in Physiology, in theory and practice;

### Program

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**

Written  and oral examinations.

**Recommended reading**

**.** Several Authors (edited by E. D'Angelo and A. Peres). Fisiologia: molecole, cellule e sistemi. EdiErmes, Milano.

**.** C. Casella V. Taglietti, Principi di Fisiologia - Volume I e II, La Goliardica Pavese.

**.** D.U. Silverthorn, Fisiologia, Casa Editrice Ambrosiana.

## GENERAL PHYSIOLOGY (M-Z)

*ROSAMARIA FIORINI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 9
**Hours** 81
**Period** 2^ semestre

### Program

Structure and function of biological membranes. Membrane Transport, Ionic Equilibria, Membrane Electrical Properties, Donnan Equilibrium
Propagation and Transmission of the Nervous Signals
Endocrine System: Neuroendocrinology
Molecular Basis of Muscle Contraction and Neuronal Control
Cardiovascular System: Hydrodynamic Characteristics, Cardiac Properties and Actions, Reflexes and Regulation of the Cardiovascular System
Respiration: Mechanics and Control, Blood Oxygen Carriers, Respiratory Gas Exchange
Renal Function and Osmotic Regulation: Urine Formation, Control of Body Fluid Volumes and Osmolality, Acid-Base Equilibrium
Digestive system, absorption, energy balance.
Immune system

### Development of the course and examination

Oral

### Recommended reading

Silverthorn, Fisiologia. Casa Editrice Pearson, Italia, 2013.

## GENETIC ENGINEERING

*TIZIANA CACCIAMANI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 2^ semestre

### Prerequisites

Basic knowledge of DNA structure and functions (Molecular Biology), protein sctructures and functions (Biochemistry), and good knowledge on prokaryotic and eukaryotic cells (Microbiology, Cytology).

### Objectives of the course

After the course the student should: (a) have acquaired the theorical and pratical skills necessary to constract and use recombinant DNA molecules and vectors, for the isolation characterization and expression of genes; (b) know the most common vectors used for cloning and producing recombinant proteins; (c) decide, according to different use/source of recombinant proteins, which biological system is optimal for expression; (d) evaluate the advantges and risks in the use of genetic engineering in different biotechnological fields.

### Program

The course is organized in lectures and laboratory practice and its aim is giving to students basic knowledge for constraction and use of cloning and expression vectors containing recombinant DNA in prokaryotic and eukaryotic system.
- Prokaryotic systems- Short introduction on bacteria and phages biology; restriction enzymes and other enzymes usefull for DNA and RNA manipulations; chemical synthesis, sequencing and amplification of DNA; site directed mutagenesis; search gene in gene banks and computer analysis of data. Cloning and expression vectors based on plasmid and bacteriophage; transfection and selection methods; constraction of genomic and cDNA libraries; large scale production of recombinant proteins.
– Eukaryotic systems- Short introduction on eukaryotic hosts, expression vector; transfection and selection methods utilized in yeast, insect cells and mammalian cells; production of recombinant protein in eukaryotes; vectors for gene, RNAi and Oligo therapies.
The laboratory practice will be organized as short research program.

### Development of the course and examination

Written. 5 questions. for each correct answer 6.30 points are assigned

**Recommended reading**

S. Primrose, R. Twyman, B.Old – Ingegneria Genetica, principi e tecniche- Zanichelli, 2004.
B.R. Glick, J.J. Pasternak – Biotecnologia Molecolare, principi e applicazioni del DNA ricombinante- Zanichelli, 1999.

## GENETICS (A-L)

*DAVIDE BIZZARO*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 8
**Hours** 64
**Period** 2^ semestre

### Prerequisites

Citology and Histology, zoology, biochemistry

### Program

Introduction: the cell cycle; mitosis and meiosis from the genetic viewpoint; the sexual reproduction and the variability.
Genotype and phenotype: the mendelian genetics. The chromosomal bases of heredity, the determination of sex and sex linked characters in eukaryotic systems. Extension of the mendelian genetic analysis: multiple alleles, variability of the relations of dominance, gene interactions and modified mendelian ratios, genes and environment. Linkage, meiotic and mitotic crossing-over, gene mapping in eukaryotes. Primers of Quantitative genetics. Genetic analysis in prokaryotes: bacterial transformation and transduction. The structure of the genetic material: DNA and RNA. DNA, chromosomes, genomes. Complexity of the eukaryotic sequences. DNA replication and recombination. Transcription and RNA maturation. Different types of RNA: mRNA, tRNA, rRNA, snRNA,. The translation process, the structure of proteins and the genetic code.
Gene cloning and the technology of recombinant DNA: the restriction enzymes, cloning vectors, genomic banks and gene libraries, synthesis of cDNA molecules. DNA sequencing, the technique of polymerase chain reaction (PCR) ecc.
Gene regulation in bacteria: the Lac and Trp operons in E.coli. Gene regulation in Eukaryotes at different levels: transcription, maturation and translation of mRNAs. Gene regulation in development and differentiation; imprinting, gene amplification and mechanisms of gene rearrangement. Genetic mutations: point mutation, chromosomal and genomic mutations. Dna repair. Mutagenesis test. The jumping sequences of DNA: the transposons.
The evolutionary genetics (genetics of populations), allelic frequencies, the Hardy-Weinberg equation. The genetic variability in natural populations. The causes of variation of the allelic frequencies in natural populations: natural selection, mutation, random genetic drift, migration. Sickle cell anaemia and thalassemia. Molecular evolution.

### Development of the course and examination

Oral. During the course an optional written test on Formal Genetics is scheduled.The final oral examination consists in the resolution of simple exercises of formal genetics, and in questions about the entire program of Genetics and the topics covered in the tutorials. The exam lasts about 30-40 minutes.

**Recommended reading**

Oral. During the course an optional written test on Formal Genetics is scheduled.The final oral examination consists in the resolution of simple exercises of formal genetics, and in questions about the entire program of Genetics and the topics covered in the tutorials. The exam lasts about 30-40 minutes.

