2021-2022

Course outline of the undergraduate program of the Department of Biology

STUDY PROGRAM COMMITTEE
BIOLOGY DEPARTMENT | UNIVERSITY OF PATRAS

Contents

COURSES OUTLINE IN ENGLISH LANGUAGE

2.1 FUNDAMENTAL PRINCIPLES IN CELL BIOLOGY - TEACHING

1. GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_BKΔ**	**SEMESTER**	**A**
COURSE TITLE	FUNDAMENTAL PRINCIPLES IN CELL BIOLOGY - TEACHING		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	3	8
Practical exercises	3	

COURSE TYPE	Scientific specialized background
PREREQUISITE COURSES	Formally, there are no prerequisite courses. However, knowledge of Biochemistry is recommended
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	
COURSE WEBSITE (URL)	

2. LEARNING OUTCOMES

Learning outcomes
The students will understand the structure and function of the nucleus, plasma membrane and ER, mitochondria and chloroplasts and will understand how the cell interacts with the micro environment and other cells.
General Competences
Search for, analysis and synthesis of data and information, with the use of the necessary technology. Decision-making.

3. SYLLABUS

1. Structure and molecular organization of the cell
2. Laboratory techniques for the study ob biomolecules and cells
3. Structure of plasma membrane
4. Functions of plasma membrane
5. Structure and molecular organization of the nucleus
6. Organization of chromatin - chromosomes
7. Structure of the cytoplasmic membrane systems
8. Functions of the cytoplasmic membrane systems
9. Sunthesis and protein selection
10. Functional modification of protein molecules
11. Uptake of cells and biomolecules
12. Mitochondria and chloroplasts

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face.	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Communication with students via e-class.	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures	39
	Lab practice	15

	Lab reports	30
	Course study	116
	Course total	**200**
STUDENT PERFORMANCE EVALUATION	For every lab exercise, students are asked to make a report based on the procedure and the techniques they have been trained. The final examination of the course includes 4 general questions, 4 overall questions to proceed and 2 practical problems to solve with the use of the techniques they have learned in lab practice The evaluation criteria are mentioned at the e-class of the course. Passing grade: 5	

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

Molecular biology of the cell. Alberts et al. Garland science 1995.

Related academic journals:

2.2 GENERAL CHEMISTRY

1.GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_ΓΧΜ**	**SEMESTER**	**A**
COURSE TITLE	GENERAL CHEMISTRY		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures and seminars	4 (3 lect. and 1 sem.)	7

COURSE TYPE	Field of Science (General Chemistry)
PREREQUISITE COURSES	Typically, there are not prerequisite courses
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek. Teaching may be however performed in English in case foreign students attend the course.
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/BIO211/

2.LEARNING OUTCOMES

Learning outcomes

By the end of this course the student should be able to:

- Determine the correct number of significant figures to report for the answer to a calculation
- Formulate net ionic equations, classify acids and bases as strong or weak, assign oxidation numbers, balance simple oxidation – reduction reactions, calculate and use molarity.
- Write and handle thermochemical equations, calculate the heat of reaction from stoichiometry, apply the Hess' law, calculate enthalpy of a reaction using standard enthalpies of formation.
- Use Lewis symbols to represent ionic bond formation and write electron configurations of ions, obtain relative bond polarities, write Lewis formulas using formal charges, relate bond order and bond length.
- Predict molecular geometries, relate dipole moment and molecular geometry, apply valence bond theory, describe molecular orbital configurations.
- Calculate solution concentration, find mole fractions, calculate: the vapor pressure lowering, the boiling-point elevation, the freezing-point depression and using them calculate the molecular weight of the solute, calculate osmotic pressure and determine colligative properties of ionic solutions
- Use the Arrhenius equation, write overall chemical equation from a mechanism, determine the molecularity of an elementary reaction and write its rate equation. Determine the rate law from a mechanism with an initial slow step.
- Apply stoichiometry to an equilibrium mixture, write equilibrium-constant expressions and obtain them from reaction composition. Use the reaction quotient, solve equilibrium problems and apply Le Chatelier's principle changing the reaction conditions.
- Identify acid and base species according to the Brønsted-Lowry and Lewis concepts, decide whether reactants or products are favoured in an acid-base reaction, calculate concentrations of H_3O^+ and OH^- in solutions of a strong acid or base.
- Determine K_a and K_b from the solution pH and vice versa, calculate concentrations of species in solutions of a weak acid or base, calculate the pH of a buffer solution.
- Calculate the solubility product constant K_{sp} and the solubility of slightly soluble (or nearly insoluble) ionic compounds. Predict if an ionic salt can precipitate when the ion concentrations are known

- Calculate the entropy change ΔS^o for a phase transition, calculate ΔG^o from ΔH^o and ΔS^o, calculate K from the standard free-energy change and ΔG^o and K at various temperatures and describe how the spontaneity or no spontaneity of a reaction is related to its Free Energy.

General Competences

By the end of this course the student will, furthermore, have developed the following skills (general abilities):

1. Ability to exhibit knowledge and understanding of the essential facts, concepts, theories and applications which are related to General Chemistry.
2. Ability to apply this knowledge and understanding the solution of problems related to General Chemistry
3. Ability to adopt and apply methodology to the solution of non-familiar problems of General Chemistry.
4. Study skills needed for continuing professional development.
5. Ability to interact with others in chemical or of interdisciplinary nature problems.

Generally, by the end of this course the student will, furthermore, have develop the following general abilities (from the list above):

- Searching, analysis and synthesis of facts and information, as well as using the necessary technologies
- Adaptation to new situations
- Decision making
- Autonomous (Independent) work
- Exercise of criticism and self-criticism
- Promotion of free, creative and inductive thinking
- Respect to natural environment
- Work design and management

3.SYLLABUS

- **Calculations with Chemical Formulas and Equations.** Molecular weight and formula weight. The mole concepts. Mass percentages from the formula. Elemental analysis: Percentages of carbon, hydrogen and oxygen. Determining formulas. Molar interpretation of a chemical equation. Amounts of substances in a chemical reaction. Limiting reactant: Theoretical and percentage yields.
- **Chemical Reactions**: Introduction Ionic theory of solutions. Molecular and ionic equations. Precipitation reactions. Acid – base reactions. Oxidation – reduction reactions. Balancing simple oxidation – reduction reactions. Molar concentration. Diluting solutions. Gravimetric analysis. Volumetric analysis.
- **Thermochemistry Energy and its units**. Heat of reaction. Enthalpy and enthalpy change. Thermochemical equations. Applying stoichiometry to heat of reaction. Measuring heat of reaction. Hess's law. Standard enthalpies of formation. Fuels-foods, commercial fuels and rocket fuels.
- **Quantum Theory of the Atom.** The wave nature of light. Quantum effects and photons. The Bohr theory of the hydrogen atom. Quantum mechanics. Quantum numbers and atomic orbitals. Electron Configurations and Periodicity Electron spin and the Pauli exclusion principle. Building-up principle and the periodic table. Writing electron configurations using the periodic table. Orbital diagrams of atoms – Hund's rule. Mendeleev's predictions from the periodic table. Periodic properties (atomic radii, ionization energies, electron affinities). Periodicity in the main-group elements.
- **Ionic and Covalent Bond Describing ionic bonds**. Electron configuration of ions. Ionic radii. Describing covalent bonds. Polar covalent bonds. Electronegativity. Writing Lewis electron-dot formulas. Delocalized bonding – Resonance. Formal charge and Lewis formulas. Bond length and bond order. Bond energy.
- **Molecular Geometry and Chemical Bonding Theory**. The VSEPR model. Dipole moment and molecular geometry. Valence bond theory. Description of multiple bonding. Principles of molecular orbital theory. Electron configurations of diatomic molecules of the second-period elements.

- **Solutions.** Types of solutions. Solubility and the solution process. Effect of temperature and pressure on solubility. Ways of expressing concentration. Vapor pressure of a solution. Boiling-Point elevation and Freezing-point depression. Osmosis. Colligative properties of ionic solutions. Coloids. 9. Rates of reaction Definition of reaction rate. Experimental determination of rate. Dependence of rate on concentration. Change of concentration with time. Temperature and rate; Collision and transition-state theories. Arrhenius equation. Elementary reactions. The rate law and the mechanism. Catalysis.
- **Chemical Equilibrium.** Chemical Equilibrium-A dynamic equilibrium. The equilibrium constant. Heterogeneous equilibria. Solvents in homogeneous equilibria. Qualitatively interpreting the equilibrium constant. Predicting the direction of reaction. Calculating equilibrium concentrations. Removing products or adding reactants. Changing the pressure and temperature. Effect of a catalyst.
- **Acids and Bases.** Arrhenius concept of acids and bases. Brønsted–Lowry concept of acids and bases. Lewis concept of acids and bases. Relative strengths of acids and bases. Molecular structure and acid strength. Self ionization of water. Solutions of a strong acid or base. The pH of a solution.
- **Acid-Base Equilibria Acid-ionization equilibria**. Polyprotic acid. Base-ionization equilibria. Acid-base properties of salt solutions. Common-ion effect. Buffers. Acid-base titration curves
- **Solubility and equilibria of slightly soluble (or nearly insoluble) ionic compounds.** The Solubility Product Constant. Precipitation Calculations and criterion for precipitation.
- **Thermodynamics and Equilibrium.** First Law of Thermodynamics. Enthalpy. Entropy and the second law of thermodynamics. Standard entropies and the third law of thermodynamics. Free energy and spontaneity. Interpretation of free energy. Relating ΔG^{o} to the equilibrium constant. Change of free energy with temperature.

4.TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Lectures and seminars face to face.	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of Information and Communication Technologies (ICTs) (e.g. PowerPoint, video etc.) in teaching. The lectures content of the course for each chapter, all problems, in the form of a series of ppt files, and announces are uploaded on the internet, from where the students can freely download them.	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures (3 conduct hours per week × 13 weeks)	39
	Seminars (1 conduct hour per week × 13 weeks) - solving of representative problems	13
	Hours for private study of the student and optional problems solving given in each lecture	118
	Two optional tests during the semester (1 conduct hour × 2 times)	2
	Final written examination at the end of semester (3 conduct hours × 1 time)	3
	Course total	**175**

STUDENT PERFORMANCE EVALUATION	1. At the end of the semester there is a final written examination with multiple choice questions and short answer questions (open text books). Minimum passing grade: 5 2. Optional participation in two written "tests" with multiple choice questions and short answer questions during the semester (open text books). The 1/10 of the grade of each test is added to the final examination grade (if it's higher than 5). 3. Optional delivery of solved problems (at least 2) each week, given in each lecture. Addition of 1 grade to the final exam grade (if it's higher than 5) of the students who have delivered all the solved problems and the percentage of the unit to the others, according to the number of solved problems each person has delivered.

5.ATTACHED BIBLIOGRAPHY

Suggested bibliography:

1) «CHEMICAL PRINCIPLES, THE QUEST FOR INSIGHT», Peter Atkins, Loretta Jones, Leroy Laverman, (*Editing by* Petros Koutsoukos - *Greek Translation by* Petros Koutsoukos, Violeta Konstantinou, Paulos Klepetsanis, Christos Kontogiannis, Nikolaos, Mpouropoulos, Kelly Velona, Christos Pappas), 7η Edition, Utopia Publications, Athens/2018
2) «GENERAL CHEMISTRY», Brown, Lemay, Bursten, Murphy, Woodward, Stoltzfus, (*Greek Translation by* Periklis Akrivos), 13η Edition, TZIOLA Publications, Thessaloniki / 2016
3) «GENERAL CHEMISTRY: PRINCIPLES AND MODERN APPLICATIONS», Ralf H. Petrucci, F. Geoffrey Herring, Jeffry Madura, & Carey Bissonette, 11th Edition, Pearson, 2016
4) «GENERAL CHEMISTRY: THE ESSENTIAL CONCEPTS», Raymond Chang and Kenneth Goldsby, 7th Edition, McGraw-Hill education, 2015
5) «MODERN GENERAL CHEMISTRY», Ebbing and Gammon, 10η Edition, (*Greek Translation by* Nikolaos Klouras), P. TRAYLOS Publications, Athens / 2014
6) «INORGANIC CHEMISTRY», G. Pneumatikakis, Ch. Mitsopoulou, K. Methenitis, A. STAMOULIS Publications, Athens / 2005 (in Greek)
7) «CHEMISTRY", Jones and Atkins, 4th Edition, W.H. Freeman and Company, New York 2000
8) «BASIC INORGANIC CHEMISTRY», Nikolaos Klouras, KOSTARAKI Publications, Athens / 1995 (in Greek)

Related academic journals:

1) Journal of the American Chemical Society (JACS)
2) Chemical Communications (RSC)
3) Journal of Biological Chemistry

2.3 GENERAL MATHEMATICS - BIOSTATISTICS

1.GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_ГМВ**	**SEMESTER**	**A**
COURSE TITLE	GENERAL MATHEMATICS - BIOSTATISTICS		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
	Lectures	3	8
COURSE TYPE	Specialized general knowledge, Skills development.		
PREREQUISITE COURSES	NO		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO		
COURSE WEBSITE (URL)			

2.LEARNING OUTCOMES

Learning outcomes
The quantitative approach to biological issues, the need to parameterize and evaluate their effects on biological systems and the development of models of biological mechanisms and systems require a disciplined quantitative approach and basic knowledge of mathematical methods and tools. The course aims to raise students' awareness of the need for serious quantitative approaches to biological matters and to introduce and familiarize them with basic mathematical and statistical concepts, methods and techniques. Upon successful completion of the course students should be able to: (1) understand the nature and mathematical behavior of quantitative biological data, (2) formulate valid scientific biological questions and hypotheses, (3) be able to design basic biological experiments and sampling, (4) able to analyze quantitative biological data by query and data type, (5) understand the concepts and types of mathematical models.
General Competences
At the end of the course, students will have developed the following skills: (1) ability to design simple yet valid experiments to study the biology & ecology of organisms, (2) ability to analyze primary quantitative biological data, (3) ability to evaluate and present quantitative analyzes.

3.SYLLABUS

1) Mathematics and Statistics in Biology: Introduction, Questions, Examples
2) Functions (linear, polynomial, exponential, allometric, logarithmic, periodic, trigonometric). Limits and continuity of functions. Rate of change of a function.
3) Derivative - Basic properties and applications of derivatives.
4) Introduction to differential equations. Study and applications of differential equations in biology
5) Integrals: simple rules of integration methods, examples in biology.
6) Statistics: basic concepts.
7) Probability Theory. Concept of probability. Combinatorial Principles - Reserved Probability
8) Sampling and Assessments: Basic concepts, sample and its effects, representative sample, main parameters, estimators and estimation.
9) Descriptive statistics
10) Experimental design
11) Hypothesis Testing
12) Correlation and Regression

4.TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face to Face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Support of educational procedure with use of the e-class electronic platform.	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures (13 weeks x 3 hours per week)	39
	Home study	161
	Course total	**200**
STUDENT PERFORMANCE EVALUATION	Written exams at the semester's end Grading scale: 1-10. Passing grade: 5	

5.ATTACHED BIBLIOGRAPHY

Suggested bibliography:

- Bowers D. (2011). Θεμελειώδεις έννοιες στη Βιοστατιστική. ΕΚΔΟΣΕΙΣ Π.Χ. ΠΑΣΧΑΛΙΔΗΣ.
- Pagano M, Gauvreau K (2002). Αρχές Βιοστατιστικής. Γ.ΠΑΡΙΚΟΣ & ΣΙΑ ΕΕ.
- Dytham C (2003) Choosing and Using Statistics. Blackwell Science.
- Quinn GP, Keough MJ (2002) Experimental Design and Data Analysis for Biologists. Cambridge University Press.
- Ruxton CD, Colegrave N (2003) Experimental Design for the Life Sciences. Oxford University Press.
- Zar JH (1998) Biostatistical Analysis. Prentice Hall.

Related academic journals:

2.4 PHYSICS

1.GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**ΒΙΟ_ΦΥΣ**	**SEMESTER**	**A**
COURSE TITLE	**PHYSICS**		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
	Lectures	3	7
COURSE TYPE	Introductory lesson in Physics. Emphasis is given to laws, phenomena and techniques related to biology issues.		
PREREQUISITE COURSES	NO		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes		
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/BIO337/		

2.LEARNING OUTCOMES

Learning outcomes
Students, after successful completing of the course, are expected to: • Have acquire the logical order of knowledge that interprets the phenomena of classical physics. • Be aware of the concepts-quantities and physical laws that govern the quantitative (numerical values) and qualitative relationships (e.g. relative orientation) between the quantities involved. • Be able to apply the physical laws and solve the problems in order to calculate useful quantities. • Identify the physical laws governing application devices in technology and in everyday life. • Be aware of exposure limits and effects of various laboratory conditions (e.g. extremely low temperatures, high pressures, volatility, electric currents, radiation, etc.) in order to take appropriate precautions. • Be convinced that the study of life phenomena is facilitated by the development of our knowledge and diagnostic techniques based also on the research and development of Physics. Be interested and have appreciated interdisciplinarity in terms of Biology and Physics and be aware of the new knowledge in this field.
General Competences
Students, after successfully completing of the course, are expected to have the ability to: • Appreciate and be interested in the interdisciplinary field of Biology and Physics. • search for the new knowledge in this field • Promote their creative thinking within the frame of the scientific culture. • Respect the natural laws and the limits they pose to humans and the natural environment concerning hazards. • Have the ability to combine and interpret elements within the cognitive field of Biology and Physics in order to form judgments that reflect on relevant social, scientific or ethical issues. • Be able to communicate information, ideas, problems and solutions to both qualified and non-specialized audiences. • Have developed those skills needed in order to decide the subject they will follow for further studies.

3.SYLLABUS

Physics and Biology. Quantities and unit systems.

Graphic representations of phenomena. Forces. Torques. Classical physics, Newton's Laws. Energy. Heat, specific heat, temperature. Phase conversions. Hydrostatics, buoyancy, fluid dynamics (Bernoulli's equation and continuity equation). Elasticity. Surface tension. Harmonic oscillation. Waves. Lenses. Microscope. The nature of light. Wave phenomena. Electrostatics. Electric fields. Capacitors. Electricity. Ohm's Law - Resistance. The potentiometer. Electric current and magnetic field. Alternative current. Rectifiers and diodes. Instruments for measuring electrical quantities. Electron emission. Electromagnetic radiation. Motion of electric charge in magnetic field. Cyclotron. Electronic Microscope. Bohr's atomic model. Elements of modern (quantum) physics. Radioactive nuclei, radioactivity.

4.TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	e-class platform email	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures	52
	Little projects	10
	Study	110
	Exams	3
	Course total	**175**
STUDENT PERFORMANCE EVALUATION	The assessment is done by Written Examination (Oral, where necessary). The written examination • aims to find out the degree of achievement of certain learning outcomes. • evaluates the accuracy and clarity in the documentation of the arguments needed for the answers and the solution of problems. • evaluates the accuracy and diligence in the figures and diagrams. • evaluates the commentary on results of the mathematical solution. The assignments given during the course are optional, but their delivery and the positive results after their evaluation, add up to one unit to the final score. The evaluation process is done in the Greek language (except in the case of Erasmus students, which are examined in English). Scoring in scale 1-10.	

5.ATTACHED BIBLIOGRAPHY

Suggested bibliography:

1. Jay Newman: «Φυσική για τις Επιστήμες της Ζωής (Physics of the Life Sciences) » Εκδ. Δίαυλος, Αθήνα 2013.
2. R. Freedman et al. «Βασικές Αρχές Φυσικής στις Επιστήμες Υγείας», Εκδ. Broken Hill Pub. 2019 Nicosia, CY
3. Paul G. Hewitt: "Οι έννοιες της Φυσικής (Conceptual Physics) », Πανεπιστημιακές εκδόσεις Κρήτης.
4. H. D. Young, University Physics (Volume I) Πανεπιστημιακή με σύγχρονη Φυσική, Μηχανική- Κύματα, εκδόσεις Παπαζήση.
5. H. D. Young, University Physics (Volume II) Ηλεκτρομαγνητισμός-Οπτική-Σύγχρονη Φυσική, τόμοι Α,Β, εκδόσεις Παπαζήση.

Related academic journals:

Physics Today, Physics World

2.5 ANIMAL BIOLOGY I: BASAL PHYLUM AND PROTOSTOMES

1.GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_BZI**	**SEMESTER**	**B**
COURSE TITLE	ANIMAL BIOLOGY I: BASAL PHYLUM AND PROTOSTOMES		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures, Laboratory Exercises, Field Work	3 (lec) + 3 (lab)	8

COURSE TYPE	Field of Science Skills Development
PREREQUISITE COURSES	NO
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes (in English)
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/BIO315/

2.LEARNING OUTCOMES

Learning outcomes
Basic knowledge for the Protostome Animals, concerning their Evolution, morphology, internal organization, Systematics & Ecology. By the end of this course the student should be able to: 1) understand and discuss the importance of Zoology for biological studies 2) discuss basic principles of animal evolution and phylogeny 3) understand most important characteristics of animal body structure 4) identify representatives of the Protostome Animals.
General Competences
By the end of this course the student will have developed the following **Special skills/competences**: 1) ability to identify important differences among major Protostome animal groups 2) ability to use an evolutionary approach in examination of Protostome Animals, concerning their morphology and ecology. Additionally, by the end of this course the student will, furthermore, have develop the following **General Abilities**: 1) Working independently 2) Team work 3) Generation of new research ideas 4) Respect for the natural environment 5) Development of free, creative and inductive thinking.

3.SYLLABUS

1. Introduction to the Animals: Zoology as a part of Biology.
2. Animal Evolution - Architectural Pattern of an Animal - Classification & Phylogenetics.
3. Protozoans.
4. Sponges & Placozoa.
5. Radiate Animals: Cnidaria, Ctenophora.
6. Annelida, Mesozoa & Nemertea.
7. Lesser Protostomes.

8. Molluscs. 9. Annelida. 10. Arthropods: Trilobita, Chelicarata, Myriapods. 11. Hexapods. 12. Crustacea. 13. Synthesis.

4.TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face to face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Support of educational procedure with use of the e-class electronic platform.	
TEACHING METHODS	***Activity***	***Semester workload***
	Lectures (13 weeks x 3 hours per week)	39
	Laboratory exercises (9 weeks x 3 hours per week)	27
	Field Exercise (1 x 8 hours)	8
	Home study	126
	Course total	**200**
STUDENT PERFORMANCE EVALUATION	1) Written exams (at the semester's end), in Course theory, accounting for the 60% of the Final Grade. 2) Practical Laboratory exams (at the semester's end), accounting for the 60% of the Final Grade. Final Course Grade: Theory Grade x 0.6 + Laboratory Grade x 0.4 Grading scale: 1-10. Passing grade: 5	

5.ATTACHED BIBLIOGRAPHY

Suggested bibliography:

1) Hickman C.P. Jr, Roberts L.S., Keen S.L., Larson A., l'Anson H. (2017) Zoology – Integrated Principles. McGraw-Hill
2) Miller S.A., Harley J.P. (2017). Zoology. McGraw-Hill
3) Instructors' Laboratory Notes

Related academic journals:

2.6 BIOCHEMISTRY I

1.GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_ABX**	**SEMESTER**	**B**
COURSE TITLE	BIOCHEMISTRY I		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures and Laboratory work		6	8
COURSE TYPE	Specialised general knowledge		
PREREQUISITE COURSES	PHYSICS, INORGANIC/ORGANIC CHEMISTRY, MATHEMATICS		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes (in English)		
COURSE WEBSITE (URL)	http://www.biology.upatras.gr/		

2.LEARNING OUTCOMES

Learning outcomes
Upon course completion, students will have acquired knowledge in biochemistry, and will have understood fundamental principles related to cell process at molecular level via studying: • The roles of main biomolecules in life. • The structures and functionalities of lipids, carbohydrates, proteins (enzymes) and nucleic acids. • The ways of energy production and storage.
General Competences
• Working independently • Team work • Search for, analysis and synthesis of data and information, with the use of the necessary technology • Production of free, creative and inductive thinking • Decision-making • Criticism and self-criticism • Adapting to new situations

3.SYLLABUS

1. Biochemistry from the perspective of physical chemistry
2. Acids/ bases and buffer solutions.
3. Biochemical role of amino acids (categories, physicochemical properties, structure).
4. Structure of proteins (biochemical properties, categories, structure, introduction to protein crystallography).
5. Relation between protein structure and function.
6. Enzymes (kinetics, inhibition, allosteric ezymes, mechanisms of catalytic activity).
7. Biochemical role of carbohydrates.
8. Biochemistry of lipids as components of biological membranes and membrane proteins.
9. Structure of DNA, RNA (conformations and effects of physicochemical parameters).
10. Nucleic acids and the flow of genetic information.
11. Redox reactions and biological oxidative processes, bioenergetics. Energy production: Phosphorylation and Oxidative phorphorylation.
12. Roles of main biomolecules in metabolism.

Laboratory Exercises

- Kinetics of the enzyme: acid phosphatase
- Spectrophotometric determination of pKa of a weak acid.
- Photometric spectra of hemoglobin.
- Titration of glycine.

4.TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face. Discussion during lecture. Encouragement in keeping notes.	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Power-Point lectures. Laboratory work using essential equipment for biochemical analyses. Discussion during lectures and practicals. Teaching material available from the platform e-class.	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures	40
	Laboratory work in small groups of students	15
	Independent Study	145
	Course total	**200**
STUDENT PERFORMANCE EVALUATION	1. Written exams at the end of the semester (70%). 2. Laboratory reports and exams on the practical part of the course (30%). Grading scale: 1-10. Passing grade: 5	

5.ATTACHED BIBLIOGRAPHY

Suggested bibliography:

1. «Βιοχημεία-Βασικές αρχές» Berg J.M., Tymoczko J.L., Stryer L. ISBN: 9789925563333 Κωδ. Εύδοξος: 77107032 Broken Hill Publishers Ltd 2018
2. «Βιοχημεία» Reginald H. Garrett, Charles M. Grisham ISBN: 978-618-5173-40-1 Κωδ. Εύδοξος: 77113116 Utopia Publishing
3. «Lehninger's Βασικές Αρχές Βιοχημείας» 2η έκδοση Nelson David L, Cox Michael M. ISBN: 9789925563203 Κωδ. Εύδοξος: 77107011 Broken Hill Publishers Ltd 2018
4. Εργαστηριακές Ασκήσεις «Βιοχημεία: Πείραμα και Θεωρία» Χ. Γεωργίου
5. Σημειώσεις του μαθήματος μέσω της ηλεκτρονικής πλατφόρμας e-class (Κωδικός μαθήματος: BIO255).

