UNIVERSITY OF PATRAS

SCHOOL OF NATURAL SCIENCES

DEPARTMENT OF BIOLOGY

POSTGRADUATE PROGRAMME

Biological Technology: Research and Applications

Concise Guide and Course Outline
Academic year 2024-2025

Patras, October 2024

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1. The Department of Biology

The Department of Biology (founded in 1697-1968 as a Department of the School ofNatural Science, University of Patras) is co-located with the Department of Mathematics in a single three-floor building. Its activities are distributed as follows:

GROUND FLOOR: Secretariat, meeting room, seminar room, reading room, computer center, classrooms, Botanical Museum, Zoological Museum.

1st FLOOR: Section of Plant Biology.

2nd FLOOR: Section of Genetics, Cell and Developmental Biology.

3rd FLOOR: Section of Animal Biology.

BASEMENT: Electron Microscopy Laboratory, Crystallography Laboratory and Confocal Microscopy Laboratory,aquaculture laboratory area, classrooms, storage areas.

The Department of Biology implements a Master's Degree Program entitled: "Biological Technology: Research & Applications", thus participating in Interdepartmental Postgraduate Programs, together with other Departments of the School of Natural Sciences (i.e., Departments of Geology, Physics, Chemistry and Mathematics), as well as with the Departments of Medicine, Pharmacy, Computer Engineering and Informatics of the University of Patras.

2. Master's Program «Biological Technology: Research & Applications»

The MSc entitled "Biological Technology: Research & Applications" aims at the postgraduate education of graduates from the Department of Biology and other related sciences in cutting-edge areas of the Biological Sciences. The MSc program (duration 3 semesters) leads to a master's degree Biological Technology: Research & Applications, that corresponds to level seven (7) of the National and European Qualifications Framework, according to article 47 of Law 4763/2020.

3. Course guide and structure

The 18-month duration MSc curriculum in *Biological Technology: Research & Applications* consists of one (1) compulsory and five (5) elective courses (corresponding to 40 ECTS) that are divided into two (2) semesters, as well as the implementation and evaluation of the MSc thesis (corresponding to 50 ECTS) during the second and third semester (**Table 1**).

Table 1. Course allocation in semesters, course type and ECTS.

1st Semester			
Course code	**Course title**	**Course type**	**ECTS**
BT_1.1	Research Methodology	Compulsory	15
BT_1.2	Cancer Biology – Biomarkers	Elective	5
BT_1.3	Structural Biology	Elective	5
BT_1.5	Topics in Applied Plant Physiology & Biotechnology	Elective	5
BT_1.6	Molecular Genetics & Applications	Elective	5
BT_1.7	Theory and Practice in Molecular-Data Analysis: Population Genetics & Phylogenetics	Elective	5

BT_1.8	Systems Biology	Elective	5
Total ECTS			**30**
2nd Semester			
Course code	**Course title**	**Course type**	**ECTS**
BT_DIP1	Diploma Thesis I	Compulsory	20
BT_2.1	Biochemistry of Oxidative Stress	Elective	5
BT_2.2	Applied Entomology	Elective	5
BT_2.3	Methodology in Biomedical Research	Elective	5
BT_2.4	Microbial Biotechnology	Elective	5
BT_2.5	Molecular & Cellular Immunobiology	Elective	5
BT_2.6	Environmental Mutagenesis	Elective	5
Total ECTS			**30**
3rd Semester			
Course code	**Course title**	**Course type**	**ECTS**
BT_DIP2	Diploma Thesis II	Compulsory	30
Total ECTS			**30**

The 1st semester is implemented from XX/XX/XXXX to XX/XX/XXXX, followed by exams in each course, and subsequently by the 2nd semester. During the curriculum, seminars will be scheduled by invited lecturers from different national and international institutes.

Resits to each course are commonly performed in September, after the completionof both semesters.

After the completion of teaching courses, all MSc students are asked to implement their diploma thesis to complete their studies (duration 12 months), after consultation with a member of the teaching staff (supervisor).

4. Description and content of courses

BT_1.1 | Research Methodology

Abstract: Research methodologies in the field of Biological Technologies.

Syllabus: Evaluation of cancer biomarkers in cancer cells using VyCAP platform. Methods of protein crystallization. Recording of behavioral parameters after induction of seizures in adult mice. Assessment of environmental stress on plants using *in vivo* chlorophyll fluorescence. Big-data analysis and *omic* technologies. Mitochondrial and nuclear molecular markers analysis. From the biological sample to the DNA sequence. Metabolomic analysis. Molecular and genetic analysis of laboratory strains of the Mediterranean fruit fly, *Ceratitis capitata*. Image analysis, microscopic cell quantification. Alcoholic fermentation. Flow cytometry. Genotoxicity and cytotoxicity effects of selected pollutants: Introduction, prediction, and evaluation.

BT_1.2 | Cancer Biology – Biomarkers

Abstract: Description of therapeutic targets/biomarkers and signal transduction pathways in tumor cells. Introduction to new approaches in cancer research: Liquid biopsy and innovative means in cancer diagnosis and prognosis.

Syllabus: Signal transduction pathways in cancer cells and therapeutic targets. Cytoskeleton in tumor cells. Biomarkers in breast and prostate cancer. ErbB receptor family in cancer therapy. Biomarkers of immune response and cancer (PD-L1 / PD-1 Axis). Introduction to Liquid Biopsy. Circulating Tumor Cells (CTCs) in Breast Cancer. Circulating Tumor Cells in Lung, Prostate, and Colon Cancer. Exosomes and cancer. Micro RNAs as biomarkers in cancer biology.

BT_1.3 | Structural Biology

Abstract: Protein production, crystallization and structural characterization via X-ray diffraction data and crystallographic methods. The role of Structural Biology in Life Sciences.

Syllabus: Biochemical methods of protein production and crystallization. Characteristics and facilities of synchrotron radiation. Introduction to X-ray diffraction and crystallography: diffraction of electromagnetic radiation, crystal symmetries, space group and point groups, Fourier transformations, methods for solving the crystallographic phase problem [Patterson methods, direct methods, molecular replacement, isomorphous replacement, anomalous dispersion].

BT_1.4 | Novel Courses in Neurobiology and Regenerative Biology

Abstract: Cellular and molecular mechanisms of selected topics related to areas of particular interest in Neurobiology and Regenerative Biology.

Syllabus: Basic prnicples of evolution and embryonic development of the neuron and of the nervous system. The synapsis and synaptic plasticity. Neural networks and the functional organization of the brain. Cellular and molecular mechanisms of learning and memory. Cellular and molecular basis of diseases of the nervous system (Parkinson's and Alzheimer's disease, epilepsy, multiple sclerosis, schizophrenia, depression]. Oxidative stress: moleclular mechanisms and endogenous anti-ontixaditve system. Neuro-endocrine and immuno interactions (e.g. stress). Basic principles in the biology of stem cells (embryonic, adult and induced) and in their clinical use. Function of adult/ tissue-specific stem cells; tissue homeostasis and regeneration. High throughput technologies, precision medicine. Themes from current scientific literature on forefront methodology [stem cells, optogenetics, robotics] in the fields of neurobiology and on the evelution and regenearation of the nervous system.