## GENETICS (M-Z)

*BRUNA CORRADETTI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 8
**Hours** 64
**Period** 2^ semestre

### Prerequisites

Citology and Histology, zoology, biochemistry

### Program

Introduction: the cell cycle; mitosis and meiosis from the genetic viewpoint; the sexual reproduction and the variability.
Genotype and phenotype: the mendelian genetics. The chromosomal bases of heredity, the determination of sex and sex linked characters in eukaryotic systems. Extension of the mendelian genetic analysis: multiple alleles, variability of the relations of dominance, gene interactions and modified mendelian ratios, genes and environment. Linkage, meiotic and mitotic crossing-over, gene mapping in eukaryotes. Primers of Quantitative genetics. Genetic analysis in prokaryotes: bacterial transformation and transduction. The structure of the genetic material: DNA and RNA. DNA, chromosomes, genomes. Complexity of the eukaryotic sequences. DNA replication and recombination. Transcription and RNA maturation. Different types of RNA: mRNA, tRNA, rRNA, snRNA,. The translation process, the structure of proteins and the genetic code.
Gene cloning and the technology of recombinant DNA: the restriction enzymes, cloning vectors, genomic banks and gene libraries, synthesis of cDNA molecules. DNA sequencing, the technique of polymerase chain reaction (PCR) ecc.
Gene regulation in bacteria: the Lac and Trp operons in E.coli. Gene regulation in Eukaryotes at different levels: transcription, maturation and translation of mRNAs. Gene regulation in development and differentiation; imprinting, gene amplification and mechanisms of gene rearrangement. Genetic mutations: point mutation, chromosomal and genomic mutations. Dna repair. Mutagenesis test. The jumping sequences of DNA: the transposons.
The evolutionary genetics (genetics of populations), allelic frequencies, the Hardy-Weinberg equation. The genetic variability in natural populations. The causes of variation of the allelic frequencies in natural populations: natural selection, mutation, random genetic drift, migration. Sickle cell anaemia and thalassemia. Molecular evolution.

### Development of the course and examination

Oral. During the course an optional written test on Formal Genetics is scheduled.The final oral examination consists in the resolution of simple exercises of formal genetics, and in questions about the entire program of Genetics and the topics covered in the tutorials. The exam lasts about 30-40 minutes.

**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

## GIS TOOLS FOR ENVIRONMENTAL AND CIVIL PROTECTION

*FRANCESCA SINI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 2^ semestre

**Prerequisites**

Geodetic, Cartographic and IT basic knowledge

**Objectives of the course**

The course introduces students to the tools and techniques of 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.
A relevant part of the course has been reserved for practical activities and opensource GIS labs.

**Program**

Part I – Geographic Information Systems Theory
An introduction to Geographical Information System (GIS); Geodesy and Cartography; Remote Sensing introduction-active and passive sensors; Digital Terrain Models (DTM); GIS Data Models; Metadata; Data Quality; Thematic Maps; Spatial Analysis and Geoprocessing; Open source and commercial GIS softwares overview; GIS for Civil Protection examples; ECDL GIS certification.

Part II – GIS application for the environment and the Civil Protection
Opensource softwares tutorial (Quantum GIS); GIS training and exercises; Project development on assigned civil protection case studies;

**Development of the course and examination**

oral or written exam with open questions;
discussion on the assigned GIS project that must be produced at least one week before the exam;

**Recommended reading**

Gomarasca M., Elementi di Geomatica, Associazione Italiana di Telerilevamento, 2004 ;
Caiaffa E., ECDL GIS. La rappresentazione cartografica e i fondamenti del GIS, McGraw-Hill, 2011
Course notes;
Quantum GIS  Manuals and software download (http://www.qgis.org )

## HUMAN ANATOMY

*MANRICO MORRONI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 54
**Period** 2^ semestre

### Prerequisites

Knowledge of the Histology

### Objectives of the course

The student must know anatomical logic of the human organism

### Program

Organization of the human body and anatomical terms. Skin. Skeletal apparatus. Circulatory system. Immune system. Respiratory system. Gastrointestinal tract. Urinary system. Male and female reproductive system. The endocrine glands. Central and periphery nervous system.

### Recommended reading

1) Manrico Morroni: Anatomia microscopica funzionale dei visceri umani, Edi-Ermes, Milano, 2008.

2) Autori vari: Anatomia dell'Uomo, Edi-Ermes, Milano, 2006.

3) M. Morroni, M.Castellucci: Quesiti di autovalutazione di anatomia umana per i corsi di laurea triennali. Stampa Nova Editrice, Jesi (AN).

## ICT FOR EMERGENCY MANAGEMENT AND ENVIRONMENTAL PROTECTION

*LUCA ABETI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 8
**Hours** 72
**Period** 1^ semestre

**Course contents**

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 & environmental protection domains.

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 focuses on issues related to the project management in Public Administration and in e-Government projects.

Each part of the course consists in lectures and practical activities carried out in laboratories. A lecture will be spent in a field trip to show technologies adopted in the Italian Civil Protection.

**Program**

*Part I* – Information Systems: Using ICT in emergency management and environmental protection; Fundaments of Computer Science; Information Systems and civil protection; Relational Databases; Semi-structured knowledge , Data Mining e Semantics; Programming Languages. Lab Activity: SQL and PostgreeSQL/MySQL.

*Part II* – Networks and Communication Systems: Fundaments of Telecommunications; Communication Networks; Networking; World Wide Web. Exercitation: Satellite Link /WiFi, PHP and usage of a remote Database.

*Part III* – Design and development: Project management of new technologies in Public Administration; Software Engineering; Human-Computer Interaction; Business process reengineering.

*Part IV* – Applied Technologies: Remote Sensing and GIS system; Critical Infrastructures; Security and disaster recovery; Risk Modeling and Analysis; Information Sharing and collaboration; Analogical and Digital Radio Communication; ROIP and VOIP Systems; Technological standardization and civil protection.

**Development of the course and examination**

The examination will consist in a team project and a written test.

**Recommended reading**

Pine (2006), John C. Pine, Technology in emergency Management, John Wiley and Sons ISBN: 978-0471789734, Danvers, MA, USA, pp. 312

Atzeni, Ceri (2003), C. Atzeni, S. Ceri, S. Paraboschi, R. Torlone, Basi Di Dati - Modelli e Linguaggi di Interrogazione, Mc Graw-Hill, ISBN: 9788838666001, Roma, IT, pp. 462.

Neri (2006), Nerio Neri, Radiotecnica per radioamatori. Con elementi di elettronica e telecomunicazioni, C&C ISBN: 9788886622011, Faenza, RA, IT, pp. 256

## INDUSTRIAL MICROBIOLOGY

*MAURIZIO CIANI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 2^ semestre

### Prerequisites

General microbiology, Biochemistry, Biotechnology of microorganisms

### Objectives of the course

The aim of the course is the achievement of theoretical competences and expertise related to the main microbial industrial process. In particular, it will evaluate the role of microorganisms and the phases of the production process related to the main biotechnology processes.