Related academic journals:

2.7 GENETICS

1.GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**ΒΙΟ_ΓΕΝ**	**SEMESTER**	**D**
COURSE TITLE	GENETICS		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Theory and practicals (laboratory exercises)	6	8

COURSE TYPE	Scientific, general background
PREREQUISITE COURSES	There is no prerequisite course
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek language
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes, in English language
COURSE WEBSITE (URL)	http://www.biology.upatras.gr/

2.LEARNING OUTCOMES

Learning outcomes

Upon course completion, the students should be able to know the following subjects: 1. chromosomes and cellular division, 2. mendelian inheritance and extensions, 3. the chromosome theory of inheritance, gene linkage and recombination, 4. quantitative genetics, 5. point and chromosomal mutations, 6. introduction to genetics of viruses and bacteria, 7. inheritance of organelles. The students will also have further developed the following competences: 1. the competence to demonstrate knowledge of essential facts, concepts, principles and theories relating to inheritance, 2. the competence to apply and understand that knowledge to Mendelian and non-Mendelian inheritance, 3. the competence to apply this knowledge for solving relative problems, 4. the competence to apply that knowledge in cases such as improving animal and plant species, as well as in applications on humans.

General Competences

- Autonomous work
- Teamwork
- Search, analyze and synthesize data and information, using the necessary technologies
- Promote free, creative and inductive thinking

3.SYLLABUS

Theory

1. Mendelian analysis General genetical approaches.
2. Fidelity of transmission of the genetic information. Mitosis-Meiosis
3. Mendelism. Relative experiments and Mendel's law. Modern conception of Mendel's rules.
4. Chromosomal theory Genes and chromosomes. Sex linked traits – Cellular evidence of the chromosomal theory.
5. Extensions to Mendelian analysis. Multiple alleles. Epistasis. Genotype – phenotype.
6. Recombination, linkage, mapping The linkage phenomenon. Methods for genetic mapping in haploid and diploid eukaryotic organisms. Cellular evidence of the recombination. Mitotic crossing-over. DNA markers mapping.
7. Sex determination and gene dosage.

8. Quantitative Genetics Basic statistical means. Methods of statistical analysis of genetical data. Quantitative traits loci.
9. Mutations. A general approach of gene mutation phenomenon. Chromosomal alterations.
10. Extranuclear inheritance. Inheritance of characters located on the cytoplasmic organelles mitochondria and chloroplasts.

Laboratory Practicals

1.Monohybrid or dihybrid crosses using *D. melanogaster* strains.
2.Polytene chromosomes
3.Human chromosomes and karyotype synthesis.
4.Lyon's hypothesis-Bar Body

4.TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Lectures using slides and Power-Point presentations and support of learning through the e-class platform.	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures and seminars	40
	Laboratory exercises	15
	Independent Study	145
	Course total	**200**
STUDENT PERFORMANCE EVALUATION	1. Theoritical written examinations at the end of the semester (70% of the final grade), which evaluates student's acquired knowledge and critical and creating thinking. Greek grading scale: 1 to 10. Minimum passing grade: 5 2. Written examinations on the laboratory exercises at the end of the experimental training (30% of the final grade, taken into account only if the student takes the minimum grade of 5 in the theoretical written examinations). Note: The evaluation is accessible to students through the electronic secretariat and internal announcements from the course professors.	

5.ATTACHED BIBLIOGRAPHY

Suggested bibliography:

1. P. J. Russell: iGenetics, A Mendelian approach
2. Griffith A et al.: Introduction to genetic analysis
3. L. Hartwel al.: Genetics: From genes to genomes

Related academic journals:

2.8 ORGANIC CHEMISTRY

1.GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_OXM**	**SEMESTER**	**B**
COURSE TITLE	ORGANIC CHEMISTRY		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures, seminars and laboratory work	5	7

COURSE TYPE	General knowledge. Field of Science (Organic Chemistry) and Skills Development (Experimental Organic Chemistry)
PREREQUISITE COURSES	There are not prerequisite courses.
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek.
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CHEM2016/ https://eclass.upatras.gr/courses/CHEM2070/

2.LEARNING OUTCOMES

Learning outcomes
At the end of this course the student should be familiar with the nomenclature and the Chemistry of the following classes of Organic Compounds: Hydrocarbons, alkyl halides, alcohols, ethers, sulfur compounds, amines, aldehydes and ketones, carboxylic acids and their derivatives, heterocyclic compounds. It will be able to recognize and plan with the right stereochemistry amino acids, peptides, proteins, simple sugars, disaccharides, polysaccharides, lipids, nucleotides and nucleic acids. At the end of the lab, the student will be able to organize and execute syntheses of simple organic molecules and edit and present the results.
General Competences
At the end of this course the student will have developed the following skills: 1. Ability to understand the essential data, concepts and theories related to Organic Chemistry. 2. Ability to apply this knowledge to concepts of Biochemistry and Molecular Biology. 3. Ability to understand the essential concepts, principles and techniques related to the synthesis and purification of simple organic compounds and their application.

3.SYLLABUS

Organic Chemistry (Theory)

Families of organic compounds, functional groups and nomenclature.
Atomic structures of the carbon, hydrogen, oxygen, sulfur and nitrogen atoms.
Chemical bonds and molecular structure. Stereochemistry.
Inductive effect and resonance.
Types of reagents, reactions and mechanisms.
Hydrocarbons.
Alkyl halides.
Alcohols.
Ethers.
Sulfur compounds.
Amines.
Aldehydes and ketones.

Carboxylic acids and derivatives.
Heterocyclic compounds.
Carbohydrates.
Amino acids and proteins.
Nucleotides and nucleic acids.
Lipids.

Experimental Organic Chemistry

1. Separation and purification methods of organic compounds:
   a. Filtration - recrystallization,
   b. Extraction,
   c. Distillation,
   d. Thin layer chromatography.
2. Application to the synthesis of simple organic compounds.

4.TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Lectures, seminars and laboratory work face to face.	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of Information and Communication Technologies (ICTs) (e.g. PowerPoint) in teaching. The lectures content of the course for each chapter are uploaded on the internet, in the form of a series of ppt and pdf files, where from the students can freely download them using a password.	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures (3 conduct hours per week x 13 weeks)	39
	Seminars (1 conduct hour per week x 10 weeks) - solving of representative problems	10
	Laboratory work (4 conduct hours per week x 3 weeks)	12
	Final examination (3 conduct hours)	3
	Hours for private study of the student and preparation for the final examination	111
	Course total	**175**
STUDENT PERFORMANCE EVALUATION	Written examination in Greek after the end of the semester. Minimum passing grade: 5 (grade scale 1-10).	

5.ATTACHED BIBLIOGRAPHY

Suggested bibliography:

- J. McMurry, "Organic Chemistry", Απόδ. στα ελληνικά: Α. Βάρβογλης, Μ. Ορφανόπουλος, Ι. Σμόκου, κ.ά., Πανεπιστημιακές Εκδόσεις Κρήτης, 2012.
- L. G. Wade,Jr.," Organic Chemistry ", Απόδ. στα ελληνικά: Δ. Κομιώτης, κ.ά., Εκδόσεις Α. Τζιόλα και Υιοί ΟΕ, 2010.
- J. Clayden, N. Greeves, S. Warren, P. Wothers, "Organic Chemistry", Oxford University Press, Oxford, 2001.
- David Klein, "Οργανική Χημεία για τις Επιστήμες της Ζωής", Μετάφραση επιμέλεια Γ. Κόκοτος, κλπ, Εκδόσεις Utopia publishing, 2015.
- Σπυλιόπουλος Ι., "ΒΑΣΙΚΗ ΟΡΓΑΝΙΚΗ ΧΗΜΕΙΑ", Εκδόσεις Σταμούλης,2008.

- Βάρβογλης Α., "ΕΠΙΤΟΜΗ ΟΡΓΑΝΙΚΗ ΧΗΜΕΙΑ", Εκδόσεις Ζήτη, 2005.
- Notes of lecturer in Greek.

Related academic journals:

2.9 ANIMAL BIOLOGY II: DEUTEROSTOMES

1. GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_BZΔ**	**SEMESTER**	**C**
COURSE TITLE	ANIMAL BIOLOGY II: DEUTEROSTOMES		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	3	8
Lab exercises (anatomies and animal species identification)	3	

COURSE TYPE	Basic knowledge, Skill development
PREREQUISITE COURSES	None. However the students are highly encouraged to have attained the knowledge offered with the course Animal Biology I.
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/BIO309/

2. LEARNING OUTCOMES

Learning outcomes
Upon completing the course, the students will be able to: A) Distinguish the general body characteristics of a major animal group, the deuterostomes, emphasizing on chordates and their evolutionary diversification into the constituent extant vertebrate groups (Agnatha, Chondrichthyes, Osteichthyes, Lissamphibia, Reptilia, Aves, Mammalia). B) To comprehend the relationships between form and basic functions of the organ systems (functional anatomy). C) To become acquainted with the evolutionary origin of the Phylum Chordata, its phylogenetic relationships with the other deuterostomes, as well as the phylogenetic relationships among the relevant chordate groups. In addition, the students will have developed the following: Ability to a) observe and identify characters of the external morphology and b) conduct with precision anatomical procedures on deuterostome representatives, using the relevant anatomy tools and, when required, under a stereo-microscope. Ability to identify and classify representative specimens of individuals (preserved specimens or skeletal parts etc.) with the use of identification keys and stereo-microscopes.
General Competences
Adaptation to new situations. Teamwork. Respect for the natural environment. Promotion of free, creative and conductive thought.

3. SYLLABUS

Ancestral and derived morphological traits of deuterostomes and their evolutionary diversification from those of other animal phyla. External morphology and internal organization (functional anatomy), life cycle and taxonomy of Echinodermata, Urochordata and Cephalochordata. Ancestral and derived morphological traits of Vertebrates and evolutionary diversification of their organ systems, in relation to those of Urochordata and Cephalochordata. External morphology and internal organization

(functional anatomy), life cycle, taxonomy and phylogenetic relationships of Agnatha, Chondrichthyes, Osteichthyes, Lissamphibia, Reptilia, Aves and Mammalia.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	PowerPoint and Prezi presentations with the use of a video projector, for the purposes of both the lectures and lab exercises of the course. Creation of digital photo archives by the students, regarding the anatomies conducted on the selected representatives of the studied animal groups. Support of the educational process and communication with the students, using the online e-class platform of the University of Patras.	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures	36
	Lab exercises	27
	Literature review and study	9
	Independent study and exams preparation by the students	128
	Course total	**200**
STUDENT PERFORMANCE EVALUATION	Written exam on the theoretical background of the course, requiring short or longer replies. Written lab exam, requiring short replies on a) representative photographic material, derived from the lab exercises and b) on animal specimens with the use of identification keys and stereo-microscopes. The written exam on the theoretical background contributes by 70% to the final course grade and the lab exam by 30%. Minimum passing grade: 5	

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

1) Hickman, C.P., Roberts, L.S., Keen, S.L., Eisnehour, D.J., Larson, A., l'Anson, H. (2014) Integrated Principles of Zoology Vol. II. 16th edition. McGraw-Hill Education: New York.
2) Kardong, K.V. (2015). Vertebrates: Comparative Anatomy, Function, Evolution. McGraw-Hill Education: New York 795 pp.
3) Lab notes on the sea urchin anatomy (E. Tzanatos).
4) Lab notes on the anatomy of the frog and the anatomy of the mouse (G. Mitsainas).
5) Lab notes on the anatomy of cartilaginous and bony fish (S. Dailianis). Lab notes on the anatomy and taxonomy of birds (P. Makridis).

Related academic journals:

2.10 BIOCHEMISTRY II

1.GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_BII**	**SEMESTER**	**C**
COURSE TITLE	BIOCHEMISTRY II		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures and Laboratory Exercises		6	7
COURSE TYPE	Specialised general knowledge		
PREREQUISITE COURSES	PHYSICS, INORGANIC/ORGANIC CHEMISTRY, MATHEMATICS, BIOCHEMISTRY I		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes (in English)		
COURSE WEBSITE (URL)	http://www.biology.upatras.gr/		

2.LEARNING OUTCOMES

Learning outcomes
Upon course completion, students will have acquired knowledge in the biochemistry of metabolism, and will have understood the basic catabolic and anabolic pathways: 1. that are involved in the formation, maintenance, growth and multiplication of living matter, as well as the interconnection, regulation, plasticity, and coordination that characterize the phenomenon of metabolism. 2. on which the phenomenon of life is based, in order for the student to be able to deepen his/her understanding into the chaotic and at the same time spatially restrained compartmental causative interactions of metabolism with the internal and external environment.
General Competences
• Working independently • Team work • Search for, analysis and synthesis of data and information, with the use of the necessary technology • Production of free, creative and inductive thinking • Decision-making • Criticism and self-criticism • Adapting to new situations

3.SYLLABUS

1. Overview of metabolism.
2. Glycolysis, Pentose phosphate pathway
3. Gluconeogenesis, glycogen metabolism
4. Krebs and glyoxylate cycles.
5. Biochemical thermodynamics of photosynthesis.
6. Fatty acid biosynthesis and degradation (ketone bodies).
7. Nitrogen metabolism. Deposition of inorganic nitrogen.
8. Nucleotide/nucleoside biosynthesis and degradation
9. Amino acid biosynthesis and degradation.
10. Protein synthesis.

11. Hormonal regulation and integration of metabolism.
12. Completing the protein life cycle: Folding, processing and degradation.

Laboratory Exercises

New exercises have been designed and will be performed from 2020 onwards.

4.TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face. Discussion during lecture. Encouragement in keeping notes.	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of ICT in teaching, laboratory education, communication with students.	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures	40
	Laboratory work in small groups of students	15
	Independent Study	120
	Course total	**175**
STUDENT PERFORMANCE EVALUATION	1. Written exams at the end of the semester (70%). 2. Laboratory reports and exams on the practical part of the course (30%). Passing grade: 5	

5.ATTACHED BIBLIOGRAPHY

Suggested bibliography:

1. «Βιοχημεία-Βασικές αρχές» BergJ.M., TymoczkoJ.L., StryerL. ISBN: 9789925563333 Κωδ. Εύδοξος: 77107032 Broken Hill Publishers Ltd 2018.
2. «Βιοχημεία» Reginald H. Garrett, Charles M. Grisham ISBN: 978-618-5173-40-1 Κωδ. Εύδοξος: 77113116 Utopia Publishing.
3. «Lehninger's Βασικές Αρχές Βιοχημείας» 2η έκδοση Nelson David L, Cox Michael M. ISBN: 9789925563203 Κωδ. Εύδοξος: 77107011 Broken Hill Publishers Ltd 2018.
4. «Βιοχημεία,Βασικές Αρχές Σε Μοριακό Επίπεδο» Pratt Charlotte , Voet Donald , Voet Judith https://www.protoporia.gr/suggrafeas-pratt-charlotte-1005273.
5. Σημειώσεις του μαθήματος μέσω της ηλεκτρονικής πλατφόρμας e-class (Κωδικός μαθήματος: BIO404).

Related academic journals:

2.11 PLANT MORPHOLOGY AND ANATOMY – DIDACTICS

1.GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_ΜΑΦ**	**SEMESTER**	**C**
COURSE TITLE	PLANT MORPHOLOGY AND ANATOMY - DIDACTICS		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures, laboratory exercises		6	8
COURSE TYPE	*General background*		
PREREQUISITE COURSES	Not required from the studies programme; the knowledge of General Biology is recommended		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No		
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/BIO328/		

2.LEARNING OUTCOMES

Learning outcomes
At the end of the course the student should be able to: understand basic principles of plant anatomy and morphology, understand the role of plants within an ecosystem and have the ability to work with plant samples using light microscope and also perform sections to various plant tissues and also has the ability to connect elements of plant biology with plant physiology. The student also is introduced to the principles of plant taxonomy.
General Competences
At the end of the course the student should be able to: Retrieve, analyze and synthesize data and information, with the use of all necessary technologies. Work autonomously. Work in teams. Advance free, creative and causative thinking.

3.SYLLABUS

Introduction to Botanical Science: History and evolution of botanical science, Origin and diversity of plant organisms, the role of plants in the ecosystem, Plants and man, Plant cell organization: The chemical foundations of plants, Cellular organelles and cellular structures, The plant cell cycle, Division of the nucleus, mitosis, meiosis, polyploidy, biological cycles and reproduction in the plant world. Organization of the plant body: from the single cell to the multi-cellular organization level, unicellular/multi-cellular plant organisms, plant tissue characteristics / adaptation to terrestrial living. Morphology / Anatomy of higher terrestrial plants: Types and characteristics of plant tissues, morphology, anatomy of basic plant organs (root, stem, leaf, flower, etc.). Main characteristics and taxonomic study of basic plant categories: Algae, Bryophytes, Lichens.

4.TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face to face lectures in classroom.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of Information Technologies both in the course lectures as well as in laboratory

<table>
<tr><td></td><td colspan="2">exercises in order to challenge dialogue with students and stimulate their critical thinking.
Also use of specialized project management software and learning process support through the e-class platform.</td></tr>
<tr><td rowspan="5">TEACHING METHODS</td><td>Activity</td><td>Semester workload</td></tr>
<tr><td>Lectures</td><td>50</td></tr>
<tr><td>Laboratory exercises</td><td>50</td></tr>
<tr><td>Study of course theory</td><td>60</td></tr>
<tr><td>Study of laboratory exercises</td><td>40</td></tr>
<tr><td></td><td>Course total</td><td>200</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION</td><td colspan="2">Students are evaluated (language of assessment is Greek) by means of short answer tests during the laboratory exercises throughout the semester, and the final evaluation at the end of the semester is done through laboratory examinations which include written short answer questions and identification and design of plant structures under the microscope (30%) and written examinations of the course theory (70%).
Passing grade: 5</td></tr>
</table>

5.ATTACHED BIBLIOGRAPHY

Suggested bibliography:

1. Raven Peter H., Evert Ray Franklin, Eichhorn Susan E. (Μετάφραση: Συλλογικό έργο): ΒΙΟΛΟΓΙΑ ΤΩΝ ΦΥΤΩΝ Εκδόσεις UTOPIA, 2014, ISBN 618-80647-4-4
Κωδικός στο σύστημα ΕΥΔΟΞΟΣ: 978-618-80647-4-4.
2. Β. Γαλάτης, Κ. Κατσαρός, Π. Αποστολάκης: ΕΙΣΑΓΩΓΗ ΣΤΗ ΒΟΤΑΝΙΚΗ Εκδόσεις Σταμούλη Α.Ε., Αθήνα 1998, ISBN 960-351-049-1. Κωδικός στο σύστημα ΕΥΔΟΞΟΣ: 22743
3. Ι. Τσέκος, Βοτανική: Δομή λειτουργική Δράση και Βιολογία Φυτών Εκδόσεις Αδελφών Κυριακίδη Α.Ε. Θεσσαλονίκη 2000, ISBN 960-343-576-7

Related academic journals:

2.12 POPULATION ECOLOGY

1.GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**ΒΙΟ_ΠΛΟ**	**SEMESTER**	**G**
COURSE TITLE	POPULATION ECOLOGY		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures, Laboratory Exercises		6	7
COURSE TYPE	Field of Science, Skills Development		
PREREQUISITE COURSES	NO		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes (in English)		
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/BIO200/		

2.LEARNING OUTCOMES

Learning outcomes
In the end of the course the student should be able to: 1. perceive ecology as a science and comprehend the content, principles, modern issues and approaches 2. approach and discuss everyday issues concerning the environment based on the knowledge on the structures, functioning and mechanisms determining the condition and the future of ecosystems 3. comprehend the effect of the environmental conditions on organisms as well as the reactions and adaptations of organisms to environmental fluctuations 4. comprehend the concept of populations, know the population main demographic characteristics and how they determine the dynamics of populations 5. assess parameters (fecundity and mortality in relation to age) and use them in order to predict the population dynamics 6. understand the basic mathematical models and their use in population ecology 7. be aware of the role of basic mechanisms, such as predation and competition, in determining population abundance 8. perceive the principles of the management of biological resources and the main characteristics of their sustainable exploitation 9. understand the significance of overexploitation and maximum sustainable yield and use them
General Competences
By the end of this course the student will have developed the following **General Abilities**: 1. Autonomous (Independent) work 2. Group work 3. Generation of new research ideas 4. Respect for the natural environment 5. Development of free, creative and inductive thinking Additionally, by the end of this course the student will have developed the following **Special skills/competences**: 1. understanding of the content and usage of the basic mathematical models of population dynamics 2. estimation and assessment of the main parameters determining population dynamics 3. estimation of critical points and parameters for the rational exploitation of biological resources 4. analysis of demographic characteristics and prediction of the dynamics of population abundance

5. ability to record and analyse environmental data with the use of autonomous data loggers.

3.SYLLABUS

The science of Ecology: principal concepts and modern approaches. The abiotic environment: spatial heterogeneity, temporal fluctuations and change trends. Effects of the environmental conditions on the organisms. The concept of population and its role in the ecosystem. Abundance and distribution of populations. Demographic characteristics. Survival-Fecundity-Life tables. Models of population dynamics (logistic population growth, predation, competition). Exploitation of biological resources and surplus production models. Management of harmful organisms. Methodology and Implementation of the teaching and pedagogical approach in Ecology.

4.TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	PowerPoint presentations. Population dynamics simulations. Interactive simulation software of population dynamics and exploitation. Data-loggers use and data analysis. Support of educational procedure using the e-class electronic platform.	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures (13 weeks x 3 hours per week)	39
	Laboratory exercises (6 weeks x 2 hours per week)	12
	Home study	124
	Course total	**175**
STUDENT PERFORMANCE EVALUATION	Written exams (at the semester's end), in Course theory and lab. Language: Greek. Exams through multiple choice questions (including negative marks), problem solving, short answer questions. Final Course Grade: Theory Grade x 0.7 + Laboratory Grade x 0.3 Grading scale: 1-10. Passing grade: 5	

5.ATTACHED BIBLIOGRAPHY

Suggested bibliography:

1. Lykakis J. 1996. Ecology. Symmetria editions, 468 pages (in Greek)
2. Molles, M. C. Jr. 2009. Ecology: Concepts and Applications (translated by Th. Georgiadis). Metehmio editions (in Greek)

Related academic journals:

2.13 DEVELOPMENTAL BIOLOGY

1.GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_AΞB**	**SEMESTER**	**D**
COURSE TITLE	DEVELOPMENTAL BIOLOGY		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
	Lectures	3	6
	Laboratory exercises	3	
COURSE TYPE	General Background		
PREREQUISITE COURSES	NO		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)			

2.LEARNING OUTCOMES

Learning outcomes
Establishment of good background on basic concepts of developmental biology and of the main experimental animal models used in the field. Introduction in the main concepts of basic and applied regenerative biology and assisted reproduction technology.
General Competences
Search for, analysis and synthesis of data and information, with the use of the necessary technology Team work Criticism and self-criticism

3.SYLLABUS

1. Fertilization
2. Early embryonic development (mammals)
3. Early embryonic development (birds)
4. Basic developmental processes (cell migration, specification, differentiation)
5. Basic signaling and morphogenetic pathways
6. Development of endoderm (mammals)
7. Development of mesoderm (mammals)
8. Development of ectoderm- development of the brain (mammals)
9. Embryonic and adult (tissue-specific) stem cells
10. Developmental biology of Caenorabditis
11. Developmental biology of the sea urchin
12. Developmental biology of Drosophila
13. Developmental biology of Zebrafish
14. Comparative developmental biology of plants and animals

4.TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of e-class environment. Exposure to image analysis software.	
TEACHING METHODS	***Activity***	***Semester workload***
	Lectures	36
	Lab Practice	22
	Individual work (preparation for lab work, lab reports, general preparation)	92
	Course total	**150**
STUDENT PERFORMANCE EVALUATION	Written assessment involving multiple choice questionnaires, "Correct- wrong" questionnaires, short-answer questions, problem solving. Minimal Passing grade: 5	

5.ATTACHED BIBLIOGRAPHY

Suggested bibliography:

1) BASIC PRINCIPLES OF DEVELOPMENTAL BIOLOGY (Greek translation), Code in Evdoxos database: 41959950, Author: J. M. W. Slack

2) PRINCIPLES OF DEVELOPMENT, Code in Evdoxos database: 86055675, Authors: Wolpert Lewis, Tickle Cheryll, Arias Martinez Alfonso.

Related academic journals:

2.14 MOLECULAR BASIS OF CELL FUNCTIONS

1.GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_MKΛ**	**SEMESTER**	**D**
COURSE TITLE	MOLECULAR BASIS OF CELL FUNCTIONS		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	3	6
Practical exercises	3	

COURSE TYPE	Scientific specialized background
PREREQUISITE COURSES	Formally, there are no prerequisite courses. However, previous knowledge of Biochemistry and fundamental principles of Cell Biology are recommended.
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes [English]
COURSE WEBSITE (URL)	

2.LEARNING OUTCOMES

Learning outcomes
Students will understand a) the structure and potential of cytoskeleton constituents and movement systems, which concern cell movements and subcellular structures, b) the mechanisms and regulation of cell proliferation, ageing and death, c) cell-cell interactions, cell-matrix interactions and communication mechanisms among cells, d) the biology of cancer cells, and e) the structure and function of immune system and fundamental principles of immune responses of the innate and adaptive immunity.
General Competences
Search for, analysis and synthesis of data and information, with the use of the necessary technology. Decision-making.