BT_1.5 | Topics in Applied Plant Physiology and Biotechnology

Abstract: Contemporary methodological approaches in Applied Plant Physiology and Plant Biotechnology. From laboratory experimentation to plant function under stressful environmental conditions.

Syllabus: Contemporary methodology in Plant Physiology. Evaluation of abiotic stresses: high/low visible light, high/low temperature, water, oxidative, ionic/osmotic stress. Evaluation of biotic stress: infection by microorganisms. Allelopathy and plant protection. Detection of metabolites of economic interest. Soil pollution by heavy metals. Remediation of agro-industrial wastes using microalgae. Transgenic plants and nutrition. Plants resistant to weeds, insects, microorganisms.

BT_1.6 | Molecular Genetics and Applications

Abstract: Molecular mechanisms underlying genetic variation in populations, with emphasis on population genetic studies and biomedical translational research.

Syllabus: Population genetics and gene variation. Methods of identification of gene variation. Software analysis in genetic variation. Molecular Cytogenetics, FISH and applications in human syndromes. Molecular basis of human disease. Genetic toxicology. Genetic basis of drug metabolism. Transcriptomics and epigenomics, applications in elucidation of the biological mechanism of common diseases. Systems biology and synthetic biology.

BT_1.7 | Theory and Practice in Molecular-Data Analysis: Population Genetics and Phylogenetics

Abstract: Theory, practice and case studies of Population Genetics and Conservation Genetics Theory and practice of molecular phylogenetic analysis and the different methods and tools for phylogenetic-tree construction.

Syllabus: Classical molecular and genomic methods in Population Genetics and Genetic Conservation. Tools and methods for the evaluation of biodiversity. e-DNA studies and approaches, non invasive sampling approaches andgenetic monitoring. Metagenomics – Epigenomics. Conservation Genetics. Population Genetics of small population and application in the Genetic Conservation (genetic drift, real and effective population size, inbreeding, population bottleneck). Adaptation I: Signatures of Selection - Adaptation II: Landscape Genetics and Genomics. Phylogenetics, DNA Barcoding, Phylogeography. Introduction to phylogenetic analysis: how to read & reconstruct a phylogenetic tree. Molecular genetic data (nucleotide sequences): databases, alignment, evolutionary models, genetic distances. Methods of phylogenetic analysis & computational tools for tree-construction. Reliability & statistical support.

BT_1.8 | Systems Biology

Abstract: This course aims at presenting the experimental and computational methods used for the high-throughput biomolecular (or omic) analyses in Systems Biology, indicating the significant opportunities but also the relevant challenges in life science research, using also examples from recent literature.

Syllabus: Introduction to Systems Biology, the major shifts that Systems Biology brought in life sciences, what is the relationship with the scientific areas of Bioinformatics, Computational Biology, Structural Biology, Genetic/Metabolic Engineering, Synthetic Biology and Precision Medicine/Agriculture. Description of the multi-step procedure of omic analyses. Experimental methodologies/protocols for transcriptomics, proteomics and metabolomics. Omic data normalization: need, methods & challenges. Data mining methods, multi-variate statistical analysis, machine learning. Biomolecular networks: structure and characteristics. Databases and reconstruction methods of biomolecular networks. Examples of multi-omic analyses and their use in translational research from recent literature.

BT_DIP1 | Diploma Thesis I

Abstract: Initiation of the research activity.

Syllabus: Collection and evaluation of literature, data presentation related to thesis subject, experimental design, implementation of experiments, evaluation of results.

BT_2.1 | Biochemistry of Oxidative Stress

Abstract: Biochemical mechanisms of antioxidant defense at the molecular and cellular level.

Syllabus: Definition of oxidative stress and its role on the physiological and abnormal processes of the organisms, free radicals and reactive oxygen species (ROS), biochemical pathways of ROS generation, Fenton/Haber-Weiss reactions in relation to the pro-oxidant role of Fe and Cu and to the defense of the organisms from these transition metals, oxidative modification and degradation of lipids, proteins, carbohydrates and nucleic acids, mechanisms of enzymic and non-enzymic antioxidant defense, physiological free radical scavengers (vitamins C and E, carotenoids, etc).

BT_2.2 | Applied Entomology

Abstract: Analysis of insects of agricultural and public health importance with emphasis on utilization of genetics, symbiosis, and novel technologies, for the development of pest control strategies with reduced environmental footprint.

Syllabus: Introduction to insects of agricultural importance with emphasis on true fruit flies. Introduction to insects of public health importance with emphasis on Aedes species. Methodologies to induce sterility to natural populations. Genetic analysis of populations of insect pests. Genetic and biological basis of the sterile insect technique. Development of sex separation strategies with emphasis on classical genetic approaches. Symbiosis in insects. Novel approaches in in the analysis of symbiotic communities. The intracellular alpha-proteobacterium *Wolbachia* and its effect on the behaviour of insect hosts. Cytoplasmic incompatibility and the incompatible insect technique. Novel technologies for the development of genetic sexing strategies in target species.

BT_2.3 | Methodology in Biomedical Research

Abstract: Basic principles of ethics and integrity in biomedical research with emphasis in translational research in neurodegeneration and neuropsychiatric disorders.

Syllabus: Good practices in experimental animal use and laboratory safety. Ethics in biological research. Experimental design and logic. Basic principles and integrity of research methodology in translation research using *in vitro* systems and animal models. Methods in neurodegenerative diseases, neuropsychiatric disorders, imaging of neurochemical mechanisms of plasticity, development and function of brain circuits. Data analysis, meta-analysis. Critical discussion of research experimental protocols using animal and/or alternative models (e.g pathophysiologic mechanisms of Parkinson's disease, social and emotional behavioral disorders, epigenetic regulation, etc.).

BT_2.4 | Microbial Biotechnology

Abstract: Microbial processes and interactions of biotechnological interest: principles, description and applications in environmental and industrial biotechnology.

Syllabus: Mathematical models in the study of complex biological systems. Kinetic studies of pure cultures and mixed microbial populations. Production and storage of energy in microbial cells. Biosynthesis and accumulation of energy-storage products (lipids, polysaccharides, polyhydroxyalkanoic acids). Cell-to-cell communication and microbial interactions. Co-existence of microbial populations (substrate competition, synergism, symbiosis, antibiosis). Microorganisms as agents of biological control/biopreservation. Industrial and environmental applications of microbial technology. Development of biotechnological processes.

BT_2.5 | Molecular & Cellular Immunobiology

Abstract: Molecular and cellular mechanisms of the immune system. The role of the immune system in health and disease.

Syllabus: Introduction to the immune system. Innate immunity. Antigen capture and presentation to lymphocytes. Antigen recognition in the adaptive immune system. T cell-mediated immunity. Effector mechanisms of T cell-mediated immunity. Humoral immune responses. Effector mechanisms of humoral immunity. Immunological tolerance and autoimmunity. Immune responses against tumors and transplants. Hypersensitivity. Congenital and acquired immunodeficiencies. Journal Club.