### Program

Micro-organisms and technologies of industrial processes; microbial biomass, biofuel, primary and secondary metabolites, industrial fermentation.
Production of microbial starter, single cell protein ( SCP) and single cell oil (SCO), biofuels: bioethanol and biodiesel. Biodiesel: biomass e valorization of by-products. Bioethanol: biomasses, pretreatments procedures, fermentation process. Primary metabolites: ; organic acids; polyalcohols. Main fermentation industries: winemaking and brewing process. Micro-organisms involved in biotechnological processes of wastewater treatment : aerobic and anaerobic wastewater processes. Composting processes, recycle of biomass. Bioremediation of water and contaminated sites.

### Development of the course and examination

Oral

### 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 del vino. A cura di di Vincenzini, M., Romano, P. e Farris G.A. CEA Editrice 2005

## INTEGRATED SYSTEMS FOR ENVIRONMENT MANAGEMENT AND REMEDIATION

*FRANCESCA BEOLCHINI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 2^ semestre

### Prerequisites

None

### Objectives of the course

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

### Program

Waste: definitions, classification and characterisation. Waste disposal and treatment technologies: selection platforms, composting, anaerobic digestion, incineration, landfill. Regulations. Life Cycle Analysis methodology applied to waste. Management of specific classes of wastes: electric and electronic equipment waste, exhaust batteries, harbour wastes. 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. Industrial quantitative risk analysis. Risk analysis applied to contaminated sediments.

### Recommended reading

Paul Wiliams, 2006 Waste Treatment and Disposal 2nd Ed. John Wiley.

Luca Bonomo, 2005. Bonifica di siti contaminati. McGraw Hill.

## LABORATORY OF BIOACTIVE MOLECULES

*GIOVANNA MOBBILI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 2^ semestre

### Prerequisites

Fundamentals General and Organic Chemistry. General knowledge on the main instrumental techniques applied to organic synthesis.

### Objectives of the course

This class introduces students to the issues concerning the synthesis and delivery of bioactive molecules. The course work will also touch general basic themes and specific examples examined during laboratory practicals.

### Program

Biopharmaceutical properties of drugs. Physicochemical parameters and drug absorption: solubility, ionisation and pH, lipophilicity, hydrogen bond, electronic properties.
Structure and pharmacological activity. Optic and geometric isomery, conformational isomery, isosterism and pharmacological activity. Target identification methods. Drug delivery systems: liposomes.
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.
Drug Delivery Systems.
Laboratory Experiments

### Development of the course and examination

Oral

### Recommended reading

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 ORGANICI – Edizioni ETS

## MARINE ANIMAL BIODIVERSITY

*BARBARA CALCINAI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 7
**Hours** 56
**Period** 1^ semestre

**Objectives of the course**

To achieve general knowledge on marine biodiversity, focusing on the biodiversity in the Mediterranean Sea. During the course practical sessions will give to the students tools for the taxonomic identification of the principal marine groups.

**Program**

The value of Biodiversity; The importance of the taxonomy; Factors increasing biodiversity: Speciation in the sea. The origin of Mediterranean fauna;

Biogeography; Coral reef biodiversity; Biodiversity and spatial complexity.

Biodiversity in special Mediterranean habitats (e.g. Coralligenous, *Cladocora caespitosa* banks, *Sabellaria* banks) Marine caves, Conero promontory. Factors for the decrease of biodiversity:

During the course the taxonomy of some marine groups will be studied by laboratory exercises

**Recommended reading**

Didactic material from the teacher.

Suggested books:

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.

Current publications available on the web.

## MARINE BIOLOGY

*RICCARDO CATTANEO VIETTI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 8
**Hours** 72
**Period** 2^ semestre

### Prerequisites

None

### Program

History of Marine Biology, Principal characteristics of marine environments, Adaptation of the organisms to the marine environment and theirs evolution, Principles of marine ecology, Organisms and community, Marine bacteria and viruses, Life cycles and life histories, Plankton characteristics and communities, Benthos: Meiobenthos and Macrobenthos, Necton.

### Development of the course and examination

Oral

### Recommended reading

Danovaro R. Biologia Marina: Cittastudi, 440 pp.

## MARINE BIOLOGY AND ECOLOGY

*ROBERTO DANOVARO*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 7
**Hours** 56
**Period** 2^ semestre

### Prerequisites

Marine Biology

### Objectives of the course

To the end of the instruction the student will have to know the functioning of all types of marine ecosystems and to resolve the different types of environmental problems for the biodiversity conservation. The student will develop specific knowledge relative to the sampling, surveying and deepening of the various aspects of marine Biology

### Program

Characteristics of marine ecosystems, Sampling methodologies and instruments for research in marine biology. Biodiversity in marine environment, Study of the ecology of lagoons and confined ambient; ecology of estuaries, deep seas, coral reefs, Mediterranean reefs, marine caves, hydrothermal vents and cold seeps, marine seagrass ecosystems and mangrove, artificial marine ecosystems and polar environments.Biological resources: intensive and extensive aquaculture. Protection of marine organisms and marine reserves. Marine pollution: biology and biological indicators. Management and control of the renewable resource

### Development of the course and examination

Oral

### Recommended reading

Danovaro R. Biologia Marina: Cittastudi, 440 pp.

## MARINE ECOTOXICOLOGY

*FRANCESCO REGOLI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 7
**Hours** 56
**Period** 1^ semestre

### Prerequisites

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

### Objectives of the course

The Course of “Methods in Ecotoxicology” 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 aim to prepare students on quality standards, the integrated complexity between development of productive activities and environmental protection, management options and environmental impact assessment, remediation and monitoring of polluted areas. 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. The course will also introduce students on environmental risk assessment, especially for highly polluted, industrial sites, and for activities related to dredging and management of contaminated sediments. At the end of the Course the student should have the capability to:
1. Describe main characteristics of chemicals and environmental distribution pathways.
2. Know topics related to biomagnification, use of bioindicator organisms and biomarker analyses.
3. Describe fundamentals and general principles of environmental impact assessment in industrialized and developing countries.
4. Apply conceptual criteria for defining quality criteria in different environmental matrices.
5. Apply criteria for environmental risk assessment in management of coastal areas, dredging and remediation activities.

### Program

The Course of Ecotoxicology is based on both theoretical lessons and practical exercitations.