3.SYLLABUS

1. Cytoskeleton and cellular movements
2. Matrix
3. Cellular interactions and cell-matrix interactions
4. Cellular recognition and fundamental principles of cell communication
5. Cell cycle regulation
6. Cell proliferation
7. Ageing, cell death [apoptosis]
8. Cancer
9. Signal transduction
10. Introduction to the immune system
11. Innate immune responses
12. Adaptive immune responses

4.TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face to face lectures in the classroom and laboratory exercises	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of ICT in teaching, laboratory education, communication with students	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures	39
	Lab practice	15
	Lab reports	15
	Course study	81
	Course total	**150**
STUDENT PERFORMANCE EVALUATION	For every lab exercise, students are asked to make a report based on the procedure and the techniques they have been trained. The final examination of the course includes 4 general questions, 4 overall questions to proceed and 2 practical problems to solve with the use of the techniques they have learned in lab practice. The evaluation criteria are mentioned at the e-class of the course. Grading scale: 1-10 Passing grade: 5	

5.ATTACHED BIBLIOGRAPHY

Suggested bibliography:
Molecular biology of the cell. Alberts *et al.* Garland science 1995

Related academic journals:

2.15 MOLECULAR BIOLOGY

1.GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_MPB**	**SEMESTER**	**D**
COURSE TITLE	MOLECULAR BIOLOGY		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	3	6
Practical exercises	3	

COURSE TYPE	Scientific specialized background
PREREQUISITE COURSES	Formally, there are no prerequisite courses. However, knowledge of Biochemistry is recommended
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	

2.LEARNING OUTCOMES

Learning outcomes
Students will understand the structure and organization of the genetic information, the laboratory techniques for the basic study of DNA. They will learn the use of enzymes in Molecular Biology and the basic principles of genetic engineering and DNA recombination.
General Competences
Search for, analysis and synthesis of data and information, with the use of the necessary technology. Team work. Decision-making.

3.SYLLABUS

1. The genetic material: Structure and topology of nucleic acids
2. Organization of prokaryotic and eukaryotic genome
3. Repetitive and non-repetitive DNA. Structure of genes. Role of introns
4. Chromatin and chromosomes: The packaging of DNA. Nucleosomes
5. Active and non-active chromatin. Methylation of DNA
6. DNA replication: Replication in Prokaryotes and Eukaryotes Mechanisms of replication
7. Genetic engineering: Restriction and DNA modifying enzymes
8. Plasmids and phages as cloning vectors
9. Construction of DNA and genomic libraries
10. Transcription. RNA maturation
11. Translation. Post translational modifications

4.TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face to face lectures in classroom and lab
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	One laboratory practice course consists on the search on certain data bases and finding of nucleic sequences of specific genes of several organisms and compare their homology with

<table>
<tr><td></td><td colspan="2">BLAST software. The course takes place at the computer centre of the Biology Department. Communication via e-class.</td></tr>
<tr><td rowspan="5">TEACHING METHODS</td><td>Activity</td><td>Semester workload</td></tr>
<tr><td>Lectures</td><td>39</td></tr>
<tr><td>Lab practice</td><td>15</td></tr>
<tr><td>Lab reports</td><td>15</td></tr>
<tr><td>Course study</td><td>81</td></tr>
<tr><td></td><td>Course total</td><td>150</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION</td><td colspan="2">The lab practice consists of three parts of a larger one, divided for educational purpose.
For the whole lab exercise, students are asked to make a report in teams of 3-4 persons. The report is written according to international standards of a research report (abstract, introduction, methods, results, conclusions). The report is sent by mail and is presented to the teacher in charge.
The final examination of the course includes 4 general questions, 4 judgment questions and 2 practical problems to solve with the use of the techniques they have learned in the lab practice.
The evaluation criteria are mentioned in the e-class of the course.
Grading scale:1-10
Passing grade: 5</td></tr>
</table>

5.ATTACHED BIBLIOGRAPHY

Suggested bibliography:

Genes. Lewin. Oxford University press. ISBN 0-19-879280-8 Έκδοση στα ελληνικά: Ακαδημαϊκές εκδόσεις, ISBN 960-88412-0-8.

Related academic journals:

2.16 ECOLOGY, COMMUNITIES AND ECOSYSTEMS

1.GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_OBO**	**SEMESTER**	**D**
COURSE TITLE	ECOLOGY, COMMUNITIES AND ECOSYSTEMS		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures, seminars, and Multimedia displays	3	6
Laboratory work & exercises	2	
Educational field-work	1 or 2 daily excursions	

COURSE TYPE	Field of Science
PREREQUISITE COURSES	Typically, there are not prerequisite course. Essentially, the students should possess: (a) knowledge provided through the previously taught theoretical courses ''Plant Biology'', 'Zoology'' and ''Science of general Biology'', and (b) laboratory skills obtained through the previously attended laboratory courses.
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek. Teaching may be however performed in English in case foreign Erasmus students attend the course.
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	http:// eclass.upatras.gr/courses/bio232

2.LEARNING OUTCOMES

Learning outcomes
By the end of this course the student will be able to: 1. Understand the basic principles and processes of Ecology 2. Gain fundamental principles of the structure and function of ecosystems 3. Apply the ecological principles in environmental assessment and management of environmental issues 4. Evaluate the biodiversity conservation as well as the climate change results in ecosystems and natural environment 5. Strengthen their efficiency to compile information in a coherent system/unit At the end of this course the student will have further developed the following skills/ competences: 1. Ability to demonstrate knowledge and understanding of essential facts, concepts, principles and theories of Ecology 2. Ability to apply such knowledge and understanding to the solution of ecological issues 3. Ability to interact with others on environmental multidisciplinary problems 4. Study skills needed for continuing professional development
General Competences
Generally, by the end of this course the student will, furthermore, have develop the following general abilities (from the list above): Adaptation to new situations Decision making Autonomous (Independent) work Group work Exercise of criticism and self-criticism

Promotion of free, creative and inductive thinking Respect to natural environment Work design and management

3.SYLLABUS

- What is Ecology? Tools and Methods of Ecological research.
- Communities and Ecosystems. Species Abundance and Diversity. Quantitative index of Diversity.
- Environmental Complexity.
- Disturbance and Diversity.
- Food webs structure and species Diversity.
- Primary Production and Energy Flow
- Models of Primary Production
- Trophic Levels
- Nutrient Cycling and Retention. Biogeochemical cycles
- Decomposition in terrestrial and aquatic Ecosystems
- Succession and Stability. Primary and Secondary Succession.
- Community and Ecosystem changes during succession.
- Landscape Ecology.
- Geographical Information Systems.
- Global Ecology

4.TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Lectures, seminars and laboratory work face to face.	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of Information and Communication Technologies (ICTs) (e.g. PowerPoint) in teaching. The lectures content of the course for each chapter are uploaded on the internet, in the form of a series of ppt files, where from the students can freely download them.	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures (3 conduct hours per week x 13 weeks)	39
	Field work	16
	Laboratory exercises/ work (2 conduct hours per week x 13 weeks)	26
	Optionally, preparation of home-works from groups of two or three students each.	24
	Hours for private study of the student and preparation of home-works and reports, for the Laboratory, and preparation for the Laboratory (study of techniques and theory)	45
	Course total	**150**
STUDENT PERFORMANCE EVALUATION	Written examination at the end of semester Grading scale: 1-10 Passing grade: 5	

5.ATTACHED BIBLIOGRAPHY

Suggested bibliography:

- Molles MC **2009**. Οικολογία (Μετάφραση: Θ. Γεωργιάδη). Εκδόσεις Μεταίχμιο [Molles MC 2008. *Ecology.* 4rd edition. Mc Graw Hill.]
- Begon M, Harper J & Townsend C **2015**. Οικολογία Πληθυσμοί, Βιοκοινότητες και Εφαρμογές [*Ecology: Individuals, Populations and Communities.* 4th Edit., Blackwell] 1η Ελληνική Έκδοση Utopia .
- Begon M, Harper J & Townsend C **1996**. *Ecology: Individuals, Populations and Communities.* 3rd Edit., Blackwell.
- EMBERLIN JC **2006**. *ΕΙΣΑΓΩΓΗ ΣΤΗΝ ΟΙΚΟΛΟΓΙΑ*. ΕΚΔΟΣΕΙΣ ΤΥΠΩΘΗΤΩ (ΜΕΤΑΦΡ.: ΜΕΛΙΑΔΟΥ Α.)
- Krebs CJ **1994**. *Ecology: the experimental analysis of distribution and abundance*. Harper & Row, New York.
- ODUM E **1993**. *ECOLOGY AND OUR ENDANGERED LIFE-SUPPORT SYSTEMS (USA)*
- ODUM E **1971**. *FUNDAMENTALS OF ECOLOGY*. SAUNDERS, PHILADELPHIA.
- Notes of lecturers in Greek [ΗΛΕΚΤΡΟΝΙΚΑ ΜΑΘΗΜΑΤΑ ΟΙΚΟΛΟΓΙΑ ΙΙ] – (BIO232, eclass.upatras.gr)

Related academic journals:

2.17 PLANT SYSTEMATICS

1.GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_ΣΦΤ**	**SEMESTER**	**D**
COURSE TITLE	PLANT SYSTEMATICS		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Theory	3	6
Lab exercises	3	
Field work		

COURSE TYPE	General background, special background, specialised general knowledge, skills development.
PREREQUISITE COURSES	No prerequisite courses. Good knowledge of the lesson Plant Morphology and Anatomy – Didactics, is needed.
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/BIO361/

2.LEARNING OUTCOMES

Learning outcomes
At the end of this course the student should be able to: - understand the importance of the Plant Systematics in the science of biology - understand the basic principles of classification and phylogeny of plants. - be able to distinguish the basic morphological differences between plants. - understand the ways of reproduction and their development within the various groups. - understand the role of plant organisms in the environment - understand the position of plant species within communities and ecosystems - understanding the importance of preserving populations of rare, protected and risk-bearing plant species - have developed critical thinking.
General Competences
At the end of the course the student should be able to: - to seek, analyze and compile data and information on important plant species collections, their characteristics and functional traits, protection and risk status, etc., from international and national databases, using and the necessary technologies - recognize plant organisms using a stereoscope and identification keys.

3.SYLLABUS

Systematic Classification of Plants, Evolution & Variety of vascular plants: Pteridophyta, Evolution & variety of woody plants and spermatophytes, Gymnosperms: Pinaceae, Taxaceae, Cupressaceae, Ephedraceae, The evolution of angiosperms (flowers, fruits, inflorescences, taxa), Diversity & Classification of Angiosperms: Salicaceae, Platanaceae, Oleaceae, Lauraceae, Fagaceae, Fabaceae, Lamiaceae, Ranunculaceae, Caryophyllaceae, Brassicaceae, Papaveraceae, Apiaceae, Asteraceae, Poaceae, Liliaceae, Orchidaceae, Plants in Communities, ecosystems and their dynamics.

4.TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of ICT in teaching, laboratory education, communication with students.	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures	39
	Laboratory practice	39
	Fieldwork	16
	Essay writing	10
	Exam preparation	46
	Course total	**150**
STUDENT PERFORMANCE EVALUATION	Semester exams: Short Response Questions, Laboratory practice and essay writing. Passing grade: 5	

5.ATTACHED BIBLIOGRAPHY

Suggested bibliography:

1. Simpson G. M 2016. Plant Systematics. Academic Press.
2. Mauseth JD. 1995. Botany: An Introduction to Plant Biology 2nd edition. Jones & Bartlett Publishers.
3. Moore R, Clark WD & Stern KR 1995. Botany. Toronto Wm. C. Brown publishers.
4. Raven PH, Evert RF &Eichhorn SE 1999. Biology of plants. 6th edition. W.H. Freeman and Company/Worth Publishers.

E-lessons of Plant Systematics: (BIO361, eclass.upatras.gr, https://eclass.upatras.gr/courses/BIO361/)

Related academic journals:

2.18 MICROBIOLOGY

1.GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_MPB**	**SEMESTER**	**E**
COURSE TITLE	MICROBIOLOGY		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures, laboratory exercises	5	7

COURSE TYPE	Specialised general knowledge.
PREREQUISITE COURSES	There are no prerequisite courses. However, knowledge of General Biology, Biochemistry and Molecular Biology is desirable.
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/BIO240/

2.LEARNING OUTCOMES

Learning outcomes
The students will gain insight into the structure of prokaryotic and eukaryotic cells and viruses, and will understand the biology of microorganisms, at biochemical and molecular level, as well as the mechanisms used by microorganisms to generate / store energy. They will also gain knowledge of the biology of representative microbial genera (bacteria, fungi) and viruses. Upon completion of the lectures and laboratory exercises, students will be able to: 1) use aseptic techniques 2) isolate microorganisms from environmental samples and cultivate them in the laboratory in pure cultures 3) examine macroscopically microbial colonies and microscopically microbial cells 4) determine the density of microbial populations in different samples 5) use cell staining techniques 6) study fungi / fungal biological cycles 7) determine the sensitivity of bacteria to antibiotics.
General Competences
Search for analysis and synthesis of data and information, with the use of the necessary technology, Working independently, Team work, Working in an interdisciplinary environment Production of new research ideas, Respect for the natural environment, Production of free, creative and inductive thinking.

3.SYLLABUS

1. The evolution of the science of Microbiology. 2. Prokaryotic and eukaryotic cell organization and structure: cytoplasmic membrane and its functional role, cell wall, flagellum. Chemotaxis. The bacterial endospore. Chromosome and plasmids. Ribosomes. 3. Gene expression. Regulation of gene expression. Transfer of DNA to bacterial cells. 4. Metabolism. Energy production in aerobic and anaerobic microorganisms. Chemoautotrophism. Photoautotrophism. 5. The phenomenon of microbial growth. The Monod equation. Culture systems. Production of biomass and metabolic products. 6. Microorganisms without cellular organization. 7. Hierarchical classification and taxonomic unit. 8. The microbial world. 8.1. Gram-negative bacteria [aerobic, facultative anaerobic], Gram-positive [cocci, spore forming, normal and irregular non-spore forming]. Mycobacteria. Photosynthetic. Aerobic chemolithotrophs. Actinomycetes. 8.2. Archaea (methanogenic, sulfur-reducing, archaea without cell wall, hyperalophiles, hyperthermophile sulfur-archaea). 8.3. Characteristics of fungi. Chytridiomycota,

Zygomycota [Rhizopus, Mucor, Mycorrhizae], Ascomycota [Schizosaccharomyces, Aspergillus and Penicillium, Order Lecanorales , Order Saccharomycetales], Basidiomycota [Agaricus sp, Brown and white rot fungi, Order Uredinales - The rust fungi, Order Ustilaginales – The smut fungi]. 8.4. Microorganisms studied with fungi. 8.5. Viruses: Animal viruses [Adenoviruses, Retroviruses], Plant viruses [Tobacco mosaic virus], Bacterial viruses [Phage T4, Phage λ].

4.TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face, Distance learning.	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	YES	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures	53
	Laboratory practice	35
	Non-directed study	87
	Course total	**175**
STUDENT PERFORMANCE EVALUATION	Language of evaluation: Greek Methods of evaluation: Short-answer questions, Problem solving, Oral examination, Laboratory work. The evaluation criteria are stated in the syllabus and analysed at the beginning of the semester. Passing grade: 5	

5.ATTACHED BIBLIOGRAPHY

Suggested bibliography:
MICROBIOLOGY AND MICROBIAL TECHNOLOGY (IN GREEK), 2ND EDITION 2017, GEORGE AGGELIS, UNIBOOKS PUBLISHERS, ATHENS

Related academic journals:
Microbiology UK, Applied Microbiology and Biotechnology, Journal of Applied Microbiology, Applied and Environmental Microbiology, Annals of Microbiology, Nature, Nature Microbiology Reviews.

2.19 MOLECULAR GENETICS

1.GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**ΒΙΟ_ΜΓΝ**	**SEMESTER**	**Ε**
COURSE TITLE	MOLECULAR GENETICS		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Theory and practicals (laboratory exercises)	6	7

COURSE TYPE	Scientific
PREREQUISITE COURSES	There is no prerequisite course
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek language
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes, in English language
COURSE WEBSITE (URL)	http://www.biology.upatras.gr/

2.LEARNING OUTCOMES

Learning outcomes

Upon course completion, the students should be able to know and understand the following subjects: the structure of the genetic material, the Central Dogma of Biology, the genetic code and the fine structure and function of the gene, the molecular basis of gene mutations, recombination and DNA repair, the transposable genetic elements in genetic variation and shaping of genomes, the interaction of DNA regulatory elements and transcription factors, the regulation of gene expression in prokaryotic and eukaryotic organisms, the genetic control of development (homeotic genes, differential gene expression), the ongogenes and cancer (epigenetic mechanisms of cancer), the behavioral genetics, and the current issues on biomedicine and biotechnology.

General Competences

- Autonomous work.
- Teamwork.
- Search, analyze and synthesize data and information, using the necessary technologies.
- Promote free, creative and inductive thinking

3.SYLLABUS

Theory

1. The genetic material. The molecular nature of the genetic material. 2. Transmission of genetic information The Central Dogma of Biology. 3. Genetic code Genetical and biochemical approach for elucidating the genetic code. 4. Gene fine structure Modern conception of the gene structure and function. Genetical and biochemical approach. 5. Mutations Molecular basis of the mutations. Mutagens mutagenicity and cancer. Repair DNA mechanisms and molecular knowledge of recombination. 6. Transposable genetic elements In pro-and eukaryotic organism. Relative transposition mechanisms and their role in the genome shaping. 7. Interaction of DNA regulatory elements and transcription factors, 8. regulation of gene expression in prokaryotic and eukaryotic organisms, 9. Developmental genetics - the genetic approach of the development in Drosophila. Homeotic genes. Differential gene expression. Tanden gene activity, 10. Ongogenes and cancer - genetic conception of cancer. Oncogenes and the mechanisms of their activity. Epigenetic

mechanisms in cancer. 11. Behavioral genetics (Intelligent coefficient, personality etc.), 12. Current issues on biomedicine and biotechnology.

Laboratory Practicals

1. Mutations in Human hemoglobin genes, Electrophoresis, Interpretation of results
2. Glutathione Transferase polymorphisms
3. Hybridization – dot blot

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Lectures using slides and Power-Point presentations and support of learning through the e-class platform.	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures and seminars	40
	Laboratory exercises	15
	Independent Study	115
	Course total	**175**
STUDENT PERFORMANCE EVALUATION	1. Theoretical written examinations at the end of the semester (70% of the final grade), which evaluates student's acquired knowledge and critical and creating thinking. Greek grading scale: 1 to 10. Minimum passing grade: 5 2. Written examinations on the laboratory exercises at the end of the experimental training (30% of the final grade, taken into account only if the student takes the minimum grade of 5 in the theoretical written examinations). Note: The evaluation is accessible to students through the electronic secretariat and internal announcements from the course professors. Grading scale: 1-10 Passing grade: 5	

5.ATTACHED BIBLIOGRAPHY

Suggested bibliography:

1. P. J. Russell: iGenetics, A Mendelian approach
2. Griffith A et al.: Introduction to genetic analysis
3. L. Hartwel al.: Genetics: From genes to genomes

Related academic journals:

2.20 ANIMAL PHYSIOLOGY

1.GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_ΦΖΟ**	**SEMESTER**	**E**
COURSE TITLE	ANIMAL PHYSIOLOGY		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	4	
Laboratory Exercises	1	
Total	5	9

COURSE TYPE	Field of Science (Physiology) Skills Development
PREREQUISITE COURSES	NO
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/BIO228/

2. LEARNING OUTCOMES

Learning outcomes

Understanding the basic principles of physiological functions of human and animals.
At the end of this course the student will be able to address issues of the basic principles of homeostasis, the structure & function of nervous system, including neurotransmission, the basic principles of sensory, motor and autonomous nervous system, mechanisms of muscle contraction and excitability, the basic principles of structure/function of cardiovascular system, respiratory system, peptic system, urinary and endocrine system.

General Competences

At the end of the course, the student will have developed the following skills/competences:

1. Understand the organization of the brain
2. Understand the basic principles of neural and muscle excitability
3. Differentiate between muscle cell types
4. The basic principles of structure/function of cardiovascular system
5. The basic principles of structure/function of respiratory system, peptic system, urinary and endocrine system
6. Perform laboratory-based experiments, to familiarize himself with basic laboratory equipment in order to measure physiological parameters e.g. reflexes, analyse normal ECG etc.
7. Observe microscopic slides of the nervous system (brain slices of cerebral and cerebellum cortex, spinal cord etc), of muscular system (smooth, skeletal, and heart muscle, neuromuscular synapses), of the normal and anaemia blood smears (thalassaemia, Erythroblastosis Fetalis etc),
8. Work as part of a team, capable of planning, execute and record experimental procedures/data Observe.

3. SYLLABUS

1. Cellular membranes and transmembrane transport.
2. Resting membrane potentials. Action potentials.
3. Synaptic transmission.

4. Membrane receptors.
5. Signal transduction pathways.
6. Organization of the nervous system.
7. The general sensory, motor, autonomous nervous system.
8. Higher functions of the nervous system.
9. Types of muscle cells
10. Molecular basis of contraction
11. Blood
12. Circulatory system
13. Electrical activity of the heart.
14. Central and peripheral control of cardiac output.
15. Respiratory system. Control of breathing.
16. Mobility of gastrointestinal tract. Gastrointestinal secretions. Digestion and absorption.
17. Elements of renal function.
18. General principles of endocrine physiology

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face to face.	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Support of educational procedure with use of the e-class electronic platform.	
TEACHING METHODS	***Activity***	***Semester workload***
	Lectures (13 weeks x 4 hours per week)	52
	Laboratory exercises (6 exercises/2nd week)	18
	Home study, reading bibliography	155
	Lectures (13 weeks x 4 hours per week)	52
	Course total	**225**
STUDENT PERFORMANCE EVALUATION	1) Written exams (at the semester's end), in Course theory, accounting for the 80% of the Final Grade. 2) Laboratory exams (at the semester's end), accounting for the 20% of the Final Grade. Final Course Grade: Theory Grade x 0.8 + Laboratory Grade x 0.2 Grading scale: 1-10. Passing grade: 5	

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

1. Vander´S **« Human Physiology »**. (in greek). BROKEN HILLPUBLIDKERS LTD Κύπρος 2016.
2. Sherwood L. « **Introduction to Human Physiology »** (in greek)Acad. Publ. Basdra & so on, Alexandroupolis 2016.

Related academic journals:

2.21 PLANT PHYSIOLOGY

1. GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_ΦΦΤ**	**SEMESTER**	**E**
COURSE TITLE	PLANT PHYSIOLOGY		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures and laboratory exercises		6	7
COURSE TYPE	Compulsory, general background		
PREREQUISITE COURSES	No prerequisite courses. The student is strongly recommended to have passed examinations in Plant Morphology and Anatomy, Cell Biology and Biochemistry.		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No		
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/BIO212/		

2. LEARNING OUTCOMES

Learning outcomes
At the end of the course the student is expected: 1) to have assimilated the basic principles of plant functions and their dependence on environmental factors and stresses 2) to have understood the particular life style of plants as well as their importance for life on planet Earth. Moreover, upon course completion, especially the laboratory practical, the student is expected 1) to be able for constructive formulation of hypotheses and design of simple, yet reasonable, experiments to test their validity 2) to be familiar with basic laboratory equipment in order to measure physiological parameters 3) to collaborate with the members of a group to perform simple or more complicated experiments 4) to be able to process and present the experimental results.
General Competences
Search for, analysis and synthesis of data and information, with the use of the necessary technology. Working independently. Team work. Production of free, creative and inductive thinking.

3. SYLLABUS

- Introduction: overview of the main plant functions. The importance of photosynthetic organisms for life on planet Earth.
- Water relations of plant cells
- Stomata and transpiration
- The light-dependent reactions of photosynthesis: light absorption, electron flow and photosynthetic phosphorylation
- The “dark” reactions of photosynthesis: CO_2 assimilation reactions, photorespiration, C4 and CAM photosynthesis
- Cellular respiration, alternative oxidases- thermogenic respiration
- Uptake and transport of water and mineral nutrients
- Transport and allocation of photosynthetic products
- Energy, carbon and water balance of plants
- Environmental factors affecting the energy, carbon and water balance of plants

– Growth, differentiation, development – Internal regulation: plant hormones and their main physiological functions – External regulation: perception and processing of environmental stimuli, photoperiodism, endogenous rythms, phototropism, gravitropism.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Lectures in classroom face-to-face, laboratory practice in groups of three students	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Lectures using contemporary methods. Compulsory laboratory practicals. Complementary usage of the e-class (open class) platform.	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures	39
	Laboratory practice	24
	Independent study and analysis of bibliography	82
	Study/ preparation of laboratory reports	30
	Course total	**175**
STUDENT PERFORMANCE EVALUATION	Compulsory written examination in both course theory and laboratory exercises. Essay questions, multiple choice questions or a combination of them. In addition, during laboratory practical the students (working in groups of three) process and discuss the experimental results of each exercise in a written report Grading scale: 1-10. Passing grade: 5	

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

- Plant Physiology I. Ridge (ed., English edition). Y. Manetas (ed., Greek edition). ION publishing group, 2005 (in greek).
- Plant Physiology K.A. Roubelakis-Angelakis (ed.). Crete University Press, 2003 (in greek).
- Plant Physiology (L. Taiz and E. Zeiger, 5th edition). C.A., Thanos (ed., 1st Greek edition). Utopia Publishing, Athens, 2012 (in greek).
- Plant Physiology, George Aivalakis, George Karabourniotis, George Liakopoulos. Embryo Press, 2016 (in greek)
- Plant Physiology and Development, (L. Taiz, E. Zeiger, I. Max Møller, A. Murphy, 6th edition), C.A., Thanos (ed., 2nd Greek edition). Utopia Publishing Athens, 2017 (in greek).
- Laboratory Exercises in Plant Physiology. Y. Manetas, G. Grammatikopoulos, Y. Petropoulou, G.K. Psaras, Hellenic Academic Ebooks, Kallipos, 2016 (in greek).