BT_2.6 | Environmental Mutagenesis

Abstract: Evaluated control systems for the detection and identification of the genotoxicological effects resulting from environmental factors and anthropogenic activities in the organisms and humans

Syllabus: Introduction - The history of Environmental Mutagenesis. Environmental mutagenesis: fact or fantasy? - The creation of a new chemical environment. The nature and the molecular basis of mutation. Classification of mutations, spontaneous mutation, DNA repair. Potential sources of exposure to mutagens - Chemical, physical, biological factors and genotoxicity. Mutagenesis, genotoxicity and carcinogenesis. *In vitro* assays for mutagenicity and/or genotoxicity. *In vivo* assays for mutagenicity and/or genotoxicity. Harmonization of screening for genetic toxicity 10. Occupational exposure and genotoxicity in humans. Antimutagenicity-antigenotixicity (antimutagenic and antigenotoxic actions of extracts). Genetic risk assessment: treatment protocols, analysis and interpretation of results. International organizations and databases associated with Environmental Toxicology and Mutagenesis - Guidelines for the mutagen risk assessment and regulation.

BT_DIP2 | Diploma Thesis II

Abstract: Completion of research activity.

Syllabus: Implementation of experiments, evaluation and interpretation of results, drawing conclusions, writing and presentation of a thesis.

5. COURSE OUTLINES

RESEARCH METHODOLOGY

1. GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
POSTGRADUATE PROGRAMME	BIOLOGICAL TECHNOLOGY: RESEARCH & APPLICATIONS		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	**BT_1.1**	**SEMESTER**	1st
COURSE TITLE	**RESEARCH METHODOLOGY**		
INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**		**CREDITS**
Lectures Laboratory exercises	15		15
COURSE TYPE	Specialised general knowledge, skills development		
PREREQUISITE COURSES	Formally, there are no prerequisite courses. Good knowledge of Cell Biology, Biochemistry, Molecular Biology, Physiology, Genetics etc is recommended.		
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: 1) to know the principles of basic research methodologies in the field of Biological Technology, 2) to formulate valid scientific questions, 3) to be able to design experiments, 4) to be able to use the appropriate methodology to design experiments, and 5) to be able to analyze and interpret the results of their experiments.
General Competences
At the end of the course, the students will have developed the following general competences: 1) search for, analysis and synthesis of data and information, with the use of the necessary technology, 2) decision-making, 3) working independently, 4) team work, 5) working in an international environment, 6) working in an interdisciplinary environment, 7) project planning and management, 8) criticism and self-criticism, and 9) production of free, creative and inductive thinking.

3. SYLLABUS

1. Evaluation of cancer biomarkers in cancer cells using VyCAP platform
2. Methods of protein crystallization
3. Recording of behavioral parameters after induction of seizures in adult mice

4. Assessment of environmental stress on plants using *in vivo* chlorophyll fluorescence
5. Big-data analysis and *omic* technologies
6. Mitochondrial and nuclear molecular markers analysis
7. From the biological sample to the DNA sequence
8. Metabolomic analysis
9. Molecular and genetic analysis of laboratory strains of the Mediterranean fruit fly, *Ceratitis capitata*
10. Image analysis, microscopic cell quantification
11. Alcoholic fermentation
12. Flow cytometry
13. Genotoxicity and cytotoxicity effects of selected pollutants: Introduction, prediction, and evaluation

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of ICT in teaching and laboratory education, and communication with students. Support of the educational process and communication with the postgraduate students via the electronic platform e-class.
TEACHING METHODS	

Activity	***Semester workload***
Lectures Laboratory exercises [13 weeks x 15 hours/week]	195
Literature study	50
Writing reports	130
Course total (25 hours per one ECT)	**375**

STUDENT PERFORMANCE EVALUATION	Written reports. Grading scale: 1-10. Passing grade: 5. Grading: 3 corresponds to ECTS grade F. Grade 4 corresponds to ECTS grade FX. Passing grades correspond to ECTS grades as follows: 5=E, 6=D, 7=C, 8=B, 9=A.

5. RECOMMENDED BIBLIOGRAPHY

Suggested bibliography
Scientific literature articles and e-class notes.

CANCER BIOLOGY - BIOMARKERS

1. GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
POSTGRADUATE PROGRAMME	BIOLOGICAL TECHNOLOGY: RESEARCH & APPLICATIONS		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	**BT_1.2**	**SEMESTER**	1st
COURSE TITLE	**CANCER BIOLOGY - BIOMARKERS**		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	3	5

COURSE TYPE	Specialised general knowledge
PREREQUISITE COURSES:	Biochemistry, Cellular Biology
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/BIO452/

2. LEARNING OUTCOMES

Learning outcomes
Upon successful completion of the course, the student will have acquired knowledge of the modern approach to cancer therapy and tumor biology. He/She will be taught all the signal transduction pathways maintaining cancer invasion and metastasis that are currently considered targets for the treatment of the disease. He/She will be informed about the most important biomarkers used for the characterization of various types of solid tumors such as breast, prostate, lung, etc. The students will also be informed about the mechanism of mutagenesis that drives benign and malignant tumors. How cells escape from primary solid tumors. Cancer cell invasion to healthy tissues and metastasis. Angiogenesis and solid tumor development. Finally, students will be informed about the Immune surveillance and immune escape of cancer cells.
General Competences
The course material aims at the development of the following general competences: ▪ Team work ▪ Working in an international environment ▪ Production of new research ideas ▪ Production of free, creative and inductive thinking

3. SYLLABUS

1. Signal transduction pathways in cancer cells that are therapeutic targets.
2. Development of benign hyperplasia and tumors. Tumor cell invasion and migration.
3. Cytoskeleton and cancer.
4. Angiogenesis and tumor growth.
5. ErbB receptor family in cancer therapy
6. Immune system and cancer.
7. Immune checkpoints biomarkers and cancer; PD-L1/PD-1 axis.
8. Introduction to Liquid Biopsy.
9. Circulating Cancer Cells and breast cancer.
10. Circulating Cancer Cells and lung, prostate, and colon cancer.
11. Exosomes and cancer.
12. Circulating Nucleic acids: ct DNA, Micro RNAs as biomarkers in cancer biology.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of ICT in teaching. Support of the educational process and communication with the postgraduate students via the electronic platform e-class.	
TEACHING METHODS	***Activity***	***Semester workload***
	Lectures [13 weeks x 3 hours per week]	39

	Study and analysis of bibliography	43
	Essay writing	43
	Course total (25 hours per one ECT)	**125**
STUDENT PERFORMANCE EVALUATION	Journal Club at the end of the semester. Grant proposal application in the field of cancer research/design research project. Written essay/report on topics related to the content of the lectures. Grading scale: 1-10. Passing grade: 5. Grading: 3 corresponds to ECTS grade F. Grade 4 corresponds to ECTS grade FX. Passing grades correspond to ECTS grades as follows: 5=E, 6=D, 7=C, 8=B, 9=A.	