Lessons will cover the following topics:

- Introduction and definition of ecotoxicology, distribution of chemicals in the environment and factors which affect their toxicity. - Toxicity Tests, general procedures, interpretation and applicability of results; examples of most commonly used tests for waters and sediments. - Ecotoxicological approach in the marine environment; biomonitoring, biological resources and

impact assessment. - Choice of bioindicator organisms. - Biological effects of chemicals, biomarkers at molecular cellular level with diagnostic and prognostic value. Effect and exposure biomarkers. - 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 in the marine environment. – Liver pathology and chemical carcinogenesis. – Biological and environmental factors which influence responses of biomarkers, basal levels, species sensitivity, adaptation mechanisms. – Case studies of ecotoxicological applications.

During the practical exercitations students will plan a monitoring program, with the choice of more appropriate species and biomarkers. The main methodologies will be presented and measured, including a brief discussion of obtained results.

**Recommended reading**

Provided material and scientific literature suggested on specific topics.

Fundamentals of Aquatic Toxicology. Edited by Gary M. Rand, Taylor & Francis 1995

Biomarkers in Marine Organisms: a practical approach. Edited by Garrigues et al., Elsevier 2001

Dragaggi Portuali – Aspetti Tecnico Scientifici per la salvaguardia ambientale nelle attività di movimentazione dei fondali marini. Pellegrini et al., Quaderni ICRAM

## MARINE MICROBIOLOGY

*CARLA VIGNAROLI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 7
**Hours** 56
**Period** 1^ semestre

### Prerequisites

knowledge of biochemistry, cytology, genetics and elements of microbiology

### Objectives of the course

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 procaryotic and protistan cells in the sea, the fundamental role of microbes in marine ecosystem and the interactions between particular microbial species and the environment or other marine organisms. Students will develop knowledge about pathogenicity mechanisms of some important human and/or fish pathogens and they will also learn to describe sampling, cultivation and identification methods to be used in marine microbial communities studies and in bacterial detection from sea-water samples

### Program

Marine environment: general characters and microbial communities. Distribution of the microbial populations in the marine habitats. The microbial loop and microbial food web. Role of microrganisms in the cycles of the main elements (sulphur, nitrogen and carbon cycles).

Mechanisms of energy production among oligothrophic bacteria.

Taxonomy and methods to study microbial evolution.

The main marine taxonomic groups of eubacteria. 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 harmful algal blooms. Chemoheterotrophs bacteria among marine proteobacteria,bacteria of the genera *Pseudoalteromonas*, *Aeromonas* e *Vibrio*.

Bacteria in extreme environments: general characters of Archaea and their strategies of adaptation. The extreme thermophiles and halofiles, the methanogens. Hydrothermal vents community and black smokers.
Marine virus and their role in the prokaryotic biodiversity.

Sampling methods and detection of microrganisms. Isolation and cultivation of marine microbes, culture media for marine populations, viable but non culturable cells.

Interaction of microrganisms with marine environment, the chemotaxis, bacterial movement in aqueous environmental, adhesion and colonization of surfaces, structure and formation of biofilms. Air-water interface, bacterioneuston and hydrocarbon-degrading marine bacteria, sediment-planktonic interface and microbial mats.
Interaction of microrganisms with other aquatic organisms, positive and negative relations.

The quorum sensing mechanism, the biochemistry and biology of bacterial and dinoflagellata bioluminescence.

Microbial water pathogens and epidemiology of main water related diseases Indicator organisms of water contamination and water quality.

**Development of the course and examination**

Oral

**Recommended reading**

Madigan, Martinko, Stahl, Clark, "Brock biologia dei microrganismi", CEA Ambrosiana, edizione 2012, volume 1 e 2

Barbieri, Bestetti, Galli, Zannoni- Microbiologia ambientale ed elementi di ecologia microbica - Casa Editrice Ambrosiana, edizione 2008

## MARINE PLANT BIODIVERSITY

*CECILIA MARIA TOTTI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 7
**Hours** 56
**Period** 2^ semestre

### Objectives of the course

Aim of this course is to provide students the instruments for understanding the aspects of biodiversity of marine plants. The systematics and ecology of algae groups and marine Angiosperms will be treated. The knowledge on biodiversity of plant communities in the marine environments will be presented, tackling the problem of influence of human impact on biodiversity changes and considering the influence of climatic fluctuations. Students will be provided with the instruments and the methodological approaches to study marine plant groups.

### Program

Introduction to algae. General characteristics and ecology. Pjhylogenetic relationships.
Cyanobacteria: cytology, morphology, reproduction and ecology.
The origin of eukaryotic algae. The distribution of algae in eukaryote supergroups (Archaeplastida, Chromalveolata, Rhizaria, Excavata Opisthokonta, Amoebozoa). Systematics and ecology of eukaryotic algae: Rhodophyta, Chlorophyta and Streptophyta, Glaucophyta, Cryptophyta, Haptophyta, Dinophyta, Stramenopili (Chrysophyceae, Bacillariohyceae, Dictyochophyceae, Raphidophyceae, Phaeophyceae), Euglenophyta, Chlorarachniophyta.
Seagrasses. Morphological, anatomical and reproductive adaptations. Biodiversity and biogeography. the seagrasses of the Mediterranean Sea; meadow types. Systematics of the Mediterranean seagrasses.
Phytoplankton communities: biogeography and diversity of phytoplankton in the Mediterranean Sea. Study cases: changes in phytoplankton communities in relation to climate.
Microphytobenthos communities. Epipelon, epipsammon, epilithon, epiphyton, epizoon. Growth forms of benthic microalgae. Importance and ecological role of microphytobenthos. Ecological factors affecting microphytobenthos growth. Methods applied to the study of microphytobenthic communities.
Macrophyte communities. Litophytic, psammophytic, epiphytic and drift seaweeds. Macroalgae of the Mediterranean Sea. Algae morphotypes: relationships with grazing and production. Factors affecting the growth of benthic macrophytes. Vegetation plans and macrophyte communities.
Harmful algal blooms. Toxic microalgae and biointoxications (DSP, PSP, NSP, ASP, CFP, AZA). raphidophyte and haptophyte toxins. Toxic benthic dinoflagellates.
Marine plants of tropical habitats. Endosymbiosis between microalgae and marine invertebrates; zooxanthellae: biological and morphological characteristics of zooxanthellae; polymorphic endosymbiosis. Mangroves: biogeography; morphological, physiological and reproductive adaptations.
Human factors affecting plant biodiversity. Alien species in plant communities of the Mediterranean Sea. Main vectors of alien species.es.