Related academic journals:

2.22 EVOLUTION

1. GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_ΕΞΛ**	**SEMESTER**	**F**
COURSE TITLE	EVOLUTION		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	3	6

COURSE TYPE	Scientific
PREREQUISITE COURSES	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek language
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes, in English language
COURSE WEBSITE (URL)	www.biology.upatras.gr

2. LEARNING OUTCOMES

Learning outcomes

Upon course completion, the students should be able to know the following subjects: 1.the process of the evolutionary thought, 2.the agents inducing random or systematic genetic changes in populations, 3.the evolution of development, 4.the genome evolution, 5.the evolutionary significance of the sex, 6.the means of species as well as the speciation theories, 7.the phylogenetic relationships and the molecular phylogeny, 8.the ecological, biogeographical and coevolutionary interactions of the species, 9.the evolution on the cosmological, geological and palaiological level, 10. the most important evolutionary pathways, 11.the mankind origin.

General Competences

- Autonomous work
- Teamwork
- Search, analyze and synthesize data and information, using the necessary technologies
- Promote free, creative and inductive thinking

3. SYLLABUS

1. Basic evolutionary concepts and the evolution of the evolutionary thought The history of the evolutionary thought from the ancient times to the present. 2.Random genetic changes in populations. Molecular and neutral evolution The role of mutations, recombination, genetic drift and migration on the populations genetic structure. The neural theory. Debate between neutralist and selectionist. 3. Adaptive evolution Natural selection. Types of selection. The maintainance of genetic variability. 4. The evolution of development Developmental constrains. Ontogeny and phylogeny. 5. Genome evolution c- value padadox. The origin of new genes. Gene dublication. 6. The evolutionary investment of the sex Sex function and sexual selection. 7. The mean of species and speciation The species definition, genetic differentiation and speciation. Isolation mechanisms. Speciation forms and theories. 8. Phylogenetic relationships and molecular plylogeny Phylogeny and taxonomy. The molecular chock. Phylogenetic trees. 9. Ecological, biopegraphical and coevolutionary species interactions Evolution and ecology, evolutionary biogeography, coevolution among organisms and species. 10. The evolution on the cosmological, geological and palaiobiological level. The palaiontological record and the phenomenon of species extinction. 11. The major evolutionary events. The origin of life and DNA. Genetic code evolution and biochemical unity of life. The Cambrian evolutionary explotion of life and the evolution of animal and plants. 12. The mankind origin Monkeys and mankind. African replacement theory and multiregional evolution. The human “races”

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face to face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Lectures using slides and Power-Point.	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures	40
	Independent study	110
	Course total	**150**
STUDENT PERFORMANCE EVALUATION	Theoretical written examinations at the end of semester, which grade students' acquired knowledge and critical and creative thinking. Greek grading scale: 1-10. Minimum passing grade: 5.	

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

1. "Evolution" Douglas Futuyma– Mark Kirkpatrick.
2. "Introduction to Evolution". S. N. Alahiotis
3. "Evolution" Barton, Briggs, Eisen, Goldstein, Patel

Related academic journals:

2.23 BIOGEOGRAPHY

1. GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_ΒΓΦ**	**SEMESTER**	**H**
COURSE TITLE	BIOGEOGRAPHY		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures,	2	
Laboratory Exercises	2	
Total		6

COURSE TYPE	Field of Science Skills Development
PREREQUISITE COURSES	Formally, there are no prerequisite courses. Nevertheless, a good knowledge of evolutionary biology, zoology, botany, and ecology highly recommended. Some knowledge of basic statistics would be useful.
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes (in English)
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/BIO377/

2. LEARNING OUTCOMES

Learning outcomes
By the end of this course the student should be able to: 1) understand the spatial structure of biodiversity 2) discuss major theories and concepts of modern biogeography 3) understand common patterns and crucial processes of organisms' distribution in space 4) make simple analyses of biogeographical data.
General Competences
By the end of the course, the student will have developed the following **Special skills/competences**: 1) ability to identify important spatial patterns of organisms' distribution 2) ability to make simple analyses of presence-absence data of species distributions 3) ability to formalize biogeographical questions and to design simple biogeographical experiments Additionally, by the end of this course the student will, furthermore, have develop the following **General Abilities**: 1) Working independently 2) Team work 3) Generation of new research ideas 4) Respect for the natural environment 5) Development of free, creative and inductive thinking.

3. SYLLABUS

1) What is Biogeography? Some facts about the history of biogeography
2) The history of the Earth: paleogeography & paleoecology
3) Distribution patterns: Endemism, Provincialism, Biogeographical Regions. Disjunct distributions
4) Biogeographical Processes: Vicariance, Dispersal

5) Methods of Historical Biogeography: Phylogenetic Biogeography, Cladistic Biogeography 6) Phylogeography, Parsimony Analysis of Endemism 7) Island Biogeography. Types and characteristics of the islands 8) Area / number of species 9) Dynamic equilibrium theory 10) Island formation patterns 11) Island theory and management 12) Human impact on island ecosystems 13) Paleogeography, Paleoecology and current biogeography of the Greek Region

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face to face.	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Support of educational procedure with use of the e-class electronic platform.	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures (13 weeks x 2 hours per week)	26
	Laboratory Exercises (4 weeks x 2 hours per week)	8
	Home study	116
	Course total	**150**
STUDENT PERFORMANCE EVALUATION	1) Written exams (at the semester's end), accounting for the 80% of the Final Grade. 2) Elaboration & Presentation of Laboratory Exercises (at the semester's end), accounting for the 20% of the Final Grade. Final Course Grade: Exams Grade x 0.6 + Laboratory's Exercises Grade x 0.2 Grading scale: 1-10. Passing grade: 5	

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

1) Whittaker R. & Fernandez-Palacios J.M. (2010). Island Biogeography
2) Lomolino M.V., Brown J.H. & Riddle B.R. (2010). Biogeography
3) Pianka, R.E. (2006) Evolutionary Ecology
4) Instructors' Notes

Related academic journals:

2.24 BIOINFORMATICS

1. GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_ΒΠΛ**	**SEMESTER**	**H**
COURSE TITLE	BIOINFORMATICS		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	2	
Teaching/Exercises in the computer room	1	
Total		3

COURSE TYPE	Specialised general knowledge
PREREQUISITE COURSES	None. However, it is recommended that the students have acquired good knowledge in the fields of Genetics, Molecular Biology, Cell Biology, Biochemistry, Developmental Biology, Physiology, Biostatistics and basic knowledge in the use of computers.
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes [English]
COURSE WEBSITE (URL)	http://www.biology.upatras.gr

2. LEARNING OUTCOMES

Learning outcomes

The course is an introduction to the scientific fields of Bioinformatics and Systems Biology, demonstrating the role and the need of informatics and mathematical modeling in approaching and solving problems in life sciences. The students are presented with the experimental and computational tools, which characterize the modern biological research, including the biological databases and specialized software. The students are exposed to the perspective and practice of the high-throughput analysis of biological data from various levels of cellular function: genomics, transcriptomics, proteomics, metabolomics, metabolic flux analysis and their integrated analysis. Effort is placed in exposing the students to the approaches of modern biological research and furthering their perception regarding the need for holistic analyses of the biological systems as networks of biomolecular networks that could support a comprehensive understanding of the biological phenomena and the genotype/phenotype relationship.

General Competences

- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Working independently
- Working in an interdisciplinary environment
- Production of new research ideas
- Production of free, creative and inductive thinking

3. SYLLABUS

Lectures

- Introduction to the science of Bioinformatics and how this was succeeded by Systems Biology/ Discussion regarding the necessity of this new approach and science in the post-genomic

revolution era/ Which research areas are covered by this scientific field, how mathematical modeling is involved and the use of informatics tools
- Timetable of Genomic Revolution
- Definition and Description of omic technologies
- Main Differences between "conventional/targeted" biology and Systems Biology
- Cellular function as a network of biomolecular networks
- Analytical technologies for next generation sequencing
- Analytical technologies for transcriptomic analysis (microarrays and RNA-Seq)
- Analytical technologies for proteomic and metabolomic analyses
- Definition of Experimental Space/ Profile Matrix – Omic data normalization and filtering methods
- Multivariate Statistical Analysis of Omic Data
- Introduction to Pathway & Network Analysis of omic data
- Introduction to integrated analyses of omic profiles in Systems Biology / New Directions

COMPUTER ROOM
- Databases PubMed/Medline, GenBank, UniProt
- Metabolic Databases (KEGG, Expasy, MetaCyc)
- Comparison between metabolic networks of model organisms
- Databases of protein protein interactions
- Comparison of Protein Protein Interaction Databases for various examples
- Introduction to the multivariate statistical analysis software of omic data TM4/MeV
- Using the software to analyze omic profiles
- Watching and discussing video on integrated analyses of omic data in systems biology (multi-omics)
- Watching and discussing video for biomolecular network analyses

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Yes; Use of ICT in teaching and communication with students through the e-class platform. In addition, the computer room is used for demonstration of biological databases and specialized bioinformatics software.	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures	26
	Lectures/Practice in the computer room	12
	Private study hours and exercise solving for the computer room practice every week	12
	Study and analysis of bibliography Preparation of an Oral Presentation of a Recent Publication Private study hours	25
	Course total	**75**
STUDENT PERFORMANCE EVALUATION	The students are evaluated from: • Their answers in exercises for the computer room practice • Oral presentation in front of the class of a recent publication in the fields of Bioinformatics/Systems Biology	

	• Written exam at the end of the semester including: ✓ Multiple-choice questions ✓ Questions requiring a short answer and justification ✓ Problem solving

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

- Malcolm Campbell & Laurie J. Heyer: Discovering Genomics, Proteomics & Bioinformatics Cold Spring Harbor Laboratory Press
- V. Helms. Principles of computational Biology: From Protein Complexes to Cellular Networks Wiley – VCH (κύρια για τον ορισμό των πρωτεϊνικών & μεταβολικών δικτύων)
- M. Klapa – Bioinformatics (Notes / Review Publications) [https://eclass.upatras.gr/courses/BIO378/]

Related academic journals:

Molecular Systems Biology
BMC Systems Biology
Bioinformatics
BMC Bioinformatics
Frontiers in Physiology – Systems Biology

2.25 BIODIVERSITY AND CONSERVATION BIOLOGY

1. GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_BBΔ**	**SEMESTER**	**H**
COURSE TITLE	BIODIVERSITY AND CONSERVATION BIOLOGY		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
	Lectures	2	3
COURSE TYPE	Scientific Area		
PREREQUISITE COURSES	Typically, there are no prerequisites. However, good knowledge of botany, zoology, mapping and assessment of ecosystems and ecology is recommended		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes (in English)		
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/BIO379/		

2. LEARNING OUTCOMES

Learning outcomes

At the end of the course the students will:
• be able to understand the pressures and threats to biodiversity at local and national level.
• be aware of the issues to biodiversity conservation at national, European and global level.
• have understood the designation and assessment principles of protected areas by integrating education, applied scientific research and sustainable management.

General Competences

At the end of the course the students will develop the following skills:
- detection and quantification capability
- ability to implement biodiversity assessment methods
- ability to use tools for the observation, conservation and management of threatened species/populations.

At the end of the course, the students will also develop the following general competencies:
1) Autonomous work
2) Teamwork
3) Production of new research ideas
4) Respect for the natural environment
5) Promoting free, creative and inductive thinking.

3. SYLLABUS

1. Introduction to conservation biology - subject, philosophical roots, ethical principles.
2. Biodiversity - general concepts and terms, genetic diversity, diversity of species, habitats, ecosystems, landscapes, worldwide biodiversity distribution.
3. The value of biodiversity - direct and indirect economic values, long-term view, existence value, environmental ethics.

4. Threats to Biodiversity - current situation and predictions, habitat destruction and fragmentation, environmental degradation and pollution, global climate change, biodiversity overexploitation, biological invasions and diseases.
5. Extinction - general concepts, rates of extinction at various ecosystems and levels, island biogeography and extinction rate predictions, problems of small population and extinction vortex.
6. Conserving populations and species - population dynamics, applied population biology, conservation categories, legal protection of species, establishing new populations, ex situ conservation strategies.
7 Protected areas - establishment and classification - design and managing, landscape ecology.
8. Conservation outside protected areas - public and private lands, working with local people, ecosystem management and restoration.
9. Sustainable management and development at the local level, conservation at the national level, funding and conservation education.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face to face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Support eLearning services through e-class platform	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures (13 weeks x 2 hours per week)	26
	Independent Study	124
	Course total	**150**
STUDENT PERFORMANCE EVALUATION	Written examinations (at the end of the semester), the theory of the course with 100% participation in the final grade. Scale: 1-10. Grade mark: 5	

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

1) Teachers' notes.
2) Primack R. B., Arianoutsou M. & Dimitrakopoulos P. 2017. A Primer of Conservation Biology (in Greek).
3) Primack R. B. 2012. A Primer of Conservation Biology, Boston University.
4) Morris W. F. & Doak D. F. 2002. Quantitative Conservation Biology: Theory and Practice of Population Analysis

Related academic journals:

2.26 HUMAN AND MEDICAL GENETICS

1. GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**ΒΙΟ_ΓΑΙ**	**SEMESTER**	**Η**
COURSE TITLE	HUMAN AND MEDICAL GENETICS		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
	Lectures	2	3
COURSE TYPE	Scientific		
PREREQUISITE COURSES	There is no prerequisite course, but good knowledge of Genetics and Molecular Genetics is desirable.		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek language		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes, in English language		
COURSE WEBSITE (URL)	www.biology.upatras.gr		

2. LEARNING OUTCOMES

Learning outcomes
At the end of the semester, the students will have gain of issues relative to genetic diseases and understand: 1. The contribution of Genetics in Modern Medicine. 2. The role of mutation on genetic diseases. 3. The use of molecular methodology to understand genetic diseases. 4. The importance of genetic councelling to avoid bitrh of humans with genetic diseases.
General Competences
• Autonomous work • Teamwork • Search, analyze and synthesize data and information, using the necessary technologies • Promote free, creative and inductive thinking

3. SYLLABUS

Genetic pedigrees and genetic diseases.
Using molecular methodology in Medical Genetics.
Human chromosomes.
Cytogenetics-structural and numerical chromosome aberrations.
Sex determination and differentiation. Abnormalities on sex determination.
Developmental genetics.
Genetics of blood groups.
Hemoglobin genes. Hemoglobin diseases-thalassemias.
Inborn error of metabolism.
Genetics of the immune system disorders.
Cancer genetics.
Pharmacogenetics-Pharmacogenomics.
Behavioral Genetics.
Human genome project.
Gene therapy.
Prenatal analysis and genetic counselling.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face to face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Lectures using slides and Power-Point presentations and support of learning through the e-class platform.	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures.	26
	Writing and oral presenting of a scientific project.	15
	Independent study.	34
	Course total	**75**
STUDENT PERFORMANCE EVALUATION	1. Theoretical written examinations at the end of the semester which evaluates student's acquired knowledge and critical and creating thinking. Greek grading scale: 1 to 10. Minimum passing: 5. *(Optional) written assay on a topic of the module which accounts for 20% of the final mark.	

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

R. L. Nussbaum et al.: Thomson & Thomson. «Genetics in Medicine» (Greek translation, 7th ed., Paschalidis Ed.)

Related academic journals:

2.27 ADVANCED TOPICS IN BOTANY

1. GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_EMB**	**SEMESTER**	**F**
COURSE TITLE	**ADVANCED TOPICS IN BOTANY**		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures, seminars, and Multimedia displays	2	6
Laboratory work & exercises	3	
Educational field–work	1 daily excursion	

COURSE TYPE	Field of Science
PREREQUISITE COURSES	The students should possess basic knowledge provided through the previously taught theoretical courses 'Plant Biology', 'Ecology' and 'Evolution'
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek. Teaching may be however performed in English in case foreign Erasmus students attend the course.
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/BIO357/

2. LEARNING OUTCOMES

Learning outcomes

By the end of this course the student will be able to:

1. Understand the basic principles and processes of speciation, as well as the reasons underlying the creation of endemism, diversity and biogeographical patterns on a global and local scale
2. Understand the fundamentals of conservation biology and the relevant risk categories of the rare, protected, threatened and endangered plant taxa
3. Understand how many endemic plant taxa exist in Greece, if there are any endemic diversity hotspots in Greece, where are these hotspots located and the reasons why they were created
4. Distinguish the rare, threatened and protected plant taxa of Greece
5. Handle the most recent and widely used protocols for the monitoring of rare, protected and endangered species
6. Perform a Population Viability Analysis, as well as to determine the size of the Minimum Viable Population
7. Estimate the extinction risk of rare, endemic and protected plant taxa via a Species Distribution Modelling framework
8. Apply the ecological principles in environmental assessment and management of environmental issues
9. Evaluate the biodiversity conservation as well as the climate change results in ecosystems and natural environment
10. Strengthen their efficiency to compile information in a coherent system/unit

At the end of this course the student will have further developed the following skills/ competences:

1. Ability to demonstrate knowledge and understanding of essential facts, concepts, principles and theories of Ecology, Evolution, Conservation Biology and Biogeography
2. Ability to apply such knowledge and understanding to the solution of ecological issues
3. Ability to interact with others on environmental multidisciplinary problems
4. Study skills needed for continuing professional development

General Competences

Generally, by the end of this course the student will, furthermore, have develop the following general abilities (from the list above):
Adaptation to new situations
Decision making
Autonomous (Independent) work
Group work
Exercise of criticism and self–criticism
Promotion of free, creative and inductive thinking
Respect to natural environment
Work design and management

3. SYLLABUS

Plant speciation and endemism patterns – Reproductive isolation mechanisms – Categories of endemic taxa – Endemism indices
Causes of plant speciation and relevant patterns in Greece – Altitudinal endemism – Refugia in time and space
Plant diversity patterns at the global and local scale
Plant diversity in Greece – Richest families, their morphological characteristics and most prominent representatives
Natural and Anthropogenic extinctions – Causes and consequences of climate change on plant diversity at the global and local scale
Extinct, Rediscovered and Newly–Described Greek endemic plant taxa – Top–50 rare Mediterranean plants – Distribution of the Greek endemic, rare, endangered and protected plant taxa
History, principles, values and ethics of Conservation Biology – Global Strategy for the Conservation of plant diversity
International Union for the Protection of Nature (IUCN) – Red Data Book – Rare, Threatened and Endangered Endemics of Greece – Risk categories – Rarest Greek endemic plant taxa – Greek endemic plant taxa facing extinction
The Legal Foundations of Conservation Biology – National and International Legislation for the protection of plant taxa – Current plant protection status in Greece – Relevant examples
Protocols for the monitoring of rare, protected, threatened and endangered species of the Greek flora – Relevant examples
Population conservation biology - Basic concepts - Population Viability Analysis - Using PVA to identify the possible threats in situ populations are facing - Causes of population decline and response strategies - Minimum Viable Population - Invasive species and other threats
Conservation actions for the endemic, rare, threatened and protected plant taxa - Ex situ & in situ conservation - Impact of management actions and climate change - Guidelines for the implementation of conservation actions.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Lectures, seminars and laboratory work face to face.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of Information and Communication Technologies (ICTs) (e.g. PowerPoint) in teaching. Support of the learning process through the e–class platform. A series of pdf files, containing

<table>
<tr><td></td><td colspan="2">each week's lecture, is uploaded in the aforementioned platform; thus, the students can have easy and free access to the lecture notes.
The students learn innovative statistical techniques via the R programming language and the freeware R–Studio application</td></tr>
<tr><td rowspan="8">TEACHING METHODS</td><td>Activity</td><td>Semester workload</td></tr>
<tr><td>Lectures (2 conduct hours per week x 13 weeks)</td><td>26</td></tr>
<tr><td>Field work</td><td>8</td></tr>
<tr><td>Laboratory exercises (3 conduct hours per week x 13 weeks)</td><td>39</td></tr>
<tr><td>Optionally, preparation of home–works from groups of two or three students each</td><td>21</td></tr>
<tr><td>Bibliographical search and study</td><td>20</td></tr>
<tr><td>Hours for private study of the student and preparation of home–works and reports, for the Laboratory, and preparation for the Laboratory (study of techniques and theory)</td><td>36</td></tr>
<tr><td>Course total</td><td>150</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION</td><td colspan="2">Written examination of weekly Laboratory exercises (80%).

Preparation and Presentation of group work (20%).
Passing grade:5</td></tr>
</table>

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

- Whittaker, R.J. & Fernández–Palacios, J.–M. **2009**. Island biogeography. Ecology, evolution and conservation. Oxford University Press]
- Primack, R.B. **2014**. Essentials of Conservation Biology. 6th ed. Sinauer Associates Inc.
- Morris, W.F. & Doak, D.F. **2002**. Quantitative conservation biology. Theory and practice of population viability analysis. Sinauer Associates Inc.
- Walker, T. **2013** Plant conservation. Why it matters and how it works. Timber Press.
- Thompson, J.D. **2005**. Plant evolution in the Mediterranean. Oxford University Press.
- Gibson, D.J. **2015**. Methods in Comparative Plant population Ecology. 2nd ed. Oxford University Press.
- Allendorf, F.W., Luikart, G. & Aitken, S.N. **2013**. Conservation and the genetics of populations. 2nd ed. Wiley–Blackwell.
- Bramwell, D. & Caujapé–Castells, J. **2011**. The biology of island floras. Cambridge University Press.
- Stuessy, T.F. & Ono, M. **1998**. Evolution and speciation of island plants. Cambridge University Press.
- Cody, M.L. **2006**. Plants on Islands. Diversity and dynamics on a continental archipelago. University of California Press.
- van Dyke, F. **2010**. Conservation Biology. Foundations, Concepts, Applications. 2nd ed. Springer.
- Leadlay, E. & Jury, S. **2006**. Taxonomy and Plant conservation. Cambridge University Press.
- Ladle, R.J. & Whittaker, R.J. **2011**. Conservation Biogeography. Blackwell Publishing Ltd.
- Primack, R.B. **2012**. A Primer of Conservation Biology. 5th ed. Sinauer Associates Inc.
- Copsey, J.A., Black, S.A., Groombridge, J.J. & Jones, C.J. **2018**. Species conservation. Lessons from islands. Cambridge University Press.
- Burns, K.C. **2019**. Evolution in isolation. The search for an island syndrome in plants. Cambridge University Press.
- Bromham, L. & Cardillo, M. **2019**. Origins of biodiversity. Oxford University Press.
- Cox, C.B., Moore, P.D. & Ladle, R.J. **2016**. Biogeography. An ecological and evolutionary approach. 9th ed. Wiley Blackwell.

- Lomolino, M.V., Riddle, B.R. & Whittaker, R.J. **2017**. Biogeography. Biological diversity across space and time. 5th ed. Sinauer Associates.
- Hoorn, C., Perrigo, A. & Antonelli, A. **2018**. Mountains, Climate and Biodiversity. Wiley Blackwell.
- Lecture notes in Greek [E–class Advanced topics in Botany] – (BIO357, https://eclass.upatras.gr/courses/BIO357/)

Related academic journals:

2.28 SPECIAL COURSE IN HUMAN PHYSIOLOGY

1. GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_ΕΦΑ**	**SEMESTER**	**F**
COURSE TITLE	SPECIAL COURSE IN HUMAN PHYSIOLOGY		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
	Lectures	2	3
COURSE TYPE	Field of Science Skills Development		
PREREQUISITE COURSES	There are no prerequisites. However, a good knowledge of Animal Physiology and Biochemistry is recommended.		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO		
COURSE WEBSITE (URL)	NO		

2. LEARNING OUTCOMES

Learning outcomes

At the end of this course the student should be able to:

- acquired knowledge on subjects related to Human Physiology.
- Familiarized themselves with medical terms and the use of novel high-throughput techniques for studying the pathophysiology of diseases.

General Competences

At the end of the course, students should have accomplished the following abilities:

1. to comprehend subjects related to special courses in Human pathophysiology (tissue/organ pathophysiology, bone pathophysiology, reproductive System dysfunctions, atherogenesis, nutrition and metabolism regulation of food intake, stress adaptation etc. Subjects related to novel, high-throughput techniques and their application to human diseases/diagnosis (e.g. microarrays, proteomics).
2. to retrieve related scientific information on Human Physiology.
3. to write assays on Human Physiology.
4. team-working.
5. to prepare power-point presentations.

3. SYLLABUS

Special aspects of human physiology such as:

- Tissue/organ pathophysiology (e.g. mechanisms of atherogenesis and therapeutic approach, connective tissue pathologies, blood diseases, bone pathophysiology, etc.).
- Reproductive System dysfunctions.
- Stress adaptation.
- Nutrition and metabolism.
- Regulation of food intake.

Subjects related to novel, high-throughput techniques and their application to human diseases/diagnosis (e.g. microarrays, proteomics).

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face to face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Support of educational procedure with use of the e-class electronic platform	
TEACHING METHODS	***Activity***	***Semester workload***
	Lectures (13 weeks x 2 hours per week)	26
	Home study	49
	Course total	**75**
STUDENT PERFORMANCE EVALUATION	Written exams at the end of semester (60% and oral presentations 40 % or 100 % without assay and oral presentation). Final Course Grade: Theory Grade x 0.6 + x 0.4 assay and oral presentation or Theory Grade Grading scale: 1-10. Passing grade ≥ 5	

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

1. Boron W.F. & Boulpaep E.L. «*Medical Physiology- cellular & molecular approaches*», Part I, II, & III, Medical Publisher Pasxalidis, Athens 2006 (in greek, selected issues).
2. Vander, A., Sherman, J., Luciano, D. & Tsakopoulos, M. «*Human Physiology*». Parts I & II, Medical Publishing Pasxalidis, Athens 2001 (in greek, selected issues).
3. Kumar V., Cotran R.S. & Robbins S.L. «*Basic Pathology-Anatomy*». Scientific Publishing Gr. Parisianos, Athens 2000 (in greek, selected issues).
4. Berne R.M. & Levy M.N.: «*Principles of Physiology*». Parts I & II. Crete University Publishing, Crete 1999 (in greek, selected issues).
5. Guyton A, «***Human Physiology***», 3rd Edition. Medical Publishing Litsas, Athens 1984 (in greek, selected issues).
6. Karlson P., Gerok W. & Grob W.: «Clinical Pathological Biochemistry», Medical Publishing Litsas, Athens 1980 (in greek, selected issues).