5. RECOMMENDED BIBLIOGRAPHY

Suggested bibliography

- Pubmed Publications
- Cancer Biomarkers in Body Fluids: Biomarkers in Circulation by Gabriel D. Dakubo (auth.)
- Predictive Biomarkers in Oncology: Applications in Precision Medicine by Sunil Badve & George Louis Kumar
- Circulating Tumor Cells, SpringerLink, Editors Richard J. Cote, Ram H. Datar

STRUCTURAL BIOLOGY

1. GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
POSTGRADUATE PROGRAMME	BIOLOGICAL TECHNOLOGY: RESEARCH & APPLICATIONS		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	**BIO_BT1.3**	**SEMESTER**	1st
COURSE TITLE	**STRUCTURAL BIOLOGY**		
INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**		**CREDITS**
Lectures	3		5
COURSE TYPE	Specialised general knowledge		
PREREQUISITE COURSES:	NO. Formally, there are no prerequisite courses. Nevertheless, a good knowledge of Biochemistry is recommended.		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek		
IS THE COURSE OFFERED TO	YES		

ERASMUS STUDENTS	
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/BIO264/

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 structures and functionalities of proteins (enzymes). • The crystallographic methods necessary for the structural determination of biological macromolecules.
General Competences
Upon course completion, students will be able to comprehend all methods related to the structural characterization of biological macromolecules, while also being capable of analyzing and presenting research data in the field of structural biology. In addition, the students will develop the following skills: ▪ 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 ▪ Production of free, creative and inductive thinking

3. SYLLABUS

Biochemical methods of protein production and crystallization. Characteristics and facilities of synchrotron radiation. Introduction to X-ray diffraction and crystallography: diffraction of electromagnetic radiation, crystal symmetries, space group and point groups, Fourier transformations, methods for solving the crystallographic phase problem [Patterson methods, direct methods, molecular replacement, isomorphous replacement, anomalous dispersion].

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of ICT in teaching. Support of the educational process and communication with the postgraduate students via the electronic platform e-class.
TEACHING METHODS	

Activity	***Semester workload***
Lectures [13 weeks x 3 hours per week]	39
Study and analysis of bibliography	50
Preparation, writing and presentation of a project	36
Course total (25 hours per one ECT)	**125**

STUDENT PERFORMANCE EVALUATION	Written essay and oral presentation of an individual project at the end of the semester, accounting for the 100% of the final grade. Grading scale: 1-10. Passing grade: 5. Grading: 3 corresponds to ECTS grade F. Grade 4 corresponds to ECTS grade FX. Passing grades correspond to ECTS grades as follows: 5=E, 6=D, 7=C, 8=B, 9=A.

5. RECOMMENDED BIBLIOGRAPHY

Suggested bibliography

- «Μία μη μαθηματική εισαγωγή στην κρυσταλλογραφία πρωτεϊνών», Ν. Γλυκός.

- «Crystallography Made Crystal Clear, Third Edition: A Guide for Users of Macromolecular Models», Gale Rhodes
- Σημειώσεις εργαστηριακής άσκησης Βιοχημείας ΙΙ «Κρυστάλλωση πρωτεϊνών» (eclass, BIO404)
- Ε. Μαργιωλάκη – Δομική Βιολογία [https://eclass.upatras.gr/courses/BIO264/]
- «Macromolecular Powder Diffraction», Book Chapter for the International Tables of Crystallography-Volume H: Powder Diffraction, chapter 7.1, 718-736, 2019, I. Margiolaki.

Related academic journals
International Union of Crystallography (IUCr) journals, Science, Nature, Journal of American Chemical Society, Angewandte Chemie, PNAS, Biomacromolecules.

NOVEL COURSES IN NEUROBIOLOGY AND REGENERATIVE BIOLOGY

1. GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
POSTGRADUATE PROGRAMME	BIOLOGICAL TECHNOLOGY: RESEARCH & APPLICATIONS		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	**BT_1.4**	**SEMESTER**	1st
COURSE TITLE	**NOVEL COURSES IN NEUROBIOLOGY AND REGENERATIVE BIOLOGY**		
INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**		**CREDITS**
Lectures	3		5
COURSE TYPE	Specialized general knowledge		
PREREQUISITE COURSES:	NO. Formally, there are no prerequisite courses. Good knowledge of Animal Physiology, Neurobiolgy, Developmental Biology as well as basic knowledge in Cellular and Molecular Biology is recommended.		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/BIO346/ https://eclass.upatras.gr/courses/BIO480/		

2. LEARNING OUTCOMES

Learning outcomes
The course aims to understand new methodologies used in the field of Neurobiology and Regenerative Biology. Issues related to the assessment of high-throughput technologies [use of stem cells, optogenetics, robotics, etc.] and concern Neurobiology and basic principles of development and regeneration of the nervous system are discussed.

General Competences
▪ At the end of the course, the student will have developed the following skills: ▪ Search for, analysis and synthesis of data and information, with the use of the necessary technology ▪ Working independently and collaborating as a team member ▪ Production of new research ideas ▪ Production of free, creative and inductive thinking

3. SYLLABUS

1. Neural networks and functional organization of the brain.
2. The synapsis and synaptic plasticity.
3. Cell and molecular mechanisms of learning and memory.
4. Cell and molecular basis of diseases of the nervous system [*Parkinson's and Alzheimer's disease, epilepsy, multiple sclerosis*, schizophrenia, depression].
5. Oxidative stress: molecular mechanisms and endogenous anti-oxidative mechanisms. Cell death.
6. Neuro-endocrine-immune interactions [e.g. in stress].
7. Basic principles in the biology of stem cells (embryonic, adult and induced) and in their clinical use.
8. Function of adult/ tissue-specific stem cells; tissue homeostasis and regeneration.
9. High throughput technologies, precision medicine.
10. Themes from current scientific literature on forefront methodology [stem cells, optogenetics, robotics] in the fields of neurobiology and on the evelution and regenearation of the nervous system.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-Face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of ICT in teaching. Support of the educational process and communication with the postgraduate students via the electronic platform e-class.
TEACHING METHODS	***Activity*** / ***Semester workload*** Lectures [13 weeks x 3 hours per week] / 39 Home study / 86 **Course total (25 hours per one ECT)** / **125**
STUDENT PERFORMANCE EVALUATION	Attendance and contribution [10%]. Oral presentation of a research topic [30%]. Written examination at the end of the semster [60%]. Grading scale: 1-10. Passing grade: 5. Grading: 3 corresponds to ECTS grade F. Grade 4 corresponds to ECTS grade FX. Passing grades correspond to ECTS grades as follows: 5=E, 6=D, 7=C, 8=B, 9=A.