**Development of the course and examination**

Oral

**Recommended reading**

GRAHAM J.E., WILCOX L.W., GRAHAM L.E., 2009. Algae. 2nd edition. Benjamin Cummings (Pearson) ed., San Francisco CA., 720 pp.
LEE R.E., 2008. Phycology. 4th edition. Cambridge University Press
DAWES C.J. 1998. Marine Botany. 2nd edition. John Wiley & Sons, New York.

## MATHEMATICAL AND STATISTICAL METHODS

*MILENA PETRINI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 9
**Hours** 72
**Period** 1^ semestre

### Program

1. NUMERICAL SETS AND REAL FUNCTIONS. Numerical sets : N, Z, Q, R . Real functions ; injective, surjettive, invertible functions. Inverse function. Monotone functions.
2. FUNCTION'S LIMIT AND CONTINUITY. Function's limit and continuity. Inf and sup for a subset in R and for a real function. Basic functions. Growth of a bacterial population. Limit of real sequences and series : standard limits ; geometrical series. Continuous functions and related theorems.
3. DERIVATIVES. Derivatives and applications to functions' study. Derivative of a real function and its geometric interpretation. Derivatives of basic functions. Derivative of the sum, product, ratio, composition of two functions and of an inverse function. Local maxima and minima and related properties. Weierstrass, Rolle, Cauchy, Lagrange theorems. Undetermined forms and de l'H^opital' theorems. Higher order derivatives. Function's graph.
4. INTEGRALS. Integrals. De nite and inde nite integral of a countinuous function and properties. Average result for the integral of a real function. Primitive function and fundamental theorem of integral calculus. Integration' methods.
5. DIFFERENTIAL EQUATIONS. D erential equations. Linear rst order d erential equations and related Cauchy problem. Bernoulli' d erential equations. Some elements of constant co cients second order di erential equations. Mathematical models in population dynamics : growth of an isolated population ; infection's d usion ; interaction between two populations : cooperation, competition, predator-prey models. Lotka-Volterra model and its linearization.
6. DESCRIPTIVE STATISTICS. Descriptive statistics. Populations, qualities, classes ; frequency ; distribution. The case of a real variable. Multivariate distributions. Linear regression and least squares correlation coe cient and matrix.

### Recommended reading

P. Marcellini, S. Sbordone, Istituzioni di Matematica e Applicazioni, Liguori Editore.
P. Baldi, Introduzione alla probabilit a. Con elementi di statistica, Mc Graw-Hill Editore.
G. Prodi, Metodi matematici e statistici, Mc Graw-Hill Editore.
P. Marcellini, S. Sbordone, Esercitazioni di Matematica, Vol. 1, 2, Liguori Editore.

## MATHEMATICS (A-L)

*PIERO MONTECCHIARI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 8
**Hours** 64
**Period** 1^ semestre

### Prerequisites

Basic elements of Calculus and Analityc Geometry

### Objectives of the course

aim of the course is to provide the basic elements of differential and integral calculus for real functions of one real variable.

### Program

Topics: Sets, Relations and Functions. Natural, Integer, Rational and Real numbers. Complex numbers, trigonometric and exponential representation. De Moivre Formula. The Induction principle. Modulus and powers. Exponential, logaritmic and angular functions. Limit of real sequences and its properties. Indeterminate forms. Monotone sequences. The Neper's number and related limits. Asymptotic comparison. Limits of real function of real variale. Properties. Indeterminate forms. Asymptotic comparison. Monotone functions. Continuity; The Weierstrass's and the Intermediate Values Theorems. Derivative and Derivative Formulas. Successive Derivative. The Fermat's, Rolle's, Lagrange's and Cauchy's Theorems. Derivative and monotonicity. Convexity. Primitives. The De L'Hospital's Theorems. Asymptots 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 sostitution. Improper integral and convergence tests.
Linear differential equations, generality and General integral. Chauchy problem. Bernoulli equations. Introduction to population dynamics. Malthus and Verhulst models.

### Development of the course and examination

written and oral test

### Recommended reading

F. Alessio e P. Montecchiari, "Note di Analisi Matematica 1", Esulapio
P. Marcellini, C. Sbordone, Calcolo, Liguori

## MATHEMATICS (M-Z)

*DARIO GENOVESE*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 8
**Hours** 64
**Period** 1^ semestre

### Prerequisites

Basic elements of Calculus and Analytic Geometry

### Objectives of the course

Aim of the course is to provide basic knowledge and tools of calculus for functions of one real variable. At the end of the course the student has to be able to solve exercises and problems concerning the differential and integral calculus for functions of one real variable. Secondly he has to be able to properly enunciate and prove the theorems discussed in the course.

### 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.

### Recommended reading

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.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 2^ semestre

**Objectives of the course**

The course aims to provide students with the knowledge of disaster medicine, medical specialty that studies attitudes which assume in relation to an exceptional event, which, although of a different nature, is always characterized by a clear disproportion between the demands of the environment and the ability of emergency health response.

**Program**

I

Introduction to Disaster Medicine

Risk Assessment and Calculation

Management of Health Resources

Role of Central Operations 118

Chain of Relief and Health Care Roles

The Great Mass Gatherings

Structure of Advanced Medical Posts and Field Hospitals

Major Incident Triage and Personal Health Record

Role of the Hospital in Major Incident: PEIMAF, PEI, PEVAC

Toxicological Emergencies

The International Medical Emergencies

Health Issues in Major Incident in Developing Countries

Psychological Issues in Disasters

**Development of the course and examination**

Oral or Written Examination

**Recommended reading**

Textbook of the Teacher

Students who cannot attend the class should request the textbook to the teacher

## MODELING OF BIOLOGICAL SYSTEMS

*ROBERTA GALEAZZI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 1^ semestre

### Objectives of the course

This course is a full-scale introduction to computational chemistry and molecular modeling, including special topics on computational-aided drug design. 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.

### Program

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.

### Development of the course and examination

Oral

### Recommended reading

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

## MOLECULAR BIOLOGY (A-L)

*ANNA LA TEANA*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 8
**Hours** 64
**Period** 2^ semestre

### Prerequisites

Knowledge of basic Cytology and Biochemistry is required.