Related academic journals:

2.29 APPLIED BIOSTATISTICS

1. GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	PREGRADUATE		
COURSE CODE	**BIO_EBΣ**	**SEMESTER**	**F**
COURSE TITLE	APPLIED BIOSTATISTICS		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	3	
Laboratory Exercises	1	
Total	4	6

COURSE TYPE	1) Specialised general knowledge, 2) Skills development
PREREQUISITE COURSES	NO
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO
COURSE WEBSITE (URL)	

2. LEARNING OUTCOMES

Learning outcomes
The aim of the course is to combine theory and practice and present the basic statistical methods of data collection, presentation and analysis in the field of life sciences. Emphasis is placed on the applied approach of concepts and methods, through the presentation of a large number of examples and actual applications from the individual fields of the life sciences. The teaching of statistical methods is done while familiarizing students with the use of computers and appropriate statistical packages for the organization and analysis of biological data. Upon successful completion of the course students should be able to: (1) be able to design basic biological experiments and sampling, (2) be able to analyze quantitative biological data by query and data type using appropriate software.
General Competences
At the end of the course, students will have developed the following skills: (1) Ability to design simple but valid experiments for the study of organism biology & ecology, (2) Ability to analyze primary quantitative biological data using appropriate software, (3) ability to evaluate and present quantitative analyzes.

3. SYLLABUS

1. Basic concepts and nature of quantitative biological data
2. Descriptive Statistics: Description of data in frequency tables. Description of data in charts. Description of data according to the distribution scheme. Description of data with numerical summary measures
3. Study Design & Data Collection
4. Conclusions - Inductive Statistics: From the sample to the population. Statistical inference. Probability, risk and odds.
5. Confidence - Estimation of Confidence Intervals: Estimation of confidence intervals for the value of a population parameter. Estimation of the difference between two population parameters. Estimation of the ratio of two population parameters.

6. Hypothesis Testing: Hypothesis testing for the difference between two population parameters. Analysis of Variance. Non-Parametric Methods. Tests for the ratio of two population parameters. Population equality tests: the chi-square test (x2). Contingency Tables.
7. Relations, Correlation & Agreement: Evaluating the correlation between two variables. Assessment of the degree of agreement.
8. Dependency, Linear & Logistic Regression: Simple Linear Regression. Multiple Linear Regression. Logistic Regression
9. Survival Analysis

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face to Face.	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	1) Use of computers and special software during the course by the instructors and the students. 2) Support of educational procedure with use of the e-class electronic platform.	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures (13 weeks x 3 hours per week)	39
	Laboratory Exercises (10 weeks X 1)	10
	Home study	101
	Course total	**150**
STUDENT PERFORMANCE EVALUATION	Written exams at the semester's end. Grading scale: 1-10. Passing grade: 5	

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

- Bowers D. (2011). Fundamental concepts in Biostatistics. Paschalides Editions.
- Pagano M, Gauvreau K (2002). Principles of Biostatistics. Editions G. PARIKOS & CO.
- Dytham C (2003) Choosing and Using Statistics. Blackwell Science.
- Quinn GP, Keough MJ (2002) Experimental Design and Data Analysis for Biologists. Cambridge University Press.
- Ruxton CD, Colegrave N (2003) Experimental Design for the Life Sciences. Oxford University Press.
- Zar JH (1998) Biostatistical Analysis. Prentice Hall.

Related academic journals:

2.30 APPLIED MICROBIOLOGY

1. GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_EMK**	**SEMESTER**	**H**
COURSE TITLE	APPLIED MICROBIOLOGY		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures, laboratory exercises		5	6
COURSE TYPE	Specialised general knowledge		
PREREQUISITE COURSES	There are no prerequisite courses. However, knowledge of General Microbiology, Biochemistry and Molecular Biology is desirable.		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO		
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/BIO241/		

2. LEARNING OUTCOMES

Learning outcomes
Students will understand the phenomenon of microbial growth in batch and continuous systems and the techniques for development of balance equations for biomass and substrate. They will study the various bioreactor systems (chemostatic, nephelostatic) and the metabolic pathways used by microorganisms to assimilate the different carbon sources, and how metabolism is regulated at molecular level during the growth cycle.
General Competences
Search for analysis and synthesis of data and information, with the use of the necessary technology, Working independently, Team work, Working in an interdisciplinary environment Production of new research ideas, Respect for the natural environment, Production of free, creative and inductive thinking.

3. SYLLABUS

Introduction. The phenomenon of microbial growth, Monod kinetics, substrate inhibition. Control of microbial growth, sterilization. Microbial growth kinetics in batch and continuous systems, dynamic equilibrium. The single-stage chemostat. Deviations from the mathematical model. Chemostat with cell recycling. Multi-stage chemostate. Growth of microorganisms on solid substrates. Transport phenomena and bioreactor design. Impact of physicochemical environment on microbial growth. Aeration and agitation systems. Heat production during fermentation. Catabolism of significant carbon sources, catabolic repression. Biotechnological applications of Microbiology in Pharmaceutical, Food and Chemical industries and environmental applications. Single cell protein. Single cell oil. Biofuels, organic acids, amino acids, solvents. Enzymes, antibiotics, steroids. Food production.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face, Distance learning	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	YES	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures	26

	Laboratory practice	35
	Non-directed study	89
	Course total	**150**
STUDENT PERFORMANCE EVALUATION	Short Answer Questions, Problem Solving, Oral Test, Laboratory Work. The evaluation criteria are stated in the syllabus and analysed at the beginning of the semester. Grading scale: 1-10 Passing grade: 5	

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

MICROBIOLOGY AND MICROBIAL TECHNOLOGY (IN GREEK), 2ND EDITION 2017, GEORGE AGGELIS, UNIBOOKS PUBLISHERS, ATHENS

Related academic journals:

Microbiology UK, Applied Microbiology and Biotechnology, Journal of Applied Microbiology, Applied and Environmental Microbiology, Annals of Microbiology, Nature, Nature Microbiology Reviews.

2.31 MARINE ECOLOGY

1. GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_ΘΟΛ**	**SEMESTER**	**F**
COURSE TITLE	MARINE ECOLOGY		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures, Laboratory Exercises, Field Work Exercise		5	6
COURSE TYPE	Field of Science, Skills Development		
PREREQUISITE COURSES	NO		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes (in English)		
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/BIO224/		

2. LEARNING OUTCOMES

Learning outcomes
In the end of the course the student should be able to: 1. understand the principles of physical and chemical oceanography 2. discuss issues relevant to the processes regulating primary and microbial productivity 3. comprehend the structure and functioning of the pelagic and the benthic environment and their interaction 4. perceive the principles of fisheries biology 5. comprehend the role of human-induced effects on the marine environment.
General Competences
By the end of this course the student will have developed the following **General Abilities**: 1. Autonomous (Independent) work 2. Group work 3. Generation of new research ideas 4. Respect for the natural environment 5. Development of free, creative and inductive thinking Additionally, by the end of this course the student will have developed the following **Special skills/competence**s: 1. ability to measure basic environmental parameters 2. knowledge of methods for the collection of plankton and benthic samples 3. ability to identify basic taxa from plankton and benthos 4. ability to evaluate the effects of environmental characteristics on the distribution of marine organisms.

3. SYLLABUS

Classification of marine environments and marine organisms. The abiotic environment. Phytoplankton and primary production. Zooplankton. Nekton and fisheries biology. Benthic communities. Energy flow and mineral cycling. Human impacts on marine biota.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	PowerPoint presentations. Support of educational procedure using the e-class electronic platform.	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures (13 weeks x 2 hours per week)	26
	Laboratory exercises (6 weeks x 3 hours per week)	18
	Field exercise	6
	Home study	100
	Course total	**150**
STUDENT PERFORMANCE EVALUATION	Written exams (at the semester's end), in Course theory and lab. Language: Greek. Exams through short answer questions. Final Course Grade: Theory Grade x 0.9 + Laboratory Grade x 0.1 Grading scale: 1-10. Passing grade: 5	

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

1. Castro P., Huber ME 2015. Marine Biology. Utopia Editions. (in Greek)
2. Nybakken JW 2009 (6th edition). Marine Biology – An Ecological Approach. (in Greek)

Related academic journals:

2.32 CLINICAL CHEMISTRY

1. GENERAL

SCHOOL	SCHOOL OF NATURAL SCIENCES		
ACADEMIC UNIT	DEPARTMENT OF BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_ΚΛΧ**	**SEMESTER**	**F**
COURSE TITLE	CLINICAL CHEMISTRY		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures		2	6
Practical exercises		3	
COURSE TYPE	Scientific specialized background		
PREREQUISITE COURSES	Formally, there are no prerequisite courses. However, knowledge of Human Physiology and Immunology are recommended		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS			
COURSE WEBSITE (URL)			

2. LEARNING OUTCOMES

Learning outcomes
The students will learn how basic clinical analyses (general blood tests, biochemical tests, immunological analyses etc.) are performed in a Clinical Laboratory, and how they can check and give reliable results.
General Competences
Search for, analysis and synthesis of data and information, with the use of the necessary technology. Decision-making.

3. SYLLABUS

1. Clinical Laboratory techniques, Clinical lab accreditation
2. Anemia-General blood tests
3. Renal function tests
4. Myocardial infraction biochemical tests, Hypertension
5. Liver function tests
6. Glucose and lipid metabolism check
7. Thyroid function tests
8. Hormones
9. Viral infections
10. Laboratory aspects of cancer
11. Immunological disorders
12. Drag determination, Reliability of results

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face to face lectures in classroom and lab
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Communication via e-class.

	Lectures with power point presentation and online videos.	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures	24
	Lab practice	15
	Tutorials	6
	Educational visits	4
	Study	101
	Course total	
STUDENT PERFORMANCE EVALUATION	Every lab exercise if followed by a test with questions of short answers and mathematical problems. The average of these tests consists the 20% of the final degree. The final examination of the course includes questions of judgement and table filling which combine analyses results and biological fluids. The grade of the final test consists the 80% of the final rating, along with the 20% of the lab tests. The evaluation criteria are mentioned at the e-class of the course. Grading scale: 1-10. Passing grade: 5	

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

- Σκορίλας Α. Αρχές Κλινικής Χημείας και Μοριακής Διαγνωστικής. Εκδόσεις Συμμετρία
- Kaplan A. Κλινική Χημεία. Εκδόσεις Πασχαλίδη

Related academic journals:

Tietz Textbook of Clinical Chemistry and Molecular Diagnostics (TIETZ TEXTBOOK OF CLINICAL CHEMISTRY) Carl A. Burtis, Edward R. Ashwood, David E. Bruns

2.33 INSTRUMENTAL ANALYSIS OF BIOMOLECULES

1. GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_MEA**	**SEMESTER**	**H**
COURSE TITLE	INSTRUMENTAL ANALYSIS OF BIOMOLECULES		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
	Lectures	3	3
COURSE TYPE	Scientific Field		
PREREQUISITE COURSES	None		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek and English in case that foreign students participate		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes		
COURSE WEBSITE (URL)	No		

2. LEARNING OUTCOMES

Learning outcomes
By the completion of the course the students should: • Have a good understanding of the biochemical, physicochemical, crystallographic, immunological, and recombinant DNA techniques that are analyzed in the course and an understanding of their theoretical background. • Know which of these technics should be used in order to answer scientific questions.
General Competences
By the completion of the course the student should gain: • The ability to critically read scientific papers that use the above techniques. • The ability to start research in fields that use the above techniques. • The competence to teach High School students. • The aptitude to continue their graduate studies in Biomedical Sciences.

3. SYLLABUS

UV-Vis Spectrophotometry. Fluorescence, Chemiluminescence, Phosphorescence. IR Spectroscopy. Atomic Absorption, Atomic Emission and Atomic Fluorescence Spectrometry. Mass Spectrometry.Thin layer Chromatography, Column Chromatography (gel permeation, ion-exchange, adsorption, affinity), HPLC (types and methodology), Horizontal electrophoresis (cellulose acetate and agarose), Vertical electrophoresis in polyacrylamide gels, Isoelectric focusing, Two-dimensional electrophoresis, Analytical and Preparative Ultracentrifugation. Crystallization methods of Biological macromolecules. Introduction in computational biology: Scattering of electromagnetic radiation, X-ray diffraction, crystal symmetry, point groups & space groups, introduction in Fourier transforms, structure factor, the convolution theorem and its applications, The Patterson function, the phase problem and Structure solution methodologies (MIR, MAD, molecular replacement, direct methods). Recombinant DNA technology. Flow cytometry: principles, sample preparation and staining with antibodies, data analysis using the CellQuest programme. Cr^{51}–release assay for the assessment of NK cell cytotoxic activity.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face to face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Power point, e-class	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures	39
	Independent study	36
	Course total	**75**
STUDENT PERFORMANCE EVALUATION	The student assessment language is Greek. The assessment is based on final written exams (50%) and paper analysis (50%). Foreign students can take the exams in English. The students are informed about the assessment criteria during the first day of class. Grading scale: 1-10 Passing grade: 5	

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

- Protein Crystallization, Second Edition, edited by Terese Bergfors, IUL Biotechnology Series
- Fundamentals of Crystallography, C. Giacovazzo, H.L. Monaco, G. Artioli, D. Viterbo, G. Ferraris, G. Gilli, G. Zanotti, M. Catti, Edited by C. Giacovazzo, International Union of Crystallography (IUCr), Oxford Science Publications
- Gene Cloning and DNA Analysis: An Introduction, Brown T.A., Edited by John Wiley & Sons, Ltd., Publication, 7th edition.
- Recombinant DNA: Genes and Genomes - A Short Course, Watson J.D., Caudy A.A., Myers R.M., Witkowski J.A., Edited by New York: W.H. Freeman: Cold Spring Harbor Laboratory Press, 3rd edition.
- **Lippincott Illustrated Reviews: Immunology, Viselli S., Melvold R., Edited by Lippicot Williams & Wilkins, 2nd edition.**
- **Notes.**

2.34 ENGLISH FOR BIOLOGY

1. GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**ΒΙΟ_ΑΓΓ**	**SEMESTER**	**F**
COURSE TITLE	ENGLISH FOR BIOLOGY		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
	Lectures	2	3
COURSE TYPE	ENGLISH FOR SPECIFIC PURPOSES AND ACADEMIC SKILLS		
PREREQUISITE COURSES	INTERMEDIATE/ADVANCED ENGLISH		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	ENGLISH		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	http://languages.upatras.gr		

2. LEARNING OUTCOMES

Learning outcomes

AT THE END OF THIS COURSE STUDENTS SHOULD:

- BE FAMILIARISED WITH THE LANGUAGE AND STYLE OF BIOLOGY TEXTS IN DIFFERENT GENRES
- BE ABLE TO READ TEXTBOOKS AND RESEARCH ARTICLES EFFECTIVELY
- BE ABLE TO IDENTIFY THE MAIN POINTS IN TEXTS, SUMMARISE AND PARAPHRASE
- BE ABLE TO DISCUSS SCIENCE TOPICS IN ENGLISH
- BE ABLE TO WRITE COHESIVELY AND APPROPRIATELY PARAGRAPHS AND TEXTS RELATED TO THE DISCIPLINE

General Competences

1. ABILITY TO UNDERSTAND DIFFERENT TEXT TYPES IN BIOLOGY WRITTEN IN ENGLISH (TEXTBOOKS, POPULARISED AND SCIENTIFIC JOURNALS) AND PERCEIVE THE LINGUISTIC, STRUCTURAL AND STYLISTIC DIFFERENCES STEMMING FROM THE VARYING PURPOSES OF TEXTS AND EXPECTED READERS. WRITING SKILLS COULD DEVELOP AS WELL.
2. ABILITY TO UNDERSTAND AND COMMUNICATE ORALLY IN ENGLISH IN SITUATIONS RELATED TO THE DISCIPLINE AND TO MAKE PRESENTATIONS WHICH WILL PREPARE THEM FOR FUTURE PRESENTATIONS IN INTERNATIONAL CONTEXTS.
3. TO USE SPECIFIC WEBSITES FOR FURTHER PRACTICE AND INDEPENDENT LEARNING.
4. TO WORK INDIVIDUALLY AND IN PAIRS AND GROUPS.
5. TO READ CRITICALLY.
6. PROMOTION OF CREATIVE AND INDUCTIVE THINKING.

3. SYLLABUS

METHODS IN SCIENCE/BIOLOGY. CONTRUCTION OF KNOWLEDGE
OBJECTS OF STUDY AND FIELDS IN BIOLOGY
TYPES OF LIVING ORGANISMS-PROTOZOA
DESCRIPTION OF SHAPES AND PARTS OF ORGANISMS
PLANTS AND ANIMALS: SIMILARITIES AND DIFFERENCES; ANIMAL BEHAVIOUR
AUTOTROPHS-HETEROTROPHS
PHYTOSYNTHESIS
GENETICS-CLONING
RESEARCH ARTICLES
ONE POPULARISED ARTICLE

ACADEMIC SUBSKILLS: WRITING REFERENCES, SUMMARISING, PARAPHRASING, USING OTHER WRITERS' WORK WITH APPROPRIATE ATTRIBUTION.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	FACE-TO-FACE	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	USE OF COMPUTERS IN THE SESSIONS NEEDED, IN POWER-POINT PRESENTATIONS OF PROJECTS AND IN COMMUNICATING WITH STUDENTS.	
TEACHING METHODS	*Activity*	*Semester workload*
	INTERACTIVE TEACHING	60
	PROJECT	15
	Course total	**75**
STUDENT PERFORMANCE EVALUATION	PASSING GRADE: 5 (FROM A SCALE OF 1-10) WRITTEN EXAM PROJECT ACTIVE PARTICIPATION IN THE LESSONS. EVALUATION CRITERIA ARE GINEN IN CLASS AND ON E-CLASS.	

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

- English in Biological Science (1978) Pearson I., O.U.P.
- Collins Cobuild - Key Words In Science and Technology (Collins Cobuild usage) (1997) Mascull. Collins Cobuild.
- Popularised articles from electronic newspapers
- Biology for AP Courses, Openstax, Rice University (free, available online). 2018
- Biology Neil A. Campbell and Jane Reece (2016) University of California, Riverside.
- https://theconversation.com/uk

Related academic journals:

1. https://www.pnas.org/
2. https://www.jove.com/journal/biology

2.35 VEGETATION ECOLOGY

1. GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_OBΛ**	**SEMESTER**	**H**
COURSE TITLE	VEGETATION ECOLOGY		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures, seminars, and Multimedia displays	2	6
Laboratory work & exercises	3	
Educational field-work	One or 2 daily excursions	

COURSE TYPE	Field of Science
PREREQUISITE COURSES	Typically, there are not prerequisite course. Essentially, the students should possess: (a) knowledge provided through the previously taught theoretical courses ''Plant Biology'', 'Zoology'' and ''Science of general Biology'', and (b) laboratory skills obtained through the previously attended laboratory courses.
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek. Teaching may be however performed in English in case foreign Erasmus students attend the course.
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes in English e.g. for Erasmus students
COURSE WEBSITE (URL)	http:// eclass.upatras.gr/courses/bio233

2. LEARNING OUTCOMES

Learning outcomes
By the end of this course the student will be able to: 1. Understand the basic principles of plant communities and their environment. 2. Gain fundamental knowledge on the composition, structure, ecology, diversity, distribution and dynamics of plant communities. 3. Evaluate the functional adaptations to the abiotic and biotic processes governing plant communities. 4. Apply the vegetation ecology principles in nature management, restoration ecology and global change studies. At the end of this course the student will have further developed the following skills/ competences: 1. Ability to demonstrate knowledge and understanding of essential facts, concepts, principles and theories of Vegetation Ecology. 2. Ability to apply such knowledge and understanding to the conservation of natural habitats and to the solution of ecological issues. 3. Ability to interact with others on environmental management of nature, protected areas and their plant communities. 4. Study skills needed for continuing professional development.
General Competences
Generally, by the end of this course the student will, furthermore, have develop the following general abilities (from the list above): • Adaptation to new situations • Decision making

- Autonomous (Independent) work
- Group work
- Exercise of criticism and self-criticism
- Promotion of free, creative and inductive thinking
- Respect to natural environment
- Work design and management

3. SYLLABUS

- Introduction to Vegetation Ecology
- Environmental parameters. Weather and climate. Soil and soil properties. The ecological role of soils.
- Plant communities. Habitat types and plant associations. Plant units/ biomes. Global distribution of plant biomes.
- Biogeographical regions. Bioclimatic and vegetation belts/zones. Vegetation zones of Greece. Succession of Vegetation
- The structure and dynamics of plant communities in Mediterranean type ecosystems. Mediterranean type ecosystems and fire. Desertification and grazing on Mediterranean type ecosystems.
- Wetlands. Functions and values of wetland ecosystems. Flora and vegetation of wetland types.
- Ago-ecosystems. Structure and function of agro-ecosystems.
- Monitoring. Plant species as bio indicators.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Lectures, seminars and laboratory work face to face.	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of Information and Communication Technologies (ICTs) (e.g. PowerPoint) in teaching. The lectures content of the course for each chapter are uploaded on the internet, in the form of a series of ppt files, where from the students can freely download them.	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures (2 conduct hours per week x 13 weeks)	36
	Laboratory exercises/work (3 conduct hours per week x 13 weeks)	39
	Field work	31
	Hours for private study of the student and preparation of home-works)	44
	Course total	**150**
STUDENT PERFORMANCE EVALUATION	Written examination at the end of semester Grading scale: 1-10. Passing grade: 5	

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

- Γεωργιάδης Θ. **2009**. *Οικολογία Βλάστησης*. Εκδόσεις Παν/μίου Πατρών.
- Δημόπουλος Π. & Πανίτσα Μ., **2017**. Οικολογία Φυτών, Εκδόσεις Κατάγραμμα
- Ellenberg H. **1988**. *Vegetation Ecology of Central Europe*. 4th Edition, Cambridge University Press
- Martin Kent. & P. Coker, **1994**. *Vegetation Description and Analysis. A Practical Approach.* John Wiley & Sons Ltd, 363pp.
- Holmes N., Boon P. & Rowell. T, **1999**. *Vegetation communities of British Rivers –a revised classification*. JNCC, 114pp.
- Rodwell J. (Editor) **2000**. *British Plant Communities.* Volumes 1-5. Cambridge University Press

- Barbour M, Burk J & Pitts W **1980**. *Terrestrial Plant Ecology*. Menlo Park, California.
- Dobson M & Frid C **1998**. *Ecology of Aquatic Systems*. Longman Ltd. 215pp.
- Moss B **1999**. *Ecology of freshwaters*. Blackwell Science, 6th Edition.
- Notes of lecturers in Greek [ΗΛΕΚΤΡΟΝΙΚΑ ΜΑΘΗΜΑΤΑ ΟΙΚΟΛΟΓΙΑ ΙΙ] – (BIO233, eclass.upatras.gr)

Related academic journals:

2.36 PLANT ECOPHYSIOLOGY

1. GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_0ΦΦ**	**SEMESTER**	**F**
COURSE TITLE	PLANT ECOPHYSIOLOGY		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures, laboratory exercises		4	6
COURSE TYPE	General background, special background, specialised general knowledge.		
PREREQUISITE COURSES	There are no prerequisite courses. Students are recommended to have passed examinations in Plant Physiology		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No		
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/BIO215/		

2. LEARNING OUTCOMES

Learning outcomes
At the end of this course the student is expected : 1.to have understand the basic mechanisms by which the environment affects the physiological functions of plants. 2.to know the main adaptations of plants against the environmental stresses 3.to be trained through the exercises, in the methodology of anatomical, morphological, physiological and biochemical measurements for the practical assessment of the degree of stress as well as the adaptive responses of the plants. At the end of this course the student will have further developed the ability: 1.to recognize the primary environmental factor that stresses a plant. 2.to use the existing equipment of a familiar laboratory in order to address more effectively an ecophysiological question. 3.to collaborate with team members in order to resolve research problems. 4.to process (using basic computer programs), evaluate and present in audience the experimental results.
General Competences
• Retrieve, analyse and synthesise data and information, with the use of necessary technologies • Work autonomously • Work in teams • Advance free, creative and causative thinking • Respect natural environment

3. SYLLABUS

First Part Environmental factors.