5. RECOMMENDED BIBLIOGRAPHY

Suggested bibliography

- *Essentials of Neural Science and Behavior.* Kandel ER, Schwartz JH & Jessel TM. Publ. of Univ. of Crete, 2011
- *Neuroscience.* Purves P., Augustine G., Fitzpatrick D., Hall W., Lamantia A.S. & McNamara J., Williams S. Parisianos Publ. SA, 2010.
- *Principles of Development.* Wolpert Lewis, Tickle Cheryll, Arias Martinez Alfonso, BROKEN HILL PUBLISHERS, 2020.
- *Developmental Biology.* Scott F. Gilbert, Michael J. F. Barresi. IMBB, Editions of the University of Crete.
- I. Kazanis. Notes of Special Topics in Developmental Biology [https://eclass.upatras.gr/courses/BIO346/]
- I. Kazanis H. M. Margarity, N. Panagopoulos. Notes of Special Topics in Neurobiology and Molecular

Neurobiology. [https://eclass.upatras.gr/courses/BIO480/]

Related academic journals

Journal of Neurobiology, Journal of Neuroscience, Molecular Neurobiology, Current Research in Neurobiology, Cell Stem Cells, Stem Cell Reports, Neuroscience, TINS, Epilepsy & Behavior, Epilepsia.

TOPICS IN APPLIED PLANT PHYSIOLOGY AND BIOTECHNOLOGY

1. GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
POSTGRADUATE PROGRAMME	BIOLOGICAL TECHNOLOGY: RESEARCH & APPLICATIONS		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	**BT_1.5**	**SEMESTER**	1st
COURSE TITLE	**TOPICS IN APPLIED PLANT PHYSIOLOGY & BIOTECHNOLOGY**		
INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**		**CREDITS**
Lectures	3		5
COURSE TYPE	Specialised general knowledge		
PREREQUISITE COURSES:	NO. Formally, there are no prerequisite courses. Nevertheless, a good knowledge of Plant Physiology, as well as Biochemistry is recommended.		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO		
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/BIO390/		

2. LEARNING OUTCOMES

Learning outcomes
The course aims to understand new methodologies used in the field of Applied Plant Physiology and their use in a wide range of applications. Issues related to the assessment of environmental stress on plants, plant protection, agri-food and environmental restoration are discussed.
General Competences
At the end of the course, the student will have developed the following skills: ▪ Search for, analysis and synthesis of data and information, with the use of the necessary technology ▪ Working independently and collaborating as a team member ▪ Respect for the natural environment ▪ Production of free, creative and inductive thinking

3. SYLLABUS

Contemporary methodology in Plant Physiology. Evaluation of abiotic stresses: high/low visible light, high/low temperature, water, oxidative, ionic/osmotic stress. Evaluation of biotic stress: infection by

microorganisms. Allelopathy and plant protection. Detection of metabolites of economic interest. Soil pollution by heavy metals. Remediation of agro-industrial wastes using microalgae. Transgenic plants and nutrition. Plants resistant to weeds, insects, microorganisms.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of ICT in teaching. Support of the educational process and communication with the postgraduate students via the electronic platform e-class.
TEACHING METHODS	

Activity	***Semester workload***
Lectures [13 weeks x 3 hours per week]	39
Study and analysis of bibliography	50
Preparation, writing and presentation of a project	36
Course total (25 hours per one ECT)	**125**

STUDENT PERFORMANCE EVALUATION	Oral presentation of an individual project in course theory at the end of the semester, accounting for the 100% of the Final Grade. Grading scale: 1-10. Passing grade: 5. Grading: 3 corresponds to ECTS grade F. Grade 4 corresponds to ECTS grade FX. Passing grades correspond to ECTS grades as follows: 5=E, 6=D, 7=C, 8=B, 9=A.

5. RECOMMENDED BIBLIOGRAPHY

Suggested bibliography

- Plant stress physiology, G. Karabourniotis, G. Liakopoulos, D. Nikolopoulos [Embryo Press, 2016, in greek]
- Plant Biotechnology, P. Hatzopoulos [Embryo Press, 2016, in greek]
- Plant Biotechnology, S. Umesha [CRC Press 2019]
- Applied Photosynthesis, Mohammad Mahdi Najafpour (editor) [In TechOpen publisher 2016]
- G. Grammatikopoulos, G. Petropoulou – lecture notes [https://eclass.upatras.gr/courses/BIO390/]

MOLECULAR GENETICS AND APPLICATIONS

1. GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
POSTGRADUATE PROGRAMME	BIOLOGICAL TECHNOLOGY: RESEARCH & APPLICATIONS		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	**BT_1.6**	**SEMESTER**	1st
COURSE TITLE	**MOLECULAR GENETICS AND APPLICATIONS**		
INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**		**CREDITS**

Lectures	3	5
COURSE TYPE	Specialised general knowledge	
PREREQUISITE COURSES:	Genetics, Molecular Genetics	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek	
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES	
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/BIO393/	

2. LEARNING OUTCOMES

Learning outcomes
Upon course completion, the students should be able to understand the basis of genetic variation in populations and have a thorough and up-to-date knowledge of applications in population studies and biomedical translational research.
General Competences
Students should be able to search, analyze and synthesize data and information, using the necessary technologies to study molecular mechanisms and markers of variation with applications in diagnosis of genetic syndromes, susceptibility to common disease, pharmacogenomics, gene editing and synthetic biology.

3. SYLLABUS

1. Population genetics and genetic variation.
2. Identification of genetic variation.
3. Big-data analysis and genetic variation.
4. Molecular Cytogenetics – FISH
5. Molecular Cytogenetics: FISH, applications in human diseases – Genetic Toxicology
6. Clinical Molecular Cytogenetics
7. Molecular Basis of Human Disease.
8. Genetics and metabolism of drugs.
9. Transcriptomics and epigenomics – applications in decoding the molecular basis and variation of common diseases.
10. Systems Biology and holistic approaches and applications of synthetic biological systems.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-Face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of ICT in teaching. Support of the educational process and communication with the postgraduate students via the electronic platform e-class.
TEACHING METHODS	
STUDENT PERFORMANCE	Written exams (70%) and assignment (30%) at the end of the semester.

Activity	***Semester workload***
Lectures [13 weeks x 3 hours per week]	39
Home study	86
Course total (25 hours per one ECT)	**125**

EVALUATION	Grading scale: 1-10. Passing grade: 5. Grading: 3 corresponds to ECTS grade F. Grade 4 corresponds to ECTS grade FX. Passing grades correspond to ECTS grades as follows: 5=E, 6=D, 7=C, 8=B, 9=A.