### Objectives of the course

The aim of the course is to allow the students to acquire basic information concerning the relationship between structure and function of nucleic acids and the various cellular processes in which they are involved, through a description of the different experimental procedures which have led to current knowledge

### Program

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 repair
Mutations. Repair systems. Cellular response to DNA damages.
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, ara 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
Methods for studying DNA: 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.
Cell-free systems.
Western blot.

**Development of the course and examination**

Exam consists in a written test with 6 open questions.

**Recommended reading**

F. Amaldi, P. Benedetti, G. Pesole, P. Plevani. "Biologia Molecolare". Casa Editrice Ambrosiana. II edizione. 2014.
M.M. Cox, J.A. Doudna, M. O'Donnell. "Biologia molecolare, Principi e tecniche". Casa Editrice Zanichelli. I edizione. 2013.
J.D. Watson, T.A. Baker, S.P. Bell, A. Gann, M. Levine, R. Losick. "Biologia molecolare del gene". Casa Editrice Zanichelli. VI edizione. 2009.

## MOLECULAR BIOLOGY (M-Z)

*DAVIDE SARTINI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 8
**Hours** 64
**Period** 2^ semestre

### Prerequisites

Cytology and Biochemistry.

### Objectives of the course

The aim of the course is to allow the students to acquire basic information concerning the relationship between structure and function of nucleic acids and the various cellular processes in which they are involved, through a description of the different experimental procedures which have led to current knowledge.

### Program

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 repair
Mutations. Repair systems. Cellular response to DNA damages.
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, ara 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
Methods for studying DNA: 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.
Cell-free systems.
Western blot.

**Development of the course and examination**

Oral

**Recommended reading**

F. Amaldi, P. Benedetti, G. Pesole, P. Plevani. "Biologia Molecolare". Casa Editrice Ambrosiana. II edizione. 2014.
M.M. Cox, J.A. Doudna, M. O'Donnell. "Biologia molecolare, Principi e tecniche". Casa Editrice Zanichelli. I edizione. 2013.
J.D. Watson, T.A. Baker, S.P. Bell, A. Gann, M. Levine, R. Losick. "Biologia molecolare del gene". Casa Editrice Zanichelli. VI edizione. 2009.

## MOLECULAR BIOPHYSICS

*FRANCESCO SPINOZZI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 1^ semestre

### Prerequisites

Students are expected to have had basic courses in physics, chemistry, biochemistry and biology.

### Objectives of the course

The students of the course will gain a relative competence in the application of the principles of Physics and Biology that underlay on a molecular level phenomena in the living systems. A basic knowledge of the structural and functional aspects of biomolecules and biological membranes and of the methodologies of the molecular biophysics will be acquired.

### Program

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; Conformational analysis and Forces determining the structure of proteins; Diffraction and scattering of X-rays and neutrons.

### Recommended reading

- 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.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 1^ semestre

### Prerequisites

Knowledge of basal concepts of genetic and molecular biology

### Objectives of the course

This course will provides an overview of structure, function, evolution of the eukaryotic genomes and genes. Moreover, after the course knowledge and information regarding identification of human disease genes and the cancer genetics will be learnt by the students.

### 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

Oral

### Recommended reading

Tom Strachan e Andrew P. Read, “Genetica umana molecolare” Zanichelli - Bologna

## PHARMACOLOGY

*STEFANO BOMPADRE*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 54
**Period** 2^ semestre

### Prerequisites

Knowledge of physics, chemistry, biochemistry and general physiology

### Course contents

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

PPharmacokinetics: 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. Receptor regulation: up and down regulation. Concentration-response curves. Full agonists, partial agonists, inverse agonists, antagonists. Sensitization and tolerance to drugs. Therapeutic index
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. Examples of active ingredients extracted from plants.
Principles of most commonly used techniques for the detection of drugs and substances of abuse in biological samples.

### Development of the course and examination

Multiple choice tests

**Recommended reading**

R. D. Howland;  M.J. Mycek, Le basi della Farmacologia, Zanichelli

## PHYSICS

*FRANCESCO SPINOZZI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 9
**Hours** 72
**Period** 2^ semestre

### Prerequisites

Basic mathematical concepts (representation on the Cartesian space, first and second order equations and systems, simple geometrical functions, elementary trigonometry); knowledge of the experimental method; knowledge of basic concepts in Chemistry (atom, molecule, chemical bond).

### Objectives of the course

The present course in Physics is concerned with the study of matter, energy, forces, and their interaction in the world and universe around us. The present curriculum includes a strong emphasis on basic theory and experiments and covers the broad fundamentals necessary for graduate study in interdisciplinary specialties requiring a strong scientific background. The course will provide the student with the necessary competences on the physical basic laws and concepts (both theoretical and experimental) to study and to understand the physical properties of the biological matter in the frame of the life and environmental sciences.

### Program

Introduction to Physics. Physical values, measurements, units and standards. Kinematic of material point. Dynamic of material point. Kinematic of rigid body. Dynamic of rigid body. Mechanics of liquids and gases. Surface phenomena in liquids. Basic physics of biological membranes: transport phenomena, diffusion, osmosis, Thermodynamics. Real and ideal gases. Kinetic theory of gases. Work, heat and internal energy. First and second laws of Thermodynamics. Entropy. Gibbs and Helmholtz free energies. Electrostatics. Electrical charge, electric field and electrical potential. Gauss´ law. Dielectrics and conductors in electrostatic fields. Condensers. Electric current. Ohm´s Laws. Simple circuits. Electric phenomena in biological systems. Static magnetic field. Magnetics. Electromagnetic field, Maxwell´s equations, electromagnetic field.

### Recommended reading

- Giambattista, Richardson & Richardson, "College Physics", Second edition, McGraw-Hill, 2007.

## PHYSICS (A-L)

*FRANCESCO SPINOZZI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 8
**Hours** 64
**Period** 2^ semestre

### Prerequisites

Basic knowledge of mathematics and algebra

### Course contents

The course uses lectures and practical exercises, in addition to at least one laboratory experiment that lasts about 3 hours. Attendance at lectures is not mandatory, but strongly recommended, while the attendance of at least one laboratory experiment is mandatory to pass the exam.

### Objectives of the course

Students have to understand the basis of physical phenomena and the laws that govern them.

### Program

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. Center 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. 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. Definition of entropy and free energy. Elements of electromagnetism, and RC circuits in relation to the cell membrane.

**Development of the course and examination**

The exam includes a comprehensive written test or two partial written tests to be passed during the course. After obtaining at least 18/30 on the written test, students are called to pass the oral test. In the oral test students also discuss the report written on the experiments carried out in the laboratory.