1. Light as energy - Solar radiation as a source of energy and information. The leaf as a receiver of solar radiation. (Examples of field experimentation).
2. The dependence of photosynthesis on light (Ecophysiological approach and field experimentation)
3. . The dependence of photosynthesis on water availability. (Ecophysiological approach and field experimentation)
4. The effect of leaf growth and age of the plant on photosynthesis. (Examples of field experimentation)
5. Photoprotection of plants growingn in Mediterranean-type environments. (Examples of field experimentation)

6. The effect of flowering on photosynthesis. (Examples of field experimentation)
7. The carbon balance of the plant. The carbon balance of communities.
8. The temperature - The temperature relationships in plants. The characteristics of the cold climate. Adaptations of plants to the arctic and alpine environment. (Ecophysiological approach and field experimentation)

Second Part Interactions between plants and their biotic environment

1. Plant secondary metabolites - Structure and biosynthesis of phenolic compounds, terpenoids and alkaloids. Interrelations of primary and secondary metabolism. The roles of secondary metabolites in plants.
2. Biochemical interactions among plants - Allelopathy. Allelopathy in desert plants. Allelopathy in Mediterranean ecosystems.
3. Defence against herbivores - Feeding deterrents. Plant toxins: non-protein amino acids, cyanogenic glycosides, alkaloids, cardenolides, saponines. Hormonal interactions between plants and animals: plant-produced estrogens and androgens, hormones of insect metamorphosis in plants (phytoecdysones).
4. Defence against microbial pathogens - Phytoalexins. Pathotoxins. 5.Attraction of herbivorous insects and pollinators - Insect pheromones produced by plants. The biochemistry of pollination. The role of odor. The role of color. Pollinator reward: pollen and nectar, nutritional value.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Lectures in classroom face-to-face, laboratory practice and field practice	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Lectures using contemporary methods. Compulsory practicals. Complementary usage of the e-class (open class) platform.	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures	26
	Laboratory practice	24
	Independent study and analysis of bibliography	78
	Study/ preparation of individual or group essay	22
	Course total	**150**
STUDENT PERFORMANCE EVALUATION	Compulsory written examination in both theory and laboratory practical. In addition, during laboratory practical the students process and discuss the experimental results of each exercise in an essay. Grading scale: 1-10 Passing grade: 5	

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

- Physiological Plant Ecology. Larcher W. Springer, 1995.
- Plant Ecology E.D Sculze, E.Beck, K.Muller-Hohenstein. Springer, 2005.
- Plant Ecophysiology K. Georghiou, C. Thanos, S. Meletiou - Christou, S. Rhizopoulou. Diavlos Publications, Athens, 2010 (in greek)
- Stress Physiology of Plants G. Karabourniotis, G. Liakopoulos, D. Nikolopoulos. Embryo Publications. Athens, 2012 (in greek)Laboratory Exercises in Plant Physiology. Y. Manetas, G. Grammatikopoulos, Y. Petropoulou, G.K. Psaras, Hellenic Academic Ebooks, Kallipos, 2016 (in greek)

Related academic journals:

2.37 FAUNA OF GREECE

1. GENERAL

SCHOOL	OF SCIENCES		
ACADEMIC UNIT	OF BIOLOGY		
LEVEL OF STUDIES	UNDEGRADUATE		
COURSE CODE	**ΒΙΟ_ΠΑΕ**	**SEMESTER**	**F**
COURSE TITLE	FAUNA OF GREECE		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures, lab exercises and field trip	3	6

COURSE TYPE	Specialised general knowledge, Skills development
PREREQUISITE COURSES	None. However, the students are highly encouraged to have attained the knowledge offered with the course Animal Biology I and Animal Biology II.
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/BIO203/

2. LEARNING OUTCOMES

Learning outcomes
By the end of the course, the students will have the ability to comprehend the reasons behind the large diversity of the Greek fauna, to discuss the general distribution patterns of its endemism and diversity, to recognize its most important constituents, focusing on terrestrial vertebrates (amphibians, reptiles, birds, mammals) and to understand the methodologies applied for recording and sampling terrestrial fauna. At the same time, they will have gained the capability to assess the threats and pressures sustained by the threatened and endemic species of the terrestrial fauna and a deeper knowledge of biodiversity and its values. In addition, they will have developed the following skills: - Acquaintance with the procedures followed during field work, in order to record and/or capture terrestrial species of the Greek fauna with the use of different approaches and specialized equipment. - Species identification of representatives of the Greek fauna, particularly of terrestrial vertebrates (amphibians, reptiles, birds, mammals), that are encountered/captured in the field, taking advantage of the theoretical part of the course and using specialized field guides. - Familiarization with Red Data Books and application of the IUCN criteria in assessing the threat status of animal species.
General Competences
Adapting to new situations. Working independently. Team work. Respect for the natural environment. Promotion of free, creative and conductive thought.

3. SYLLABUS

The richness of the Greek fauna, Effects of paleogeography, paleoclimate and geology on the formation of the Greek fauna. Speciation in the Greek area. Animal biodiversity in Greece and distribution patterns, focusing on Vertebrates. Endemic, threatened, rare and protected species of the Greek fauna.

Threats and pressures, faced by the Greek fauna and respective conservation measures. Application of the IUCN criteria, in order to assess the threat status of animals.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of video projections during lectures and lab work. Enhancement of teaching by using video streaming technologies over the internet (such as Youtube). Creation of digital photograph archives of the animals and their habitat, by the students, during the field trip. Support of the educational process and communication with the students, using the online eclass platform of the University of Patras.	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures	22
	Lab exercises	11
	Literature review and study	9
	Participation in the field trip	45
	Essay, regarding the results of the field trip	45
	Independent study and exams preparation by the students	45
	Course total	**150**
STUDENT PERFORMANCE EVALUATION	Written exam in Greek, requiring short or longer replies. Written report in Greek on the results and impressions of the field trip The written exam and the written report contribute equally to the total course grade (by 50% each). Minimum passing grade: 5	

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:
Notes for the course 'Fauna of Greece' in MS Powerpoint – G. Mitsainas.

Related academic journals:

2.38 EXPERIMENTAL ANIMAL PHYSIOLOGY

1. GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**ΒΙΟ_ΠΕΦ**	**SEMESTER**	**Η**
COURSE TITLE	EXPERIMENTAL ANIMAL PHYSIOLOGY		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
	Lectures	2	3
COURSE TYPE	Scientific, development of knowledge		
PREREQUISITE COURSES	none		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO		
COURSE WEBSITE (URL)			

2. LEARNING OUTCOMES

Learning outcomes

At the end of the course the students should be able to know the basic principles of experimental methods used in animal physiology and will have the ability to put and approach experimentally, research question in animal physiology.

By the end of the course students are expected to have learned:

1. How usage of animals promotes biological research
2. The multiple levels of biological organization that experimental physiology studies: from behavior to systems, organs, cells and molecules
3. Animated experimental models of systems physiology
4. How experimental approaches may vary from less to more invasive depending on the level of biological organization the research is interested in studying, e.g. from in vivo to in vitro, from extracellular to intracellular electrophysiological recordings
5. How to formulate research questions and aims on topics of animal physiology
6. The principles of experimental techniques and methods: electrophysiology, neurophysiology, quantitative autoradiography, neurosurgery
7. How to search for and use appropriate and updated literature

General Competences

- Scientific knowledge in the field of Physiology
- Group work
- Experimental design
- Development of independent critical scientific thinking.

3. SYLLABUS

- The experimental animal.
- Determinations of biological substrates.
- Electrophysiology: general aspects. Measurements of physiological parameters in human.
- The use of radioactive substances in Physiology. Quantitative autoradiography: imaging and quantification of receptors, enzymes, transporters and systems of second messengers.
- Presentation of a topic in Physiology.
- Neurosurgery.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Lectures, thematic presentation by groups of students.	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Power-point presentations, e-class, multimedia.	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures	25
	Group work	25
	Reading bibliography	25
	Course total	**75**
STUDENT PERFORMANCE EVALUATION	Written exams at the end of semester (80%) and evaluation of oral and written presentations (20%). Language Greek Grading scale: 1-10. Minimum passing grade: 5.	

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

- Experiments of Physiology, Tharp, Gerald D. και Woodman, David A.
- Essentials of Neural Sciences and Behavior, Kandel et al., Edts Appleton and Lange
- Neuroscience of Behavior. Basic Principles, Methods, Techniques and Experimental Excercises, Panagis G.
- Proposed review articles

E-books:

http://www.experimentalphysiology.gr/textbook/

Related academic journals:

2.39 ENVIRONMENTAL ANIMAL PHYSIOLOGY

1. GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_ΠΦΖ**	**SEMESTER**	**F**
COURSE TITLE	ENVIRONMENTAL ANIMAL PHYSIOLOGY		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
	Lectures	2	3
COURSE TYPE	Field of Science Skills Development		
PREREQUISITE COURSES	There are no prerequisites.		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO		
COURSE WEBSITE (URL)			

2. LEARNING OUTCOMES

Learning outcomes
At the end of the course the student is will have acquired a basic knowledge of environmental physiology; including: The subject of research for Environmental Animal Physiology and Biometeorology, the role of biorrythms, temperature and humidity in living organisms, the effects of altitude and radiation in living organisms, the subject of research for Environmental Toxicology, the main heavy metal effects including lead, cadmium, asbestos, mercury, manganese, etc.
General Competences
At the end of the course, the student will have developed the following skills/competences: - Be a team player, capable retrieve related scientific information on Environmental Physiology. - To write assays on Environmental Physiology - To work as part of a team - To prepare power-point presentations.

3. SYLLABUS

1. Environmental Pysiology-Subject of research
2. Chronobiology and Biorrythms
3. Biometeorology
4. Altitude
5. Radiation
6. Environmental Toxicology

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face to face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Lectures (using power-point presentations).	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures (13 weeks x 2 hours per week)	26
	Home study	49
	Course total	**75**
STUDENT PERFORMANCE EVALUATION	Written exams at the end of semester (85% and oral presentations 15 % or 100 % without assay and oral presentation). Final Course Grade: Theory Grade x 0.85 + x 0.15 assay and oral presentation or only Theory Grade Grading scale: 1-10. Passing grade ≥ 5	

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

Performing in Extreme Environments Armstrong LE. (in greek) "TELETHRION" Publ., 2011.

Related academic journals:

2.40 RADIOBIOLOGY

1. GENERAL

SCHOOL	NATURAL SCIENCE		
ACADEMIC UNIT	BIOLOGY DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE - ELECTIVE		
COURSE CODE	**BIO_ΡΔΒ**	**SEMESTER**	**H**
COURSE TITLE	RADIOBIOLOGY		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
	Lectures	2	3
COURSE TYPE	Specialised general knowledge,		
PREREQUISITE COURSES	There are not prerequisite courses		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek. Teaching could be performed in English, in case of foreign students attend the course.		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES, in English		
COURSE WEBSITE (URL)	https://eclass.upatras.gr/modules/document/?course=BIO225 https://eclass.upatras.gr/modules/document/?course=BIO211		

2. LEARNING OUTCOMES

Learning outcomes

By the end of this course the student should be able to:

- Recognize the types of ionizing radiations
- Know the most important sources of ionizing radiations
- Describe the modes of radiation interactions with matter
- Explain the difference in range of the different types of ionizing radiations
- Know the main interaction products between radiation and matter
- Have a concise knowledge of radiation quantities and their Units
- Describe the advantages and disadvantages of each detector and choose the most appropriate detector for a specific use
- Describe the advantages and disadvantages of the most widely used dosimeters
- Have a concise knowledge on the basic concepts of nuclear reactors operating, of nuclear weapons, accidents happened and their environmental consequences
- Know the effects of ionizing radiation on live organisms
- Manipulate safely radiotracers and know when and how can man use them

General Competences

By the end of the course the student will have further developed the following skills/ competences:

- Ability to demonstrate knowledge and understanding of essential facts, concepts and principles relating to Radiobiology
- Ability to apply such knowledge for solution of qualitative and quantitative problems of the familiar field
- Study skills needed for continuing professional development
- Ability to interact with others on multidisciplinary problems

Generally, by the end of this course the student will, furthermore, have develop the following general abilities (from the list above):

- Searching, analysis and synthesis of facts and information, as well as using the necessary technologies
- Adaptation to new situations

- Decision making
- Autonomous (Independent) work
- Exercise of criticism and self-criticism
- Promotion of free, creative and inductive thinking
- Respect to natural environment
- Work design and management

3. SYLLABUS

- **Radioactivity – Ionizing Radiations:** Radioactivity. Sources of ionizing radiations. Modes of radioactive decay. Kinetic of radioactive decay. Radioactivity units.
- **Interactions of Radiation with Matter**: Charged particle interactions. Range of charged particles. Stopping power. Gamma ray interactions. Neutron interactions. Effects of radiation on matter. Chemical behaviour of ions, excited states and free radicals.
- **Dosimetry:** Radiation Quantities and Units. Measurement of exposure of Dose, Dose Equivalent and Exercises. Measurement of Dose by films, TLDs, pocket dosimeter, monthly inventory and recommended limits of Dose Equivalent
- **Types of radiation detectors**: ionization chamber, proportional counter, Geiger-Müller counter, scintillation detectors, semiconductor detector HPGe, liquid scintillation detector, methods correcting quenching
- **Nuclear Energy and Environment:** Principles of operation and types of nuclear reactors, accidents, nuclear weapons, environmental consequences
- **Effects of ionizing radiations on live organisms:** Sources of radiation exposure. Physics and Chemistry of Radiobiology. Radiolysis of water. Effects of radiation on biomolecules (proteins, carbohydrates, nucleic acids etc.) and chromosomes. Mutations-chromosomic defects. Target theory. Survival curves. Radiation protection
- **Biomedicinal applications of ionizing radiation:** Applications of X-rays and radionuclides in biomedical sciences. Tracers and radiotracers in Medicine and Biology. Manipulation and storage of radionuclides. Radionuclides in Radiodiagnostic and Radiotherapy (radiomedicals). Technetium in Radiodiagnostic. Radio-Immuno-Assays, (RIA) and Immuno-Radio-Metric Assays (IRMA).

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Lectures face-to-face.	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of Information and Communication Technologies (ICTs) (e.g. PowerPoint, video etc.) in teaching. The lectures content of the course for each chapter, all problems, in the form of a series of ppt files, and announces are uploaded on the internet, from where the students can freely download them.	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures (2 conduct hours per week × 13 weeks)	26
	Hours for private study of the student and optional problems solving given in each lecture	46
	Final written examination at the end of semester (3 conduct hours × 1 time)	3
	Course total	**75**

STUDENT PERFORMANCE EVALUATION	1. At the end of the semester there is a final written examination with multiple choice questions and short answer questions (open text books). Minimum passing grade: 5 2. Optional delivery of solved problems (at least 2) each week, given in each lecture. Addition of 1 grade to the final exam grade (if it's higher than 5) of the students who have delivered all the solved problems and the percentage of the unit to the others, according to the number of solved problems each person has delivered.

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

- «BIOLOGICAL RESPONSES, MONITORING AND PROTECTION FROM RADIATION EXPOSURE», K.P. Mishra, Allahabad, India 2015
- «ΡΑΔΙΟΒΙΟΛΟΓΙΑ, Ακτινοβολίες και Ζωή», Λ. Χ. Μαργαρίτης, Εκδ. ΣΥΜΜΕΤΡΙΑ, Αθήνα 2010
- «RADIOBIOLOGY FOR THE RADIOLOGISTS», Eric J. Hall, 5th Edition, LIPPINCOTT WILLIAMS & WILKINS, Philadelphia, 2000
- «ΚΛΙΝΙΚΗ ΡΑΔΙΟΒΙΟΛΟΓΙΑ», Γ. Α. Πλατανιώτης, Εκδ. UNIVERSITY STUDIO PRESS, Θεσσαλονίκη 2000
- «AN INTRODUCTION TO RADIOBIOLOGY», A. H. W. Nias, 2nd Edn, JOHN WILEY & SONS, Baffins Lane, 1998
- «RADIOISOTOPES IN BIOLOGY», R. J. Slater, Edition IRL PRESS AT OXFORD UNIVERSITY PRESS 1998
- «INTRODUCTION TO RADIOBIOLOGY», M. Tubiana, J. Dutreix, A. Wambersie, D. K. Bewley, TAYLOR & FRANCIS 1990
- «ΔΟΣΙΜΕΤΡΙΑ ΚΑΙ ΒΙΟΛΟΓΙΚΕΣ ΕΠΙΠΤΩΣΕΙΣ ΤΩΝ ΑΚΤΙΝΟΒΟΛΙΩΝ», Σ. Χαραλάμπους, Εκδ. Π. ΖΗΤΗ & Σια Ο.Ε., Θεσσαλονίκη 1985
- «BIOLOGICAL RADIATION EFFECTS», Jürgen Kiefer, SPRINGER-VERLAG 1985

Related academic journals:

1. International Journal of Radiation Biology
2. Radiation Biology

2.41 ENVIRONMENTAL POLLUTION

1. GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_PYΠ**	**SEMESTER**	**H**
COURSE TITLE	ENVIRONMENTAL POLLUTION		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures and laboratory exercises (interactive teaching)	3	6

COURSE TYPE	General background, specialised general knowledge, skills development.
PREREQUISITE COURSES	Students with basic knowledge in the fields of Ecology, Organic and Inorganic Chemistry, Plant and Animal Physiology.
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/BIO210/

2. LEARNING OUTCOMES

Learning outcomes

Elective undergraduate course that aims to acquire general knowledge on environmental pollution management issues.

Within the course the students will acquire the necessary knowledge related to:

- → the most important categories of pollutants/contaminants.
- → the entrance of chemical substances/pollutants into the environment.
- → the effects of pollutants on different levels of organism function (cellular, biochemical, molecular).

The aim of the course is to inform students about:

- → the current knowledge about the environmental status of ecosystems both in Mediterranean area and Greece.
- → the strategies that should be performed for assessing the health status of aquatic ecosystems (e.g. chemical and biological monitoring).
- → the different stages/processes of urban and industrial wastes treatment.
- → the Renewable Energy Sources (RES) as well as their role as alternative and environmentally friendly energy saving solutions.
- → the basic principles of (eco)-toxicology, via students' involvement in the implementation of simulation exercises (e.g. toxicity tests, using microalgae and organisms-bioindicators, water quality analysis, etc.).

The current course will enable students to:

- → interpret various phenomena related to the presence of pollutants in the environment (eutrophication, greenhouse effect, ozone hole, etc.).
- → understand basic phenomena, commonly related with the presence and the effects of environmental pollutants (e.g. bioaccumulation, etc.).
- → understand and apply water quality analysis methods.
- → know the main processes commonly performed in Waste Water Treatment Plants (WWTPs).
- → suggest solutions and strategies for assessing environmental issues commonly related with the presence of pollutants.
- → acquire the appropriate skills for conducting inter-scientific collaborations for assessing environmental pollution issues.

General Competences
After the end of the current course, the degree-holder will be able to: → search, analyze and synthesize biological data, using the necessary technologies. → make the appropriate decisions, regarding the scientific approach of environmental issues. → work in international and interdisciplinary environment. → plan and manage environmental projects. → respect and protect and natural sources. produce free. Creative and inductive thinking.

3. SYLLABUS

Environmental pollution; Pollutants and xenobiotic compounds; Environmental transport and fate of pollutants; Pollutants' effects on biota (organism behavior, cellular, biochemical and molecular effects); Environmental status of Mediterranean area and Greece (socio-economic effects of pollution); Monitoring strategies of pollution (chemical monitoring and biomonitoring); Wastewater Treatment Plant processes; Renewable Energy Sources (RES) and Environment.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face.	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Using information and communication technologies (PowerPoint presentations and video animation) during the teaching process.	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures (13 x 2h)	26
	Laboratory practice (4 x 1h)	4
	Laboratory report	4
	Interactive teaching (1 x 2h)	2
	Study and analysis of bibliography	5
	Project	15
	Self-study	94
	Course total	**150**
STUDENT PERFORMANCE EVALUATION	Student performance evaluation is conducted in Greek. Specifically, it includes: - Student participation in laboratory exercises and delivery of laboratory reports. - Presentation of a project related to the material and the intended outcomes of the course (up to 30% of the final grade). - Written exams, with short-answer questions, open-ended questions, problem solving (70% of final grade). Grading scale: 1-10. Passing grade: 5	

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

→ Biological effects of environmental Pollutants – Ecotoxicology: experimental approaches and outcomes (university notes; Ass. Prof. Stefanos Dailianis, in Greek).
→ Hill MK 2004. Understanding Environmental Pollution: A Primer (2nd Edition). CUP.
→ Rana SVS 2006. Environmental Pollution: Health and Toxicology. Alpha Science International Ltd.
→ Freedman B 1995. Environmental Ecology, Second Edition: The Ecological Effects of Pollution, Disturbance, and Other Stresses. Academic Press.

Related academic journals:

Environmental Pollution, Chemosphere, Aquatic Toxicology, Environmental International, Environmental Research.

2.42 AQUACULTURE

1. GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_ΥΔΑ**	**SEMESTER**	**H**
COURSE TITLE	AQUACULTURE		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures, Laboratory Exercises, Field Work		2 (lec) + 3 (lab)	6
COURSE TYPE	Field of Science Skills Development		
PREREQUISITE COURSES	Ichthyology		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes (in English)		
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/BIO305/		

2. LEARNING OUTCOMES

Learning outcomes
At the end of the course the student should be able to: 1. know the categories of aquaculture rearing systems. 2. know the basic parameters of water quality which are important for aquaculture. 3. know the basic stages in the production process in marine aquaculture and biological components in production of fish larvae, live feed, fish juveniles and on-growing of the most important marine fish species. 4. know the production process in culture of microalgae, rotifers and Artemia. 5. comprehend the basic principles of microbial ecology in rearing systems, and processes during deterioration of flesh quality. 6. know the basic impact of aquaculture on the environment and most important fish diseases in cultured fish populations. 7. know the basic principles in culture of salmonids, eels, bivalves, and macroalgae.
General Competences
By the end of this course the student will have developed the following **General Abilities**: 1. Autonomous (Independent) work 2. Group work 3. Generation of new research ideas 4. Respect for the natural environment 5. Development of free, creative and inductive thinking Additionally, by the end of this course the student will have developed the following **Special skills/competences**: 1. The ability to culture microalgae and monitor their growth 2. The ability to culture rotifers and monitor their growth 3. The ability to rear fish larvae and monitor ontogenetical changes 4. The ability to feed fish larvae with live food organisms.

3. SYLLABUS

Introduction to aquaculture. Water quality. Mediterranean Marine Aquaculture. Broodstock management. Microalgae. Live food. Larval cultures. Fish nutrition. Microbial ecology. Fish Diseases. Flesh quality. Environmental impact of aquaculture. Salmonids. Bivalves. Macroalgae.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face to face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	PowerPoint and Prezi presentations. Support of educational procedure using the e-class electronic platform.	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures (13 weeks x 2 hours per week)	26
	Laboratory exercises (6 weeks x 3 hours per week)	12
	Home study	112
	Course total	**150**
STUDENT PERFORMANCE EVALUATION	Written exams (at the semester's end), in Course theory and lab. Language: Greek. Exams through short answer questions. Final Course Grade: Theory Grade x 0.7 + Laboratory Grade x 0.3 Grading scale: 1-10. Passing grade: 5	

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

1. Notes in Aquaculture. G. Koumoundouros.
2. Manual on Hatchery Production of Seabass and Gilthead Seabream Volume 1, by A. Moretti, M. Pedini Fernandez-Criado, G. Cittolin, and R. Guidastri. F.A.O. Rome, 1999.

Related academic journals:

2.43 PHOTOSYNTHESIS

1. GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_ΦΤΝ**	**SEMESTER**	**H**
COURSE TITLE	PHOTOSYNTHESIS		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
	Lectures	2	3
COURSE TYPE	Elective, special background		
PREREQUISITE COURSES	There are no prerequisite courses. The student is strongly recommended to have a basic knowledge of Plant Physiology and Biochemistry.		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No		
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/BIO400/		

2. LEARNING OUTCOMES

Learning outcomes
At the end of the course the student is expected: 1) to have acquired a specialized knowledge on photosynthesis and the underlying regulatory and protective mechanisms of the photosynthetic apparatus 2) to have understood the evolution of photosynthetic traits from bacteria to higher plants 3) to combine the knowledge acquired during this and previous courses and have a spherical aspect of photosynthesis.
General Competences
Search for, analysis and synthesis of data and information, with the use of the necessary technology Working independently Production of free, creative and inductive thinking Respect for the natural environment

3. SYLLABUS

- Introduction: importance of photosynthesis.
- Other assimilative pathways (apart from CO_2 assimilation) in the chloroplast and their physiological role: reduction and assimilation of nitrite and sulfate, reduction of oxaloacetate and oxidized glutathione.
- Permeability of chloroplastic envelope, import/export of biomolecules to/from the chloroplast, experimental approaches.
- Internal regulation of photosynthesis: co-ordination and detuning of photochemical and biochemical reactions, photoactivation of chloroplastic enzymes. Starch and sucrose synthesis.
- Photoinhibition of photosynthesis and photoprotective mechanisms: avoidance and dissipation of excess solar radiation, non-photochemical quenching of excitation-energy, alternative electron flows and their physiological role, enzymatic and non-enzymatic scavenging of reactive oxygen species produced during the “light reactions”. The protective role of photorespiration.
- Bacterial photosynthesis. Oxygenic *vs* anoxygenic photosynthesis: cyanobacteria, purple and green sulfur and non-sulfur bacteria, heliobacteria. Halobacteria. CO_2 assimilative cycles. Ecological significance of the photosynthetic bacteria.