5. RECOMMENDED BIBLIOGRAPHY

Suggested bibliography

- Krebs J.E. et al.: Lewin's Basic Principles of Genes
- Hartl L. D & Cochrane J.B.: Genetics – Analysis of Genes and Genomes. A Mendelian Approach
- Griffith A et al.: Basic Principles of Genetic Analysis
- Publications/Articles in Pubmed

Related academic journals

Gene, European Journal of Human Genetics, American Journal of Human Genetics, Human Molecular Genetics, Genes and Immunity, Nature Genetics, PLOS Genetics

THEORY AND PRACTICE IN MOLECULAR-DATA ANALYSIS: POPULATION GENETICS AND PHYLOGENETICS

1. GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
POSTGRADUATE PROGRAMME	BIOLOGICAL TECHNOLOGY: RESEARCH & APPLICATIONS		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	**BT_1.7**	**SEMESTER**	1st
COURSE TITLE	**THEORY AND PRACTICE IN MOLECULAR-DATA ANALYSIS: POPULATION GENETICS AND PHYLOGENETICS**		
INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**		**CREDITS**
Lectures	3		5
COURSE TYPE	Specialised general knowledge		
PREREQUISITE COURSES:	NO. Formally, there are no prerequisite courses. Nevertheless, a good knowledge of Genetics, Molecular Biology, Evolution is recommended.		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO		
COURSE WEBSITE (URL)			

2. LEARNING OUTCOMES

Learning outcomes
Upon completion of the course, students will be in the position to: ▪ Know the basic principles of Population Genetics

- Identify the importance of biodiversity and the major risk sources of it
- Be aware of the molecular techniques and tools for the study of biodiversity
- Understand the principles and to interpret the genetic data in the context of genetic conservation
- Understand the principles of adaptation and the genetic interactions within
- To handle and manage molecular databases
- Read and reconstruct phylogenetic trees based on molecular genetic data

General Competences

At the end of the course, students will have developed the ability to think through the "filter" of Evolution, and acquired skills in independent and team work, search for, analysis and synthesis of data and information, production of free, creative and inductive thinking, and criticism and self-criticism.

3. SYLLABUS

1. Classical molecular and genomic methods in Population Genetics and Genetic Conservation
2. Tools and methods for the evaluation of biodiversity
3. e-DNA studies and approaches, non invasive sampling approaches andgenetic monitoring. Metagenomics – Epigenomics
4. Conservation Genetics
5. Population Genetics of small population and application in the Genetic Conservation (genetic drift, real and effective population size, inbreeding, population bottleneck)
6. Adaptation I: Signatures of Selection - Adaptation II: Landscape Genetics and Genomics
7. Phylogenetics, DNA Barcoding, Phylogeography
8. Introduction to phylogenetic analysis: how to read & reconstruct a phylogenetic tree. Molecular genetic data (nucleotide sequences): databases, alignment, evolutionary models, genetic distances. Methods of phylogenetic analysis & computational tools for tree-construction. Reliability & statistical support

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of ICT in teaching. Support of the educational process and communication with the postgraduate students via the electronic platform e-class.
TEACHING METHODS	

Activity	***Semester workload***
Lectures [13 weeks x 3 hours per week]	39
Study assignments	26
Home study	60
Course total (25 hours per one ECT)	**125**

STUDENT PERFORMANCE EVALUATION	Written exams and project assignments at the end of the semester Grading scale: 1-10. Passing grade: 5. Grading: 3 corresponds to ECTS grade F. Grade 4 corresponds to ECTS grade FX. Passing grades correspond to ECTS grades as follows: 5=E, 6=D, 7=C, 8=B, 9=A.

5. RECOMMENDED BIBLIOGRAPHY

Suggested bibliography

- Futuyma D., Kirkpatrick M. 2019. ΕΞΕΛΙΞΗ. 4η αμερικανική-1η ελληνική έκδοση. Εκδ. UTOPIA, Αθήνα
- Barton N., Briggs D., Eisen J., Goldstein D., Patel N. 2011. ΕΞΕΛΙΞΗ. 1η Ελληνική έκδοση. Εκδ. UTOPIA, Αθήνα.

SYSTEMS BIOLOGY

1. GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
POSTGRADUATE PROGRAMME	BIOLOGICAL TECHNOLOGY: RESEARCH & APPLICATIONS		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	**BT_1.8**	**SEMESTER**	1st
COURSE TITLE	**SYSTEMS BIOLOGY**		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	3	5

COURSE TYPE	Specialised general knowledge
PREREQUISITE COURSES:	NO. Formally, there are no prerequisite courses. Nevertheless, a good knowledge of Genetics, Molecular Biology, Biochemistry and Cell Biology is recommended. Knowledge of Informatics and/or Bioinformatics is preferable.
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/BIO394/

2. LEARNING OUTCOMES

Learning outcomes
The course aims at teaching the experimental and computational methodologies of omic analyses in Systems Biology, indicating the significant opportunities, but also the relevant challenges in life sciences research, using also examples from the recent literature.
General Competences
At the end of the course, the students will have developed the following skills: ▪ 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 ▪ Production of free, creative and inductive thinking

3. SYLLABUS

Introduction to Systems Biology. Description of the multi-step procedure of omic analyses. Experimental methodologies/protocols for transcriptomics: DNA microarrays and RNASeq. Experimental methodologies/protocols for proteomics and metabolomics. Omic data normalization: need, methods &

challenges. Data mining methods, multi-variate statistical analysis. Biomolecular networks: structure and characteristics. Databases of biomolecular networks. Examples of integrated omics analyses from recent literature.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of ICT in teaching. Support of the educational process and communication with the postgraduate students via the electronic platform e-class.
TEACHING METHODS	

Activity	***Semester workload***
Lectures [13 weeks x 3 hours per week]	39
Home study	86
Course total (25 hours per one ECT)	**125**

STUDENT PERFORMANCE EVALUATION	Homework throughout the course (20%), written exams (40%) and oral presentation of a recent publication (40%) at the end of the semester. Grading scale: 1-10. Passing grade: 5. Grading: 3 corresponds to ECTS grade F. Grade 4 corresponds to ECTS grade FX. Passing grades correspond to ECTS grades as follows: 5=E, 6=D, 7=C, 8=B, 9=A.

5. RECOMMENDED BIBLIOGRAPHY

Suggested bibliography

- Class notes in e-class.
- Publications/videos provided in e-class.
- V. Helms. Principles of Computational Cell Biology: From Protein Complexes to Cellular Networks. Wiley-Blackwell, 2008.

DIPLOMA THESIS I

1. GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
POSTGRADUATE PROGRAMME	BIOLOGICAL TECHNOLOGY: RESEARCH & APPLICATIONS		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	**BT_DIP1**	**SEMESTER**	2nd
COURSE TITLE	**DIPLOMA THESIS I**		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures Laboratory exercises		20

COURSE TYPE	Specialised general knowledge
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
Postgraduate students should be able to: 1) study and manage the relevant international bibliography, 2) design experiments related to the subject of their Diploma Thesis, 3) carry out the relevant experiments successfully, and 4) interpret results from experimental data and draw conclusions.
General Competences
▪ Working independently ▪ Team work ▪ Generating new research ideas ▪ Project planning and management ▪ Search for, analysis and synthesis of data and information, with the use of the necessary technology ▪ Promoting free, creative and inductive thinking.

3. SYLLABUS

Initiation of the research activity [collection and evaluation of literature, data presentation related to thesis subject, experimental design, implementation of experiments, evaluation of results].