**Recommended reading**

Fisica Generale – A. Giambattista, B. McCarthy Richardson & R. Richardson – McGraw-Hill

## PHYSICS (M-Z)

*PAOLO MARIANI*

**Seat** Scienze
**A.A.** 2014/2015
**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, simple geometrical functions, elementary trigonometry); knowledge of the experimental method; knowledge of basic concepts in Chemistry (atom, molecule, chemical bond).

### Objectives of the course

The present course in Physics is concerned with the study of matter, energy, forces, and their interaction in the world and universe around us. The present curriculum includes a strong emphasis on basic theory and experiments and covers the broad fundamentals necessary for graduate study in interdisciplinary specialties requiring a strong scientific background. The course will provide the student with the necessary competences on the physical basic laws and concepts (both theoretical and experimental) to study and to understand the physical properties of the biological matter in the frame of the life and environmental sciences.

### Program

Introduction to Physics. Physical values, measurements, units and standards. Kinematic of material point. Dynamic of material point. Kinematic of rigid body. Dynamic of rigid body. Mechanics of liquids and gases. Surface phenomena in liquids. Basic physics of biological membranes: transport phenomena, diffusion, osmosis, Thermodynamics. Real and ideal gases. Kinetic theory of gases. Work, heat and internal energy. First and second laws of Thermodynamics. Entropy. Gibbs and Helmholtz free energies. Electrostatics. Electrical charge, electric field and electrical potential. Gauss´ law. Dielectrics and conductors in electrostatic fields. Condensers. Electric current. Ohm´s Laws. Simple circuits. Electric phenomena in biological systems. Static magnetic field. Magnetics. Electromagnetic field, Maxwell´s equations, electromagnetic field.

The course is divided in 63 hours of lectures and 18 hours of practical work, which will be performed in the Student Physics Laboratory of the University.

### Recommended reading

## PHYSIOLOGY OF MARINE ANIMALS

*ROSAMARIA FIORINI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 7
**Hours** 56
**Period** 2^ semestre

### 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

Oral

### 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.

## PLANT BIOTECHNOLOGY

*ALESSANDRA NORICI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 1^ semestre

### Objectives of the course

The aim of this course is to provide students with the tools to understand and master algal biotechnology, a relatively new and booming field in the applied plant sciences. The focus will especially be on methodological approaches required to design, development and monitor large-scale algal cultures. In addition, case studies of commercial exploitation of algal biomass will be provided with the aim of being critically evaluated.

### Program

*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 sit*; 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*: methods of cultivation and commercial exploitation

*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, use for human and animal nutrition, use for CO2 sequestration and flue gas remediation, use for the treatment of waste water, use for the production of valuable chemical molecules.

*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**

Oral examination

**Recommended reading**

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

## PLANT PHYSIOLOGY

*MARIO GIORDANO*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 8
**Hours** 72
**Period** 1^ semestre

### Prerequisites

-Literature search skills
-Sufficient knowledge of the English language to allow comprehension of the scientific literature
-Thorough knowledge of chemistry, biochemistry and physical-chemistry, and plant/algae cytology
-Basic knowledge of algae and plant structure and of their phylogenetic relationships

### Objectives of the course

The student will acquire a basic knowledge of the main physiological processes in plants. In addition to this the student will acquire the ability to independently and creatively analyze primary sources of information and to use them in a scientific/research context.

### Program

- Basic principles of solute transport and diffusion
- Photosynthesis: basic principles, evolution of photosynthesis, Photosynthetic pigments, antennae, reaction centers, chloroplast electron transfer, fixation of inorganic carbon,
- Photorespiration
- CO2 concentrating mechanisms, C4 and CAM photosynthesis
- Synthesis and degradation of starch and their regulation
- Synthesis and degradation of Sucrose and their regulation
- Photomorgphogenesis (selected topics)
- Plant hormones
-Water transport

### Development of the course and examination

written examination including open questions, calculation, graphs, and multiple choice questions

**Recommended reading**

Buchanan, Gruissem and Jones. Biochimica e Biologia molecolare delle Piante. Zanichelli

Taiz and Zeiger. Plant Physiology  5th edition. Sinauer Assoc

## REPRODUCTIVE BIOLOGY OF MARINE ORGANISMS

*OLIANA CARNEVALI*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 7
**Hours** 56
**Period** 1^ semestre

**Objectives of the course**

This course provides the students fundamental tools to understand the molecular mechanisms involved in the reproduction and the methodologies to study the life cycle of marine species for the evaluation of natural fish stocks. The student will be able to evaluate the presence and the potentiality of some pollutants to interfere with the reproductive functions of teleosts.

The students will be able to apply the basic knowledge provided by the course in the aquaculture practice as a supplement to natural stock.

**Program**

Introduction to biology reproduction course

Endocrine control of reproduction: hypothalamus- pituitary-gonadal axes.

Pineal glad and reproduction

Sexual determination and puberty in fish.

Germinal cells cycle.

Vitellogenesis: hormonal control of vitellogenin synthesis ,egg types and reproductive strategies

Biotechnology of reproduction

Reproductive toxicology.

Stress and reproduction: hypothalamus-pituitary- interregnal axes

Application of biotechnology and molecular tools in aquaculture to improve animal welfare

**Development of the course and examination**

Oral

**Recommended reading**

Norris DO Vertebrate Endocrinology. Third edition Academic Press

P.Baben, J Cerdà and E.Lubzens Edts. The fish Oocyte: from basic studies to biotechnological applications. Spring

Programma

## SANITARY EMERGENCIES

*ERICA ADRARIO*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 6
**Hours** 54
**Period** 2^ semestre

**Course contents**

Occurring a catastrophe or a collective accident determines more or less precise and quick answer from the collectivity: the aid

This answer can vary in form and intensity relating to the gravity of the consequences on the environment, but it always must be a sanitary answer since the amplitude of the material damages is augmented by the presence of victims.

After occurring a catastrophe, the organization of the sanitary aid has to be integrated in the widest context of the global organization of the aids . That consists in a certain number of different interventions, involving experts of different activities, whose objective is permitting the execution of the sanitary aid .

The whole operations is developed on the base of:

1. making quickly stop of the danger assuring the recovery of the victims:

rescue

2. realizing a certain number of actions allowing the medical unities to take care of the victims :

aid assistance

**Objectives of the course**

The course intends to furnish the student the essential elements and the knowledges about the organization of the aids during natural (or not ) calamity , tactical and logistic aspects about the organization of the materials, as well as base techniques of the activation of the aid chain.