– Evolution of photosynthesis.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Lectures in the classroom face-to-face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Lectures using contemporary methods. Complementary usage of the e-class (open class) platform.	
TEACHING METHODS	***Activity***	***Semester workload***
	Lectures	26
	Independent study and analysis of bibliography	49
	Course total	**75**
STUDENT PERFORMANCE EVALUATION	Compulsory written examination at the end of the course. Essay questions, multiple choice questions or a combination of them. Grading scale: 1-10. Passing grade: 5	

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

- Plant Physiology, George Aivalakis, George Karabourniotis, George Liakopoulos, Embryo Press, 2016 (in greek)
- Photosynthesis, Lecture notes, Y. Manetas, Y. Petropoulou (in greek)
- Teaching material (ppt slides) from the course lectures (available in the e-class platform), Y. Petropoulou

Related academic journals:

2.44 IMMUNOBIOLOGY

1. GENERAL

SCHOOL	SCHOOL OF NATURAL SCIENCES		
ACADEMIC UNIT	DEPARTMENT OF BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_ANB**	**SEMESTER**	**G**
COURSE TITLE	IMMUNOBIOLOGY		
INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**	
Lectures	2		
Practical exercises	3		
TOTAL ECTS		6	
COURSE TYPE	Scientific specialized background		
PREREQUISITE COURSES	Formally, there are no prerequisite courses. However, previous knowledge of fundamental principles of Cell and Molecular Biology and Biochemistry are recommended.		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes [English]		
COURSE WEBSITE (URL)	http://www.biology.upatras.gr/index.php?option=com_content&view=article&id=36&Itemid=302		

2. LEARNING OUTCOMES

Learning outcomes
Course content aims at understanding the organization and function of the immune system, at the molecular and cellular level. Upon successful completion of the course, students will have acquired the skills to understand the phenomena associated with the functions of the immune system in health and disease.
General Competences
• *Search for, analysis and synthesis of data and information, with the use of the necessary technology* • *Working independently* • *Team work* • *Production of new research ideas*

3. SYLLABUS

1. Introduction to the immune system
2. Innate immunity
3. Antigen capture and presentation to lymphocytes
4. Antigen recognition in the adaptive immune system
5. T-cell mediated immunity
6. Effector mechanisms of T cell-mediated immunity
7. Humoral immune responses
8. Immunological tolerance and autoimmunity
9. Immune responses against tumors and transplants
10. Hypersensitivity
11. Congenital and acquired immunodeficiencies

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Yes	
TEACHING METHODS	***Activity***	***Semester workload***
	Lectures	26
	Laboratory practice	12
	• Study & analysis of bibliography • Tutorials	112
	Course total	**150**
STUDENT PERFORMANCE EVALUATION	Written exams at the end of the semester Grading scale: 1-10. Passing grade: 5	

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

1. AK Abbas et al. Βασική Ανοσολογία: λειτουργίες και διαταραχές του ανοσοποιητικού συστήματος [2η έκδοση, 2018]
2. Janeway's Immunobiology [9th edition, 2016]
3. Ε. Ροσμαράκη – Ανοσοβιολογία [https://eclass.upatras.gr/courses/BIO403/]

Related academic journals:

2.45 BRAIN AND MIND

1. GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_ΕΦΝ**	**SEMESTER**	**G**
COURSE TITLE	BRAIN AND MIND		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
	Lectures	2	3
COURSE TYPE	Scientific, specific knowledge in Neurosciences development of skills		
PREREQUISITE COURSES	Successful attendance of the course Animal Physiology is recommended		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek. Instructions and presentations will be given in English in case foreign students attend the course		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No		
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/BIO260/		

2. LEARNING OUTCOMES

Learning outcomes
At the end of the course, the student will be able to: 1.Understand brain and behavior relationship 2.Understand the role of the brain in perception, and higher cognition 3.Identify the neural circuits that control specific behaviors 4.Understand how emotions arise out of the brain activity 5.Understand neural plasticity mechanisms At the end of the course, the student will have developed the following skills/competences. 1.Critical scientific understanding the interaction of brain structure, function and plasticity. 2.Knowledge of brain organization and specificity of neural networks responsible for behavior and intelligent processes. 3.Understanding the mechanisms underlying the physiology and pathophysiology of cognitive and emotional functions.
General Competences
Development of creative thinking, understanding of scientific reasoning, critical reading of bibliography and learning new knowledge. Skills of group work.

3. SYLLABUS

1. Neurobiological basis of behavior, perception and cognition Cellular and biochemical specificity of neural circuits.
2. From nerve cells to cognition Representation of cognitive functions and personal space. Experience-based internal body representation
3. Learning and memory Cellular mechanisms of learning and memory. Neuronal changes associated with learning. Experience-based modification of somatotopic map.
4. Cerebral cortex and cognition. Frontal, parietal and temporal association areas are involved in motor planning, higher sensory functions and emotional behavior.

5. Sex and the Brain Gonadal hormones and sexually differentiated brain. Masculinization of the brain. Brain influences on sex-depended behaviors. 6. Emotional states. Relationship of emotional and cognitive states. Cortical and sub-cortical representation of emotions.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Lectures, working groups case-based learning.	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Power point, multimedia, e-class platform	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures	20
	Group work, presentations	15
	Reading bibliography	20
	Studying-exams	20
	Course total	**75**
STUDENT PERFORMANCE EVALUATION	Language Greek (or English in case of foreign students) Written exams at the end of semester (80%), Group presentation (20%) Passing grade: 5	

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

1. Essentials of Neural Sciences and Behavior, Kandel et al., Edts Appleton and Lange
2. Brain and Behaviour, Kolb, Whishaw, Edts Paschalides
3. Review scientific papers in related topics of Neurosciences

Related academic journals:

2.46 SOIL PROPERTIES

1. GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_ΕΔΦ**	**SEMESTER**	**G**
COURSE TITLE	SOIL PROPERTIES		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
	Lectures	2	3
COURSE TYPE	Special background, Skills development		
PREREQUISITE COURSES	No		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek. Teaching		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No		
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/GEO337/		

2. LEARNING OUTCOMES

Learning outcomes
Upon successful completion of this course , the students will be able to: 1. Use techniques and methods of mechanical analysis and classification of soil (determination of grain size), 2. Determine soil water content and absorbent capacity, 3. Determine the pH, conductivity and the percentage of soil carbonates, 4. Understand the role of nutrients, total organic carbon, total nitrogen and total phosphorus as well as techniques and methods of soil sampling and description. Finally, the students will be able to synthesize all the mechanical and geochemical data of the field and laboratory using appropriate methodologies and software.
General Competences
Search for, analysis and synthesis of data and information with the use of the necessary technology working independently.

3. SYLLABUS

Introduction to Weathering and Soil Types of weathering and soils Soil classification, its components and structures Soil formation / soil physical and chemical processes Soil degradation factors Organic and inorganic constituents of soil Geochemical processes in soils Climate and soil

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	In classroom theory (face-to-face) using power point presentations. Tutorial support for the non directed study and the better understanding of theory. Seminar lessons using geo software for the laboratory techniques.	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of Information and Communication Technologies (ICTs) (power point) in teaching Support of Learning Process and Dissemination of educational material through the University of Patras e-class platform.	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures (2 conduct hours per week x 13 weeks)	26
	Non-directed study	25
	Project preparation	18
	Presentation of laboratory Techniques	6
	Course total	**75**
STUDENT PERFORMANCE EVALUATION	Final Exam written compulsory, project preparation and intermediate exams written optional, of increasing difficulty, which may include Multiple choice test, Questions of brief answer, Questions to develop a topic, Judgment questions and Exercise solving Marking Scale: 0-10. Minimum Passing Mark: 5.	

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

1. Εδαφολογία η Φύση και οι Ιδιότητες των Εδαφών 2015, N. C. Brady, R. R. Weil ISBN: 9789608002623 Σελίδες: 1004, Εκδόσεις Εμβρυο
2. Μαθήματα εφαρμοσμένης εδαφολογίας 2002. Ν. Χουλιάρας ISBN: 9789604112883, Σελίδες:154
3. Εδαφολογία, 2005 Χ. Πασχαλίδης ISBN: 9789608002388 Σελίδες 184, Εκδόσεις Εμβρυο

Related academic journals:

1. SOILS, EGU Copernicus
2. Journal of Soils and Sediments, Springer

2.47 SELECTED TOPICS IN CELL BIOLOGY

1. GENERAL

SCHOOL	SCHOOL OF NATURAL SCIENCES		
ACADEMIC UNIT	DEPARTMENT OF BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_E0K**	**SEMESTER**	**G**
COURSE TITLE	SELECTED TOPICS IN CELL BIOLOGY		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
	Lectures	2	3
COURSE TYPE	Scientific specialized background		
PREREQUISITE COURSES	Formally, there are no prerequisite courses. However, previous knowledge of Cell and Molecular Biology are recommended.		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes [English]		
COURSE WEBSITE (URL)			

2. LEARNING OUTCOMES

Learning outcomes
Students will emphasise into areas of Cell Biology such as cancer, apoptosis, stem cells and their applications, as well as issues related to the immune system and its role in host defence.
General Competences
Search for, analysis and synthesis of data and information, with the use of the necessary technology. Decision-making.

3. SYLLABUS

1. Tumor biology
2. Angiogenesis
3. Growth factors and signal transduction
4. Proteasome and apoptosis
5. Stem cells and applications
6. Innate immunity: inflammation and antiviral protection
7. The complement system
8. Lymphopoiesis
9. Antigen capture and antigen presentation
10. Lymphocyte activation and effector functions of T and B cells
11. The use of antibodies in research, diagnosis and cure
12. Vaccination

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face to face lectures in classroom.	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Communication via eclass. Lectures with PowerPoint presentation and online videos.	
TEACHING METHODS	***Activity***	***Semester workload***
	Lectures	26

	Study	49
	Course total	**75**
STUDENT PERFORMANCE EVALUATION	Written exams at the end of the semester. Grading scale: 1-10. Passing grade: 5	

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

- Molecular Biology of the cell. Alberts *et al.* Garland science 1995.

Related academic journals:

2.48 APPLIED ETHICS AND BIOETHICS

1. GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_EHB**	**SEMESTER**	**G**
COURSE TITLE	APPLIED ETHICS AND BIOETHICS		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
	Lectures	3	3
COURSE TYPE	Specialised general knowledge		
PREREQUISITE COURSES			
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes (in English)		
COURSE WEBSITE (URL)	http://www.biology.upatras.gr/		

2. LEARNING OUTCOMES

Learning outcomes

Upon course completion, the student will be able to know the following subjects satisfactorily:

1. the main philosophical and moral questions from the practical results of knowledge, derived from the development of the major bio-scientific-technological achievements, and in relation to their moral implications extended from the experimental organisms to human beings.
2. the main bioethical principles and their legal framework for limiting the risks from the applications of new biotechnologies such as assisted reproduction, cloning, genetically modified organisms, stem cells, genetic redesign of life, procedural genetics, artificial intelligence etc.

General Competences

- Working independently
- Team work
- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Production of free, creative and inductive thinking
- Decision-making
- Criticism and self-criticism
- Adapting to new situations

3. SYLLABUS

I. 1. General Introduction: From moral theory to meta-ethics and transition to applied ethics, with special emphasis on the emergence of the epistemological autonomy of applied ethics as an area of conjugation of science, law and philosophy. 2. Introduction to the applied ethics method as a weighting field of positive values in the context of genuine moral dilemmas. 3. Introduction to the fields of bioethics. 4. Introduction to Bioethics Institutions.

II. Bioethics of genetically modified plants / food (indicatively, plant biotechnology - creation of plants resistant to pathogens, and environmental stresses - transgenic plants and diet / taste) Bioethics questions from the implementation of the above achievements (impacts on humans and the environment, social questions, patent issues, biosecurity issues).

III. Bioethical reference to assisted reproduction (indicatively, at what embryonic stage the beginning of life is identified, embryo selection, prenatal control, termination of pregnancy, sperm / egg

donors, surrogate mothers), the use of stem cells (for example, embryonic stem cells, stem cell banks, sex selection, immortality and euthanasia in procedural genetics.

IV. Molecular biotechnology and bioethical issues: Definitions and examples. Historical data. Ethical codes, basic principles of biomedical ethics ("Belmont text") and bioethics committees. Basic principles of research activity. Instructions for researchers conducting clinical studies (informed consent of participants, personal patient data and anonymity, rules and ethics committees). Patents. The Asilomar Conference on Recombinant DNA. Cloning - Transplants - Gene therapy and moral dilemmas. Genetic redesign and children on demand - Eugenics. Mapping human genome, and tissue and gene ownership. Personalized medicine and pharmacogenomics. Biotechnology Law, and protection of personal genetic data. Infectious diseases and protection of public health.

V. Bioethics on experimental animal models, and good practice in the use of experimental animals: 1. Genetic engineering of animals used in science. 2. Animal welfare (housing). 3. Animal management (phenotype issues, experimental procedures, pain, suffering and strain, duration of studies, final rejection and euthanasia), reports to the International Society for Applied Ethology and the World Organization for Animal Health.

VI. Neuro-ethics (referring to ethical dilemmas arising from the rapid growth of neuroscience research, and related to the possible application of new diagnostic and therapeutic approaches, not only in illness but also in health, such as improvement of cognitive abilities, mental mood, emotion etc.)

VII. Bioethics of neurotechnological applications, artificial intelligence ("evolving" machines), bio-robotics, bio-governing ("digital citizen"), "neuro-politics", geno-technologically pursued "superman" etc.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face. Discussion during lecture. Bibliographic projects.	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Face-to-face. Discussion during lecture. Bibliographic projects.	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures	26
	Study and analysis of bibliography	10
	Independent study	39
	Course total	**75**
STUDENT PERFORMANCE EVALUATION	Written exams at the end of the semester. Grading scale: 1-10 Passing grade: 5	

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:
Notes

Related academic journals:

2.49 ETHOLOGY

1. GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_HΘΛ**	**SEMESTER**	**G**
COURSE TITLE	ETHOLOGY		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
	Lectures	2	3
COURSE TYPE	Field of Science Skills Development		
PREREQUISITE COURSES	NO Formally, there are no prerequisite courses. Nevertheless, a good knowledge of evolutionary biology, zoology, ecology and animal physiology is highly recommended.		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Geek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes (in English)		
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/BIO238/		

2. LEARNING OUTCOMES

Learning outcomes
By the end of this course the student should be able to: 1) understand the content and scope of animal behavior studies 2) develop a critical view regarding explanations of animal behavior 3) understand the various levels of ethological explanations 4) identify important subjects for study in ethology 5) formulate sound scientific questions and hypotheses on animal behavior 6) discuss major theories and approaches in ethology and behavioral ecology 7) develop an evolutionary point of view regarding explanations of animal behavior 8) understand the comparative approach in ethology and, more generally, Biology.
General Competences
By the end of the course, the student will have developed the following **Special skills/competences**: 1) ability to set up simple but robust experiments for the study of behavior 2) ability to evaluate and present major theories and concepts of the evolutionary interpretation of behavior 3) deeper understanding of human behavior and its evolutionary roots. Additionally, by the end of this course the student will, furthermore, have develop the following **General Abilities**: 1) Working independently 2) Team work 3) Generation of new research ideas 4) Respect for the natural environment 5) Development of free, creative and inductive thinking.

3. SYLLABUS

1. Introduction to the study of ethology. Basic principles and concepts. 2. Animal behavior: history and development. 3. Proximate and ultimate questions and causes. 4. The development of behavior. 5. Control of behavior and neuronal mechanisms. 6. Organization of behavior: neurons and hormones. 7. Adaptations for survival, feeding and territoriality. 8. Communication: a world of signals and information. 9. Reproductive behavior. 10. Social behavior. Examples.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face to face.	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Support of educational procedure with use of the e-class electronic platform	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures (13 weeks x 2 hours per week)	26
	Elaboration of a project	7
	Home study	42
	Course total	**75**
STUDENT PERFORMANCE EVALUATION	1) Written exams (at the semester's end), accounting for the 80% of the Final Grade. 2) Elaboration & Presentation of a project (at the semester's end), accounting for the 20% of the Final Grade. Final Course Grade: Exams Grade x 0.6 + Project's Grade x 0.2 Grading scale: 1-10. Passing grade: 5	

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

1) Davies N.B, Krebs J.R, West S.A (2017) Introduction to Behavioral Ecology
2) Instructors' Notes

Related academic journals:

2.50 ICHTHYOLOGY

1. GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_IXΘ**	**SEMESTER**	**G**
COURSE TITLE	ICHTHYOLOGY		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures, Laboratory Exercises, Field Work		2 (lec) + 3 (lab)	6
COURSE TYPE	Field of Science Skills Development		
PREREQUISITE COURSES	NO		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes (in English)		
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/BIO207/		

2. LEARNING OUTCOMES

Learning outcomes
In the end of the course the student should be able to: 1. know the basic concepts of the fish evolution and physiology. 2. identify the main groups of fish based on their morphological characteristics. 3. understand the particularities of fish biology, e.g. movement in the aquatic medium, buoyancy, respiration and osmoregulation. 4. know the feeding habits and the reproductive strategies of fish. 5. comprehend the functioning of the circulatory, nervous and digestive systems as well as the functioning and importance of their sensory organs. 6. comprehend modern aspects of fish Biology. 7. understand elements of fisheries science and management of fisheries resources.
General Competences
By the end of this course the student will have developed the following **General Abilities**: 1. Autonomous (Independent) work 2. Group work 3. Generation of new research ideas 4. Respect for the natural environment 5. Development of free, creative and inductive thinking Additionally, by the end of this course the student will have developed the following **Special skills/competences**: 1. The ability to use the basic functions of the Fishbase database on the web 2. The ability to identify fish species using identification keys 3. The ability to understand the principles of growth and age-reading techniques from fish scales and otoliths 4. The ability to collect and analyse data on length, weight, fecundity and age of fish 5. The ability to collect and use fisheries data.

3. SYLLABUS

Introduction to Ichthyology. Fish morphology and anatomy. Movement in the aquatic medium. Respiration. Development. Reproduction, feeding, osmoregulation. Behaviour. Growth. Fish and their habitats. Freshwater and marine fish fauna. Greek and Mediterranean fish. Fisheries and aquaculture. Current issues in fish Biology.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face to face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	PowerPoint presentations. Support of educational procedure using the e-class electronic platform	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures (13 weeks x 2 hours per week)	26
	Laboratory exercises (6 weeks x 3 hours per week)	18
	Home study	106
	Course total	**150**
STUDENT PERFORMANCE EVALUATION	Written exams (at the semester's end), in Course theory and lab. Language: Greek. Exams through short answer questions. Final Course Grade: Theory Grade x 0.7 + Laboratory Grade x 0.3 Grading scale: 1-10. Passing grade: 5	

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

1. Dailianis S. Ichthyology Notes (in Greek)
2. Neofytou (1996). Ichthyology. 1st Edition. University Studio Press. (in Greek)

Related academic journals:

2.51 NEUROBIOLOGY

1. GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_NEY**	**SEMESTER**	**G**
COURSE TITLE	NEUROBIOLOGY		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	3	3

COURSE TYPE	Field of Science. Skills Development.
PREREQUISITE COURSES	There are no prerequisites. However, a good knowledge of Animal Physiology is recommended
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/BIO228/

2. LEARNING OUTCOMES

Learning outcomes
At the end of the course the student is will have acquired a basic knowledge of neuroscience; including brain organization, neural cells, synapses, neurotransmission, evolution and development of nervous system, patho physiology of movement, nervous cell survival, neurodegeneration and neuroplasticity, special senses, sleep and arousal, origin of human language and animal models used for language perception, neuroimaging techniques, neurobiology of addiction etc.
General Competences
At the end of this course the student will have developed a competence in understanding all levels of brain function (from cellular to systems) - to retrieve related scientific information on Neurobiology. - to write assays on Neurobiology - to prepare power-point presentations - team-working

3. SYLLABUS

1. Organization of the CNS. Structure and function of nerve cells and glial cells.
2. Axonal flow and transport. Neurotransmission.
3. Synapse formation and synaptic transmission.
4. Neurotransmitter systems with an emphasis on GABAergic, Catecholaminergic and Glutaminergic System.
5. Basic principles of evolution and development of the nervous system (structure of primitive and more evolved nervous systems), evolution of neocortex and of gyrenecephalia, emergence of myelin, basic characteristics of neural stem cells).
6. Pathophysiology of movement.

7. Nervous cell survival, aging, neurodegeneration (Parkinson's disease, Alzheimer's disease, multiple sclerosis, etc.).
8. Special senses (vision, hearing, taste, smell).
9. Analgesia.
10. Sleep and awakening.
11. Behavioural tests (open field, elevated plus maze, water maze etc.).
12. Language (origins of human language, animal models used for language perception, language defects, neurobiology of speaking.
13. Neuroimaging techniques (PET, MRI, fMRI, etc.) and neuroethics.
14. Subjects related to novel, high-throughput techniques and their application (stem cells use for meurodegenerative diseases, neurogenomics, neuroproteomics, optogenetics, deep brain stimulation etc.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face to face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Lectures (using power-point presentations).	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures (13 weeks x 3 hours per week)	39
	Home study	36
	Course total	**75**
STUDENT PERFORMANCE EVALUATION	Written exams at the end of semester (85% and oral presentations 15 % or 100 % without assay and oral presentation). Final Course Grade: Theory Grade x 0.85 + x 0.15 assay and oral presentation or only Theory Grade Grading scale: 1-10. Passing grade ≥ 5	

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

- *Essentials of Neural Science and Behavior* Kandel ER, Schwartz JH & Jessel TM. (in greek), Publ. of Univ of Crete, 2011.
- *Neuroscience,* Purves P., Augustine G., Fitzpatrick D., Hall W., Lamantia A.S. & McNamara J. Williams S. (in greek) Parisianos Publ. SA, 2010.

Related academic journals:

2.52 ELEMENTS OF GEOLOGY AND PALAEONTOLOGY

1. GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_ΣΓΠ**	**SEMESTER**	**G**
COURSE TITLE	ELEMENTS OF GEOLOGY AND PALAEONTOLOGY		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures, laboratory exercises		4	6
COURSE TYPE	Basic and Skills Development, Scientific Field		
PREREQUISITE COURSES	Typically, there are not prerequisite courses		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes, teaching may be however offered in English in case foreign students attend the course.		
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/BIO336/ (in Greek)		

2. LEARNING OUTCOMES

Learning outcomes

Upon successful completion of this course the students will be able to:

- understand the basic principles of geology and palaeontology
- interpret the the dynamics of the planet
- identify and appreciate the evolution of the living and abiotic world
- apply methods and practices for extracting results in relation to maps and the stratigraphy of an area
- know about the fossils which are the proof of evolution, and their use in geological research
- distinguish fossilized from extant organisms
- know about the origin, development and evolution of life, what extinction events are, when they occur and what impact they have on the evolution of life
- understand that land is a constantly changing world and these changes are directly related to the evolution and shaping of life on earth.

General Competences

Generally, by the end of this course the student will, furthermore, have developed the following general abilities:

- Adjusting to new conditions.
- Independent work.
- Group work.
- Working in a multidisciplinary environment
- Respecting the environment.
- Promoting free and creative thinking.
- Generating new research ideas

3. SYLLABUS

Theory

- Characteristics and dynamics of planet Earth.
- Geological time and dating
- Introduction to Petrography

- Evolution of the climate and the environment in the history of the Earth.
- Fossils - Fossilization - Fossil Categories – Types of Fossilisation - Types of Fossils
- Palaeontological Species Definition
- Palaeoecology - Taphonomy.
- What life is - Appearance and evolution of life on Earth – Extinction events
- Life during the Cryptozoic Eon
- Life during the Phanerozoic Eon
- Evolution of Vertebrates: fishes, amphibians, reptiles, birds, mammals, primates.

Practical

- Positioning and map building
- Analysis and interpretation of granulometric data
- Interpretation of palaeoenvironmental data
- Study of fossils
- Familiarizing with some of the most important and common groups of organisms we encounter as fossils and which appeared and dominated during the Phanerozoic Eon.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Lectures and laboratory practice face to face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of Information and Communication Technologies (ICTs) (PowerPoint) in teaching. Supporting teaching and communication through e-class. The lectures content of the course are uploaded on the e-class platform, in the form of a series of ppt files, from where the students can freely download them.	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures (2 conduct hours per week x 13 weeks)	26
	Laboratory work (2 conduct hours per week x 13 weeks)	26
	Hours for the preparation of laboratory work reports	39
	Hours for private study of the student	39
	Fieldwork	20
	Course total	**150**
STUDENT PERFORMANCE EVALUATION	**Theory** Assessment Language: Greek Final Examination: Written, Graded Difficulty, which may include Multiple Choice Test, Short Answer Questions, Essay Development Questions, Problems-Exercises. **Rating Scale: 0-8.** **Laboratory** Assessment of students' participation and performance in exercises given during the semester through written reports for each laboratory exercise. The participation in the fieldwork is obligatory. **Rating Scale (total): 0-2** The final grade of the course is the sum of the grades of the Theory and the Laboratory. **Minimum Pass Grade: 5**	

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

1. Prothero, R.D., 1998, Bringing fossils to life: An introduction to palaeobiology, WCB/McGraw-Hill
2. Clarkson, E., 1998, Invertebrate Palaeontology and evolution, Wiley-Blackwell
3. Benton M.J., 2005, Vertebrate Paleontology, Blackwell Science Ltd
4. Benton M. J., Harper D., A.T., 2009, Introduction to Paleobiology and the Fossil Record, Wiley-Blackwell, Chichester.
5. Levin, H.,2013, The Earth through time, Wiley
6. Notes of lecturers in English.

Related academic journals:

Geology, Paleoclimatology Paleoecology Paleogeography, BioGeoScienses.

2.53 PHYSICAL CHEMISTRY

1. GENERAL

SCHOOL	NATURAL SCIENCE		
ACADEMIC UNIT	BIOLOGY DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE - ELECTIVE		
COURSE CODE	**BIO_ΦΥΧ**	**SEMESTER**	**G**
COURSE TITLE	PHYSICAL CHEMISTRY		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
	Lectures	3	3
COURSE TYPE	Specialised general knowledge		
PREREQUISITE COURSES	There are not prerequisite courses		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek. Teaching could be performed in English, in case of foreign students attend the course		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://eclass.upatras.gr/modules/document/?course=BIO230		

2. LEARNING OUTCOMES

Learning outcomes

At the end of this course the student should be able to:

- Have a concise knowledge on the basic concepts of Kinetics and Thermodynamics.
- Distinguish between a descriptive and an interpretative theory
- Describe how a descriptive and how an interpretative theory emerges. 4
- Predict the ideal gas behavior and interpret deviations of real gasses.
- Predict the phase changes of a system consisting of one component.
- Interpret physical phenomena, such as diffusibility of gasses, osmosis and boiling point elevation after dissolving a nonvolatile solid.
- Assemble a distillation apparatus (simple or fractional) and interpret how the separation of the different components of a mixture can be performed.
- Predict the reactions spontaneity at constant T and P.
- Explain the significance of a rate law and the rate constant of a reaction.
- Integrate the rate laws for first- and second order reactions.
- Write the rate laws for elementary unimolecular and bimolecular reactions.
- Write the Arrhenius equation and use it for the Arrhenius equation parameters calculation.
- Understand and use the steady-state approximation for simplifying the analysis of a kinetic scheme.