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of ICT in laboratory education, and communication with students.
TEACHING METHODS	

Activity	***Semester workload***
Collection and evaluation of literature, data presentation related to thesis subject	150
Experimental design	100
Implementation of experiments, evaluation of results	250
Course total (25 hours per one ECT)	**500**

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 commitee. Grading scale: 1-10. Passing grade: 5. Grading: 3 corresponds to ECTS grade F. Grade 4 corresponds to ECTS grade FX. Passing grades correspond to ECTS grades as follows: 5=E, 6=D, 7=C, 8=B, 9=A.

5. RECOMMENDED BIBLIOGRAPHY

Suggested bibliography
Scientific literature articles

BIOCHEMISTRY OF OXIDATIVE STRESS

1. GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
POSTGRADUATE PROGRAMME	BIOLOGICAL TECHNOLOGY: RESEARCH & APPLICATIONS		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	**BT_2.1**	**SEMESTER**	2nd
COURSE TITLE	**BIOCHEMISTRY OF OXIDATIVE STRESS**		
INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**		**CREDITS**
Lectures	3		5
COURSE TYPE	Specialised general knowledge		
PREREQUISITE COURSES:	Formally, there are no prerequisite courses. Nevertheless, a good 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
The course aim is to have a general understanding in the biochemical mechanisms of antioxidant defense at the molecular and cellular level. By the end of the course, students will have an understanding of the general molecular and cellular mechanisms of antioxidant defense, and their relationship with disease, nutrition and the environment in general.
General Competences
At the end of the course, the students will have developed the following skills: ▪ 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 ▪ Production of free, creative and inductive thinking

3. SYLLABUS

Definition of oxidative stress and its role on the physiological and abnormal processes of the organisms, free radicals and reactive oxygen species (ROS), biochemical pathways of ROS generation, Fenton/Haber-Weiss

reactions in relation to the pro-oxidant role of Fe and Cu and to the defense of the organisms from these transition metals, oxidative modification and degradation of lipids, proteins, carbohydrates and nucleic acids, mechanisms of enzymic and non-enzymic antioxidant defense, physiological free radical scavengers (vitamins C and E, carotenoids, etc).

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of ICT in teaching.
TEACHING METHODS	

Activity	***Semester workload***
Lectures [13 weeks x 3 hours per week]	39
Home study	86
Course total (25 hours per one ECT)	**125**

STUDENT PERFORMANCE EVALUATION	Written exams and Journal Club at the end of the semester. Grading scale: 1-10. Passing grade: 5. Grading: 3 corresponds to ECTS grade F. Grade 4 corresponds to ECTS grade FX. Passing grades correspond to ECTS grades as follows: 5=E, 6=D, 7=C, 8=B, 9=A.

5. RECOMMENDED BIBLIOGRAPHY

Suggested bibliography

Halliwell, B., Gutteridge, J. M. C. (2015). Free Radicals in Biology and Medicine, Oxford University Press, 5th edition, pp 904

APPLIED ENTOMOLOGY

1. GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
POSTGRADUATE PROGRAMME	BIOLOGICAL TECHNOLOGY: RESEARCH & APPLICATIONS		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	**BT_2.2**	**SEMESTER**	2nd
COURSE TITLE	**APPLIED ENTOMOLOGY**		
INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**		**CREDITS**
Lectures	3		5
COURSE TYPE	Specialised general knowledge		
PREREQUISITE COURSES:	There are no prerequisite courses. Students should have general knowledge on Biology, Genetics and Molecular Biology.		
LANGUAGE OF INSTRUCTION	Greek		

and EXAMINATIONS:	
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	

2. LEARNING OUTCOMES

Learning outcomes
The course aims to highlight the importance of classical genetic and molecular tools, and new technological advances in the develpment of methodological control of natural populations of insects that paraseitize crops or have a negative impact on public health.
General Competences
At the end of the course, the students will have developed the following skills: ▪ 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 ▪ Production of free, creative and inductive thinking

3. SYLLABUS

Introduction to insects of agricultural importance with emphasis on true fruit flies. Introduction to insects of public health importance with emphasis on Aedes species. Methodologies to induce sterility to natural populations. Genetic analysis of populations of insect pests. Genetic and biological basis of the sterile insect technique. Development of sex separation strategies with emphasis on classical genetic approaches. Symbiosis in insects. Novel approaches in in the analysis of symbiotic communities. The intracellular alpha-proteobacterium Wolbachia and its effect on the behaviour of insect hosts. Cytoplasmic incompatibility and the incompatible insect technique. Novel technologies for the development of genetic sexing strategies in target species.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-Face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of ICT in teaching. Support of the educational process and communication with the postgraduate students via the electronic platform e-class.
TEACHING METHODS	

Activity	***Semester workload***
Lectures [13 weeks x 3 hours per week]	39
Home study	86
Course total (5 hours per one ECT)	**125**

STUDENT PERFORMANCE EVALUATION	Short-answer questions, essay/report, oral examination, public presentation. Grading scale: 1-10. Passing grade: 5. Grading: 3 corresponds to ECTS grade F. Grade 4 corresponds to ECTS grade FX. Passing grades correspond to ECTS grades as follows: 5=E, 6=D, 7=C, 8=B, 9=A.

5. RECOMMENDED BIBLIOGRAPHY

Suggested bibliography

- Russel P.J. (2009) iGenetics Μια Μεντελική Προσέγγιση, (ΤΟΜΟΣ Α+Β): ISBN: 978-960-88412-8-4, Ακαδημαϊκές εκδόσεις Ι. Μπάσδρα & ΣΙΑ Ο.Ε.
- V. A. Dyck, J. Hendrichs, and A. S. Robinson (2021) *Sterile Insect Technique. Principles and Practice in Area-Wide Integrated Pest Management*, eds. (New York: CRC Press), 781–814. Available at: doi.org/10.1201/9781003035572.
- Hendrichs, J., Pereira, R., and Vreysen, M. J. B. eds. (2021). *Area-wide Integrated Pest Management: Development and Field Application*. Boca Raton, FL: CRC Press, Taylor and Francis Group, LLC.
- FAO/IAEA/USDA. 2019. Product Quality Control for Sterile Mass-Reared and Released Tephritid Fruit Flies, Version 7.0. International Atomic Energy Agency, Vienna, Austria. 148 pp.
- Watson J.D. (2007) Recombinant DNA: genes and genomes – a short course. New York: W.H. Freeman : Cold Spring Harbor Laboratory Press
- Augustinos A (2022) Manual of Laboratory Exercises
- Selected articles

METHODOLOGY IN BIOMEDICAL RESEARCH

1. GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
POSTGRADUATE PROGRAMME	BIOLOGICAL TECHNOLOGY: RESEARCH & APPLICATIONS		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	**BT_2.3**	**SEMESTER**	2nd
COURSE TITLE	**METHODOLOGY IN BIOMEDICAL RESEARCH**		
INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**		**CREDITS**
Lectures	3		5
COURSE TYPE	Special background, specialised scientific knowledge		
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/BIO343/		

2. LEARNING OUTCOMES

Learning outcomes
Students will develop critical thinking about the experimental design, implementation, analysis and utilization of research data, based on *in vivo* and *in vitro* models. Upon successful completion of the course will have deep understanding of the basic principles of methodology, integrity and bioethics in biomedical research, with emphasis on translational research in neurodegenerative diseases and neuropsychiatric disorders.
General Competences

At the end of the course, students will have understood the ethics and integrity in research as well as the basic principles of research protocol design and development. Will be able to do team work or work independently, develop critical thinking, design experiments, manage projects and respect cultural differences.