Practical training of cardiopulmonary reanimation on manikin will be performed.

**Program**

The answer to the catastrophe

Organization of the aids

Tactical and logistic aspects

Rescue Personnel

Structures and their functioning

Evacuation

Basic Aid Techniques

Triage

Actual Aid in Italy: state of the art

BLSd

**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.** 2014/2015
**Credits** 6
**Hours** 48
**Period** 1^ semestre

### Prerequisites

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

### Objectives of the course

Aims. The course enables students to acquire the theoretical and methodological fundamentals, as well as the informatic techniques of univariate and multivariate statistical analysis as applied to the study of experimental sciences.
Objectives. At the end 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) as well as acquire the ability of performing the related informatic procedures for data analysis using commercial statistical packages.

### Program

Content. Theoretical and methodological fundamentals of the main techniques of univariate and multivariate statistical analysis as applied to the study of experimental sciences. Hypothesis testing. Analysis of variance. 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, archeological (paleobiological) and chemical problems. Computer laboratory activity for the study of a few real cases considered during the course.

### Development of the course and examination

The assessment method is a theoretical-practical written test.

### Recommended reading

O. Vitali. Statistica per le Scienze Applicate. Vol. 2. Cacucci Editore, Bari, 1993.
O. Vitali. Principi di Statistica. Cacucci Editore, Bari, 2003.
R.R. Sokal, F.J. Rohlf. Biometry. The Principles and Practice of Statistics in Biological Research, W.H. Freeman, San Francisco, 1995.

W.J. Krzanowski. Principles of Multivariate Analysis. A User's Perspective, Revised edition, Oxford University Press, 2000.

I.T. Jolliffe. Principal Component Analysis, Seconda ediz., Springer-Verlag, New York, 2002.

## UNDERWATER SCIENTIFIC METHODOLOGY

*CARLO CERRANO*

**Seat** Scienze
**A.A.** 2014/2015
**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 technique applied to study the marine environment.

**Objectives of the course**

The scope is to offer the basic knowledge both theoretical and practical on the study of marine environment by direct exploration.

At the end of the course the student will have to know the technique and the main methodologies to survey and sample marine benthos.

**Program**

Diving: effects on man
- Physiological effects
- Psychological effects

Diving equipment
- Mixed gas diving
- Protective systems
- Communication systems
- Transport systems
- Cave diving

Diving plan
- Dive tables and Computers

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 are scheduled to teach directly underwater some of the studied techniques.

**Recommended reading**

Slides showed during lectures will be provided to the students

## ZOOLOGY (A-L)

*CARLO CERRANO*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 8
**Hours** 72
**Period** 1^ semestre

### Prerequisites

It is recommended to pass the course of Citology and Istology

### Objectives of the course

The course aims to provide students with the knowledge of animal biodiversity through a detailed description of their organisation at cell and anatomical level. The phylogenetic relationships among phyla, the reproductive strategy and their ecology will be also considered. Finally some basic aspects of general zoology will be treated.
At the end of course, students should know animals at morphological level with details regarding their cellular organisation and anatomy, reproductive strategies and ecology. They should know also the phylogenetic relationships among phyla and the basic aspects of general zoology.

### Program

Introduction: Biodiversity and theories on the evolution

Principles of classification: the species concept and the super specific categories.

Ontogeny: gametes, fecundation, cleavage, gastrulation, larvae.

Protozoa: Flagellates, Amoeboid, Sporigenous, Ciliates.

Metazoa

Radial organisms

Sponges: Calcispongiae, Exactinellids, Demospongiae, Homoscleromorpha

Cnidarians: Hydrozoa, Scyphozoa, Cubozoa, Anthozoa.

Ctenophores

Bilateralorganisms

Platyhelminthes: Turbellaria, Digenea, Monogenea, Cestoda

Mesozoa, Nemertea

Lofotrocozoa: Bryozoa, Rotifers, and minor groups

Origin of the coelome

Mollusca: Gastropoda, Bivalvia, Cephalopoda and allied classes

Anellida: Polychaeta, Oligochaeta, Hirudinea

Echiurida

Sipunculida

Pogonophora

Ecdisozoa :Nematoda, Priapulida, Loricifera, Onicofora, Tardigrada

Arthropoda: Chelicerata, Mandibulata

Chelicerata: Merostomata, Arachnidi, Pycnogonida

Mandibulata: Crustacea, Myriapoda, Insecta

Chetognata

Echinodermata: Asteroidea, Echinoidea, Ophiuroidea, Crinoidea, Oloturoidea

Chordata: Urochordata, Coephalochordata

Animals in their habitats

**Development of the course and examination**

Oral

**Recommended reading**

Hickman et al “IntegratedPrinciples of Zoology” McGraw-Hill (15thedition)

## ZOOLOGY (M-Z)

*STEFANIA PUCE*

**Seat** Scienze
**A.A.** 2014/2015
**Credits** 8
**Hours** 72
**Period** 1^ semestre

### Prerequisites

It is recommended to pass the course of Citology and Istology

### Objectives of the course

The course aims to provide students with the knowledge of animal biodiversity through a detailed description of their organisation at cell and anatomical level. The phylogenetic relationships among phyla, the reproductive strategy and their ecology will be also considered. Finally some basic aspects of general zoology will be treated.
At the end of course, students should know animals at morphological level with details regarding their cellular organisation and anatomy, reproductive strategies and ecology. They should know also the phylogenetic relationships among phyla and the basic aspects of general zoology.

### Program

Unicellular Eukarya
Metazoa
Porifera
Cnidaria and Ctenophora
Platyhelminthes and Nemertea
Gnathifera and small Lophotrochozoa: Rotifera, Entoprocta, Ectoprocta, Brachiopoda, Phoronida
Mollusca
Annelida
Small Ecdisozoa: Nematoda, Onychophora, Tardigrada
Arthropoda: Chelicerata, Myriapoda, Crustacea, Esapoda
Echinodermata
Cordata: Urochordata, Cephalochordata, Craniata
Agnatha, Chondrichthyes, Osteichthyes
Amphibia
Amniota: Reptilia and Mammalia

### Development of the course and examination

Oral

**Recommended reading**

Zoologia (15° edizione) , Cleveland P. Hickman, Jr., S. Roberts, S. L. Keen, D. J. Eisenhour, A. Larson, H. Lanson, McGraw-Hill