General Competences

At the end of the course the student will have further developed the following skills/competences:

- Ability to demonstrate knowledge and understanding of essential facts, concepts, principles and theories relating physical chemistry
- Ability to apply such knowledge and understanding to the solution of qualitative and quantitative problems nature.
- Ability to adopt and apply methodology to the solution of unfamiliar problems.
- Ability to interact with others on inter- or multidisciplinary problems.

3. SYLLABUS

- **Scientific Method, the method by which Science advances**:

Kinetic Molecular Theory, as an example of a descriptive theory. Formulating a theory starting from empirical laws. The Ideal Gas Law as an outcome of Scientific Method. Interpretation of empirical laws and predictions of ideal gas behavior. Real gasses (virial and van der Waals equations).

- **Thermodynamics, as an example of an interpretative theory:**

Basic definitions needed to describe a thermodynamic system. The First Law of Thermodynamics. The principle of maximum Entropy and the second Law of Thermodynamics. Equilibrium conditions, spontaneous changes and equilibrium. Legendre's transformations. Definition and properties of new thermodynamic functions (F, H and G). Thermodynamic degrees of freedom. Gibbs-Duhem equation. Phase diagrams of pure substances and ideal solutions. The freezing point depression and boiling point elevation. Osmotic pressure. The temperature composition diagram and fractional distillation. Spontaneous Reactions at constant T and P.

- **Kinetics:**

Reaction rates. Reaction order and molecularity. Rate constant of a reaction. Order determination of a reaction by "The integrated method" and "The Differential Method". Rate laws from the mechanism of a reaction. The steady-state approximation. The temperature dependence of reaction rates. Theories of elementary reactions.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Lectures and solving problems face-to-face.	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	• Presentation only of figures by PowerPoint. • Problem-solving seminars for the instructive solution of synthetic problems.	
TEACHING METHODS	*Activity*	*Semester workload*
	• Lectures (3 conduct hours per week × 13 weeks) • Problem solving by students	39
	Hours for private study of the student and optional problems solving given in each lecture	33
	Final written examination at the end of semester (3 conduct hours × 1 time)	3
	Course total	**75**
STUDENT PERFORMANCE EVALUATION	• Final written examination of short-answer questions, in Greek • Lectures are supported by problem-solving modules, which are not compulsory. Students who have attended successfully these modules, get a bonus if they secure the minimum passing mark in the final written examinations. • Written examination Greek grading scale: 1-10. Minimum passing grade: 5.	

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

- «Physical Chemistry» G. Karaiskakis, Eds.: P. Travlos-E. Kostarakis, Athens, 1995.
- «Physical Chemistry», N. Katsanos, Ed. Papazisi, 3rd ed. έκδοση, Athens 1993.
- "Atkins' Physical Chemistry" P. Atkins and J. de Paula, 8th ed., Oxford University Press, 2006.

Related academic journals:

2.54 MAPPING AND ASSESSMENT OF ECOSYSTEMS AND THEIR SERVICES

1. GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_XAO**	**SEMESTER**	**G**
COURSE TITLE	MAPPING AND ASSESSMENT OF ECOSYSTEMS AND THEIR SERVICES		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures, seminars, and Multimedia displays	3	6
Laboratory work & exercises	2	

COURSE TYPE	Field of Science Skills development
PREREQUISITE COURSES	Typically, there are not prerequisite course. A good knowledge on the field of ecology is recommended.
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek. Teaching may however be performed in English in case foreign Erasmus students attend the course.
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/BIO373/

2. LEARNING OUTCOMES

Learning outcomes

By the end of this course the students will be able to:

1. Understand the patterns of and identify the spatial distribution of the various ecosystem types
2. Apply methods of qualitative, quantitative, temporal and spatial assessment of ecosystems' condition
3. Identify and assess ecosystems' main services
4. Discuss major theories and concepts of modern perspectives of the contribution of ecosystem services in sustainable management and human well-being
5. Select and implement methods on mapping ecosystem types and their services at different spatial scales

At the end of this course the students will have further developed the following skills/ competences:

1. Ability to identify the various ecosystem types and their main services
2. Ability to assess ecosystems' condition and services
3. Ability to create thematic maps, conduct spatial analyses on ecosystems and their services using Geographic Information Systems (GIS) and compile relevant cartographic studies
4. Ability to formalize scientific and management questions in the field of conservation biology and sustainable management
5. Ability to conduct environmental impact assessments, on ecosystems' condition and services, of the various construction projects and activities

Ability to communicate scientific data and outcomes to decision makers, via their interpretation from the perspective of the ecosystem service concept.

General Competences

Generally, by the end of this course the student will, furthermore, have develop the following general abilities (from the list above):

- Search, analyze and synthesize data and information, using the necessary technologies
- Adaptation to new situations
- Autonomous (Independent) work
- Group work
- Working in an interdisciplinary environment
- Decision making
- Respect to natural environment
- Design and project management
- Respect for diversity and multiculturalism

3. SYLLABUS

1. Introduction to Mapping and Assessment of Ecosystem and their Services – subject of study, terms, historical review of the establishment and integration of the ecosystem services' concept in integrated management and decision making

2. Classification of ecosystem types and of their services: identification, classification methods and categories, main problems and challenges

3. Basic principles and methods of mapping ecosystems types and biophysical parameters.

4. Mapping of ecosystems, vegetation units and habitat types: sampling methods, satellite imagery and remote sensing, photo-interpretation, thematic representations, spatial analyses.

5. Mapping ecosystem services; main mapping methods; What do we choose to map, where, when, and why?

6. Geographic Information Systems (GIS): digital maps compilation, geographic and spatial data types, spatial analyses, geo-databases

7. The value of mapping as a research and decision-making tool.

8. Qualitative and quantitative assessment of ecosystems condition and of their services: ecosystems conservation status assessment methods, identification of the provided services and the demand for services, creation and evaluation of management scenarios.

9. The value of ecosystem services in decision-making: practical applications of mapping and assessing ecosystems and their services.

10. Ecosystem services and protected areas: challenges, opportunities and prospects.

11. Case-study exercise using Geographic Information Systems (GIS).

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Lectures, seminars and laboratory work (face to face).
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of Information and Communication Technologies (ICTs) (e.g. PowerPoint, videos) in teaching. The lectures content of the course for each chapter are uploaded on the internet, in the

	form of a series of ppt files, where from the students can freely download them.	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures (3 conduct hours per week x 13 weeks)	39
	Laboratory exercises/ work (2 conduct hours per week x 13 weeks)	20
	Optionally, preparation of home-works from groups of two or three students each.	26
	Hours for private study of the student and preparation of home-works and reports, for the Laboratory, and preparation for the Laboratory (study of techniques and theory)	65
	Course total	**150**
STUDENT PERFORMANCE EVALUATION	Written examination at the end of semester (70%) Laboratory practicum (30%) Passing grade: 5	

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

- Dimopoulos P, Kokkoris IP (2017). Mapping and assessment of ecosystem and their services. Katagramma publishing, Kiato, pp. 272 (in Greek). ISBN 978-960-9407-39-7
- Burkhard B, Maes J (Eds.) (2017). Mapping Ecosystem Services. Pensoft Publishers, Sofia, 347pp.
- Jacobs S, Burkhard B, Van Daele T, Staes J, Schneiders A (2015). "The Matrix Reloaded": A review of expert knowledge use for mapping ecosystem services. Ecol Modell. 295:21–30.
- Haines-Young R, Potschin M (2013). 'Common Classification of Ecosystem Services (CICES): Consultation on version 4, August-December 2012', Report to the European Environment Agency [Internet]. [cited 2017 Jan 21]. Available from:
- https://www.nottingham.ac.uk/CEM/pdf/CICES%20V43_Revised%20Final_Report_29012013.pdf
- Kokkoris IP, Drakou EG, Maes J, Dimopoulos P (2018). Ecosystem services supply in protected mountains of Greece: setting the baseline for conservation management, International Journal of Biodiversity Science, Ecosystem Services & Management, 14:1, 45-59, DOI: 10.1080/21513732.2017.1415974
- Dimopoulos P, Drakou E, Kokkoris I, Katsanevakis S, Kallimanis A, Tsiafouli M, Bormpoudakis D, Kormas K, Arends J (2017). The need for the implementation of an Ecosystem Services assessment in Greece: drafting the national agenda. One Ecosystem 2: e13714. https://doi.org/10.3897/oneeco.2.e13714
- Kokkoris IP, Dimopoulos P, Xystrakis F, Tsiripidis I (2018). National scale ecosystem condition assessment with emphasis on forest types in Greece. One Ecosystem 3: e25434. https://doi.org/10.3897/oneeco.3.e25434
- Kokkoris IP, Bekri ES, Skuras D, Vlami V, Zogaris S, Maroulis G, Dimopoulos D, Dimopoulos P (2019). Integrating MAES implementation into protected area management under climate change: A finescale application in Greece. Science of the Total Environment, 695, 133530
- QGIS training manual https://docs.qgis.org/2.2/en/docs/training_manual/
- Notes of lecturers (in Greek): https://eclass.upatras.gr/courses/BIO373/

Related academic journals:

2.55 FOOD CHEMISTRY AND TECHNOLOGY

1. GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_XTP**	**SEMESTER**	**G**
COURSE TITLE	FOOD CHEMISTRY AND TECHNOLOGY		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	4	6
Laboratory work	4	

COURSE TYPE	Field of Science and Skills Development.
PREREQUISITE COURSES	There are not prerequisite courses.
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek. Teaching may be however performed in English in case foreign students attend the course.
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes.
COURSE WEBSITE (URL)	

2. LEARNING OUTCOMES

Learning outcomes

By the end of this course the student will acquire the necessary knowledge on:

1. Chemistry, nutritional value, microbiology, and methods of production of carbohydrate-, protein- and fat-containing foods, juices, alcoholic beverages and dairy products at industrial, semi-industrial and/or household scale.
2. Industrial practices and new trends on improving the quality and the production processes of food, as well as to produce new foods with health benefits.
3. The importance of fermentation technology in food production and the linking of biotechnology with the food industry.
4. Applying analytical methods for the determination of food composition.

General Competences

Generally, by the end of this course the student will have further developed the following general abilities (from the list above):

- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Adapting to new situations
- Decision-making
- Working independently
- Team work
- Working in an interdisciplinary environment
- Production of new research ideas
- Criticism and self-criticism
- Production of free, creative and inductive thinking

Specifically, by the end of this course the student will acquire:

1. Practical skills for the separation and analysis of food ingredients using classical and instrumental analytical techniques.
2. Ability to recognize the role and nutritional value of food ingredients in order to adapt their daily diet to the benefit of their own health and to deal with problems (diet, diabetes, anaemia, etc.) and to be able to advise other people respectively.
3. Capability to assess the nutritional value of industrial foods.

4. Knowledge on the production of different types of wine (dry, sweet, red, white).
5. Ability to assess the impact of the various processes of food production on its composition and quality.
6. Possibility to seek employment in companies, industries and laboratories, the majority of which in Greece are in the food sector.
7. Ability to critically evaluate knowledge for the selection of appropriate products/technologies to create new companies of food production, processing, or analysis.
8. Ability to have a consulting role in food production, processing, and analysis companies and to seek employment in these companies.

3. SYLLABUS

1. Carbohydrate containing foods: Production of syrups (raisin syrup, carob syrup). Production of sugar - molasses. Starch and glucose industry. Honey. Sweeteners.
2. Bakery products. Raw materials. Chemical composition. Swelling. Functional properties of starch and gluten. New Trends (Starter Cultures, Enzymes, Applications of Genetic Engineering, Chemical Additives).
3. Oenology: Composition and correction of must. Alcoholic fermentation. White and red vinification. Sweet wines and Mistelles (non-fermented fortified wines). Sparkling wines. Retsina (resinated wine). Stafiditis (raisin wine). Mavrodaphni (Greek red fortified wine). Thermovinification. Wine composition. Alcoholic fermentation by-products. Aging. Diseases and defects. Wine clarification. Racking. Sulphite addition. Pasteurization. Bottling. Wine Mechanics: Crushing/grape crushers. Must draining/drainers. Presses. Must transfer pumps. Bioreactor types (fermentation tanks). Must recycling (tide) during vinification. Filters. Pasteurizers. Bottle washing machines. Filling machines. Capping-tamping machines. Installation of bottling line. Wine tasting: Colour, appearance, aroma, taste, ingredients with sweet, sour or astringent feel. Sulphited musts. Wine and other grape derivatives in human diet.
4. Vinegar. Alcoholic beverages-Distillates (tsipouro, tsikoudia, ouzo, brandy, whiskey, vodka). Potable alcohol from raisins, molasses, cereals and potatoes.
5. Rapid alcoholic fermentations by *Saccharomyces cerevisiae* and *Zymomonas mobilis*. Bioreactors. Alcoholic fermentation parameters. Refineries. Liquors.
6. Beer production. Malting. Brewing. Maturation. Treatments.
7. Yeasts in food & food ingredients production. Isolation. Growth. Metabolism. Raw materials for the production of food grade yeasts. Industrial production. Food uses (wine, beer, spirits, bakery products, food supplements, probiotics, food flavour enhancers, single cell protein, dairy yeasts, yeasts for the production of food ingredients).
8. Citrus juice industry: Raw material, juicing, factors that affect the quality of juice, heat treatment of citrus juices, concentration of citrus juices, essential oils.
9. Fats and oils. Fat and oil alterations. Treatment of raw materials and products (refining, discoloration, deodorization, hydrogenation).
10. Meat Technology: Composition, microbiology, canning, meat products.
11. Milk Technology: Composition, microbiology, treatments (filtration, cooling, pasteurization, condensation, homogenization, skimming).
12. Dairy products.

Laboratory exercises:

1. Analytical presentation of all laboratory exercises-Tutorial.
2. Flour analysis: (a) Determination of gluten. (b) Ash determination. (c) Detection of oxidants.
3. Oil Analysis: (a) Saponification number. (b) Degree of acidity. (c) Iodine number. (d) Colour reactions. (e) Detection of antioxidant additives and paraffin oil in olive oil by thin layer chromatography.
4. Milk analysis: (a) Protein determination by the Kjeldahl method. (b) Fat determination by the Gerber method. (c) Specific weight.
5. Determination of total fat in olive pit or cocoa or nuts by Soxhlet extraction.
6. Sugar analysis by the Lane-Eynon method: Determination of (a) reducing sugars, (b) total sugars, and (c) sucrose in honey.
7. Sugar analysis: Determination of (a) glucose by Kolthoff's methods, (b) fructose, and (c) detection

of sugar syrup, and (d) starch syrup in honey.

8. Oenology: *Saccharomyces*. (a) Preparation of wet and solid yeast culture. (b) Preparation of liquid yeast culture in must in order to enhance the fermentation of wine. (c) Determination of yeast concentration in fermenting must.
9. Oenology: Examination and alcoholic fermentation of grape must. (a) Measurement of density. (b) Determination of total acidity. (c) Corrections of must. (d) Alcoholic fermentation for white dry wine. (e) Alcoholic fermentation for red sweet wine. (f) Preparation of Mistelle. (g) Rapid alcoholic fermentation by addition of yeast. Kinetics of fermentation. Determination of cell concentration. (h) Microscopic examination of yeasts (observation of healthy cells, dead cells, bacteria contamination). Microscopic examination of yeast cells prior to fermentation.
10. Oenology: Chemical analysis of wines: (a) alcoholic strength, (b) total acidity, (c) volatile acidity, (d) free sulphite, (e) bound sulphite, (f) total sulphite.
11. Oenology: Treatments for the preparation of white dry and red sweet wine: (a) Fermentation monitoring: Macroscopic. Microscopic observation of yeasts. Enhancement of stuck fermentation with yeast. (b) Cease of fermentation by addition of alcohol in sweet wine production. (c) Determination of the end of fermentation. Racking. Clarification. Sulphite addition. Wine cooling. Filtration.
12. Gas chromatographic analysis of oils (fatty acid methyl esters).
13. Sensory evaluation of wine.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	1. Face-to-face lectures using Information and Communication Technologies (ICTs) (e.g. PowerPoint), and presentation of the theoretical background of the laboratory exercises. 2. Laboratory exercises in groups of 2-3 students.	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of ICTs (e.g. PowerPoint) in teaching. The lectures content of the course for each chapter are uploaded on the internet (e-class), in the form of a series of .ppt/.pdf files, where from the students can freely download them using a password, which is provided to them at the beginning of the course.	
TEACHING METHODS	***Activity***	***Semester workload***
	Lectures (4 contact hours per week x 13 weeks)	52
	Εργαστήριο (4 contact hours per week x 13 weeks)	52
	Final exam (6 contact hours)	6
	Hours for private study of the student and preparation for the final examination.	40
	Course total	**150**
STUDENT PERFORMANCE EVALUATION	1. Laboratory exercises (40% of the final course grade). Average score of oral and written test after the end of each exercise, and final written examination of the laboratory exercises. 2. Final written exam (60% of the final grade).	

	3. All the above take place in the Greek language, as well as in English for foreign students (e.g. ERASMUS students). Grade scale: 1-10 Passing grade:5

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

1. Α. Κουτίνας, Μ. Κανελλάκη. «Χημεία και Τεχνολογία Τροφίμων». Εκδόσεις Νέον. Κωστάκη Δ. Αθανάσιου. κωδ.ευδόξου: 86195516.
2. Ανδρικόπουλος Νικόλαος. Ανάλυση Τροφίμων (Β' Έκδοση). Θεωρία Μεθοδολογίας – Οργανολογίας και Εργαστηριακές Ασκήσεις. 2015
3. H.-D. Belitz, W. Grosch, P. Schieberle. Χημεία Τροφίμων. 3η Έκδοση, Επιστ. Επιμ.: Σ. Ραφαηλίδης, Μετάφρ.: Μ.Δ. Παπαγεωργίου, Α.Ι. Βάρναλης, Εκδόσεις Τζιόλα, 2007.
4. Ε. Βουδούρη, Μ. Κοντομηνά. Εισαγωγή στη Χημεία Τροφίμων. Εκδόσεις ΟΕΔΒ, 2006.
5. Jackson, R. Wine Science, 3rd Edition: Principles and Applications. 2008, Elsevier Inc. A.

Related academic journals:

Comprehensive Reviews in Food Science and Food Safety
Current Opinion in Food Science
Food and Bioprocess Technology
Food Chemistry
Food Engineering Reviews
Food Microbiology
Food Research International
Innovative Food Science and Emerging Technologies
International Journal of Food Microbiology
Journal of Agricultural and Food Chemistry
Journal of Food Engineering
LWT - Food Science and Technology
Trends in Food Science and Technology

2.56 DIPLOMA THESIS I

1. GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**BIO_ΔΙΠΛΙ**	**SEMESTER**	**G**
COURSE TITLE	DIPLOMA THESIS I		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
	Experimental project	12	6
COURSE TYPE	Special background		
PREREQUISITE COURSES			
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes (English)		
COURSE WEBSITE (URL)	http://www.biology.upatras.gr/		

2. LEARNING OUTCOMES

Learning outcomes
Upon Diploma Thesis completion, the students should be able to: 1. Design experiments related to the subject of their Diploma Thesis, 2. Carry out the relevant experiments successfully, 3. Interpret results from experimental data and draw conclusions, 4. Study and manage the relevant international bibliography, and 5. Organize, write and present the subject of their Diploma Thesis
General Competences
Adapting to new situations Working independently Team work Generating new research ideas Project planning and management Promoting free, creative and inductive thinking

3. SYLLABUS

The Diploma Thesis (DT) is an elective course that lasts two semesters (G and H). When selected by the student, it is considered as a compulsory elective course. The supervisor of the DT is a member of the teaching staff of one of the three Divisions of the Department of Biology, in which the thesis is carried out. The supervisor of the DT may also be a Faculty member of another Department, who has been instructed to teach a course of the Department of Biology curriculum. Upon completion of the experimental project, the students are expected to write and submit their thesis. Following the public presentation of the thesis, the student is examined by a three-member Examination Committee.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face to face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of ICT, laboratory education, communication with students	
TEACHING METHODS	***Activity***	***Semester workload***

	Experimental project. Upon completion, the students are expected to write and submit their thesis. Following the public presentation of the thesis, the student is examined by a three-member Examination Committee.	
	Course total	**150**
STUDENT PERFORMANCE EVALUATION	Evaluation of the student's performance in the laboratory. Evaluation of the written thesis, in which the results are presented and discussed. Public presentation of the thesis, and examination of the student by a three-member Examination Committee. Grading scale: 1-10 Passing grade: 5	

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:
Scientific literature papers

Related academic journals:

2.57 DIPLOMA THESIS II

1. GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**ΒΙΟ_ΔΙΠΛΙΙ**	**SEMESTER**	**Η**
COURSE TITLE	DIPLOMA THESIS II		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
	Experimental project	12	12
COURSE TYPE	Special background		
PREREQUISITE COURSES			
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes (English)		
COURSE WEBSITE (URL)	http://www.biology.upatras.gr/		

2. LEARNING OUTCOMES

Learning outcomes
Upon Diploma Thesis completion, the students should be able to: 6. Design experiments related to the subject of their Diploma Thesis, 7. Carry out the relevant experiments successfully, 8. Interpret results from experimental data and draw conclusions, 9. Study and manage the relevant international bibliography, and 10. Organize, write and present the subject of their Diploma Thesis
General Competences
Adapting to new situations Working independently Team work Generating new research ideas Project planning and management Promoting free, creative and inductive thinking

3. SYLLABUS

The Diploma Thesis (DT) is an elective course that lasts two semesters (G and H). When selected by the student, it is considered as a compulsory elective course. The supervisor of the DT is a member of the teaching staff of one of the three Divisions of the Department of Biology, in which the thesis is carried out. The supervisor of the DT may also be a Faculty member of another Department, who has been instructed to teach a course of the Department of Biology curriculum. Upon completion of the experimental project, the students are expected to write and submit their thesis. Following the public presentation of the thesis, the student is examined by a three-member Examination Committee.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face to face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of ICT, laboratory education, communication with students	
TEACHING METHODS	***Activity***	***Semester workload***

	Experimental project. Upon completion, the students are expected to write and submit their thesis. Following the public presentation of the thesis, the student is examined by a three-member Examination Committee.	
	Course total	**300**
STUDENT PERFORMANCE EVALUATION	Evaluation of the student's performance in the laboratory. Evaluation of the written thesis, in which the results are presented and discussed. Public presentation of the thesis, and examination of the student by a three-member Examination Committee. Grading scale: 1-10 Passing grade: 5	

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:
Scientific literature papers

Related academic journals:

2.58 INTERSHIP

1. GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**ΒΙΟ_ΠΡΧ**	**SEMESTER**	**7ο**
COURSE TITLE	Internship		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
	Internship		6
COURSE TYPE	Specialised general knowledge		
PREREQUISITE COURSES			
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No		
COURSE WEBSITE (URL)	http://www.biology.upatras.gr/en/internship/		

2. LEARNING OUTCOMES

Learning outcomes
The Internship is an important activity that attracts the interest of many students of the Department and is a connection of higher education with the labor market, offering students a first important work experience in a field related to their scientific interests.
General Competences
• Working independently • Team work • Search for, analysis and synthesis of data and information, with the use of the necessary technology • Production of free, creative and inductive thinking • Decision-making • Criticism and self-criticism • Adapting to new situations and a professional environment

3. SYLLABUS

The Internship is an elective course of the 7th or 8th semester with 6 ECTS. Eligible to participate in the Internship are fourth-year or senior students who, after their selection, are employed for a period of two (2) months, in public or private institutions. The supervisor of the Internship is a member of the teaching staff of one of the three Divisions of the Department of Biology. Upon completion of the Internship, the students are expected to write and submit a scientific report-presentation. Following the presentation of the Internship, the student is examined by the supervisor.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face. Discussion during lecture. Encouragement in keeping notes.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	YES

TEACHING METHODS	*Activity*	*Semester workload*
	Scientific Internship project. Upon completion, the students are expected to write and submit a scientific report. Following the presentation of the Internship, the student is examined by the supervisor	
	Course total	**150**
STUDENT PERFORMANCE EVALUATION	Evaluation of the student's performance in the Institution of Internship . Evaluation of the written report, in which the results are presented and discussed.	

5. ATTACHED BIBLIOGRAPHY

2.59 INTERSHIP

1. GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**ΒΙΟ_ΠΡΕ**	**SEMESTER**	**8ο**
COURSE TITLE	Internship		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
	Internship		6
COURSE TYPE	Specialised general knowledge		
PREREQUISITE COURSES			
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No		
COURSE WEBSITE (URL)	http://www.biology.upatras.gr/en/internship/		

2. LEARNING OUTCOMES

Learning outcomes
The Internship is an important activity that attracts the interest of many students of the Department and is a connection of higher education with the labor market, offering students a first important work experience in a field related to their scientific interests.
General Competences
• Working independently • Team work • Search for, analysis and synthesis of data and information, with the use of the necessary technology • Production of free, creative and inductive thinking • Decision-making • Criticism and self-criticism • Adapting to new situations and a professional environment

3. SYLLABUS

The Internship is an elective course of the 7th or 8th semester with 6 ECTS. Eligible to participate in the Internship are fourth-year or senior students who, after their selection, are employed for a period of two (2) months, in public or private institutions. The supervisor of the Internship is a member of the teaching staff of one of the three Divisions of the Department of Biology. Upon completion of the Internship, the students are expected to write and submit a scientific report-presentation. Following the presentation of the Internship, the student is examined by the supervisor.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face. Discussion during lecture. Encouragement in keeping notes.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	YES

TEACHING METHODS	*Activity*	*Semester workload*
	Scientific Internship project. Upon completion, the students are expected to write and submit a scientific report. Following the presentation of the Internship, the student is examined by the supervisor	
	Course total	**150**
STUDENT PERFORMANCE EVALUATION	Evaluation of the student's performance in the Institution of Internship . Evaluation of the written report, in which the results are presented and discussed.	

5. ATTACHED BIBLIOGRAPHY