3. SYLLABUS

- Safety and good practice in experimental research
- Ethics and research integrity. Experimental design.
- Basic principles of research methodology in translational research.
- Using *in vitro* systems and animal models to study neurodegenerative diseases and neuropsychiatric disorders. Critical discussions of research protocols (e.g. pathophysiological mechanisms of Parkinsons disease, social disorders, emotional dysfunctions epigenetics etc).
- Imaging brain neurochemistry, neural plasticity
- Data analysis and meta-analysis
- Critical thinking on research protocols, design and management of projects

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of ICT in teaching. Support of the educational process and communication with the postgraduate students via the electronic platform e-class.
TEACHING METHODS	

Activity	***Semester workload***
Lectures [13 weeks x 3 hours per week]	39
Bibliographic search and study	46
Presentation of a research proposal	20
Writing an εssay	20
Course total (25 hours per one ECT)	**125**

STUDENT PERFORMANCE EVALUATION	Presentation of a research proposal, written assay at the end of the semester. Grading scale: 1-10. Passing grade: 5. Grading: 3 corresponds to ECTS grade F. Grade 4 corresponds to ECTS grade FX. Passing grades correspond to ECTS grades as follows: 5=E, 6=D, 7=C, 8=B, 9=A.

5. RECOMMENDED BIBLIOGRAPHY

Suggested bibliography

- Up to date research publications, review articles
- E-class notes

Related academic journals

BMC Med Ethics, J Neurosci, Cell, Nature, Science, Neurosci, J Parkinsons Dis, Nat Rev Neurosci., Mol Neurobiol, Neurobiol Dis., Front Behav Neurosci, Prog Neuropsychopharmacol Biol Psychiatry, etc.

MICROBIAL BIOTECHNOLOGY

1. GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
POSTGRADUATE PROGRAMME	BIOLOGICAL TECHNOLOGY: RESEARCH & APPLICATIONS		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	**BT_2.4**	**SEMESTER**	2nd
COURSE TITLE	**MICROBIAL BIOTECHNOLOGY**		
INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**		**CREDITS**
Lectures	3		5
COURSE TYPE	Specialized general knowledge		
PREREQUISITE COURSES:	Good knowledge of Cellular Biology, Microbiology, Biochemistry, Molecular Biology and Genetics is recommended.		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/BIO450/		

2. LEARNING OUTCOMES

Learning outcomes

Understanding of: 1) the structure of mathematical models used in the study of microbial processes of biotechnological interest, 2) the biochemical processes related to energy production in microbial cells, 3) microbial interactions, 4) topics of biological control/biopreservation, and 5) the transfer of fundamental biological knowledge to environmental and industrial biotechnology.

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

3. SYLLABUS

Mathematical models in the study of complex biological systems. Kinetic studies of pure cultures and mixed microbial populations. Production and storage of energy in microbial cells. Biosynthesis and accumulation of energy-storage products (lipids, polysaccharides, polyhydroxyalkanoic acids). Cell-to-cell communication and microbial interactions. Co-existence of microbial populations (substrate competition, synergism, symbiosis, antibiosis). Microorganisms as agents of biological control/biopreservation. Industrial and environmental applications of microbial technology. Development of biotechnological processes.

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 / 86 **Course total (25 hours per one ECT)** / **125**
STUDENT PERFORMANCE EVALUATION	Written exams (30%) and Journal Club/reports (70%) at the end of the semester. Language of evaluation: Greek or English Grading scale: 1-10. Passing grade: 5. Grading: 3 corresponds to ECTS grade F. Grade 4 corresponds to ECTS grade FX. Passing grades correspond to ECTS grades as follows: 5=E, 6=D, 7=C, 8=B, 9=A.

5. RECOMMENDED BIBLIOGRAPHY

Suggested bibliography

Microbiology and Microbial Technology (in Greek), 2nd edition 2017, George Aggelis, UNIBOOKS Publishers, Athens

Related academic journals

Journal of Biotechnology, Microbiology-UK, Applied and Environmental Microbiology, Applied Microbiology and Biotechnology, Food Microbiology

MOLECULAR & CELLULAR IMMUNOBIOLOGY

6. GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
POSTGRADUATE PROGRAMME	BIOLOGICAL TECHNOLOGY: RESEARCH & APPLICATIONS		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	**BT_2.5**	**SEMESTER**	2nd
COURSE TITLE	**MOLECULAR & CELLULAR IMMUNOBIOLOGY**		
INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**		**CREDITS**
Lectures	3		5
COURSE TYPE	Specialised general knowledge		

PREREQUISITE COURSES:	NO. Formally, there are no prerequisite courses. Nevertheless, a good knowledge of Cellular and Molecular Biology, as well as Biochemistry is recommended.
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/BIO451/

7. LEARNING OUTCOMES

Learning outcomes
The course aims at understanding the organisation and function of the immune system at the molecular and cellular level, as well as the phenomena associated with normal and abnormal functions of the immune responses.
General Competences
At the end of the course, the students will have developed the following skills: ▪ 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 ▪ Production of free, creative and inductive thinking

8. 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. Effector mechanisms of humoral immunity.
9. Immunological tolerance and autoimmunity.
10. Immune responses against tumors and transplants.
11. Hypersensitivity.
12. Congenital and acquired immunodeficiencies.
13. Journal Club.

9. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of ICT in teaching. Support of the educational process and communication with the postgraduate students via the electronic platform e-class.
TEACHING METHODS	

Activity	***Semester workload***
Lectures [13 weeks x 3 hours per week]	39
Study and analysis of bibliography	50

	Preparation, writing and presentation of a project	36
	Course total (25 hours per one ECT)	**125**
STUDENT PERFORMANCE EVALUATION	Written essay and oral presentation of an individual project at the end of the semester, accounting for the 100% of the final grade. Grading scale: 1-10. Passing grade: 5. Grading: 3 corresponds to ECTS grade F. Grade 4 corresponds to ECTS grade FX. Passing grades correspond to ECTS grades as follows: 5=E, 6=D, 7=C, 8=B, 9=A.	

10.RECOMMENDED BIBLIOGRAPHY

Suggested bibliography:

- K. Abbas et al. – Cellular & Molecular Immunology [10th edition]
- Janeway's Immunobiology [9th edition]
- Male et al. – Immunology [9th edition]
- Roitt et al. - Roitt's Essential Immunology [13th edition]
- Ε. Ροσμαράκη – Μοριακή & Κυτταρική Ανοσοβιολογία [https://eclass.upatras.gr/courses/BIO451/]

Related academic journals:

Immunity, Cell, Nature Immunology, Nature Reviews Immunology, Science Immunology, The Journal of Immunology, European Journal of Immunology, The Journal of Experimental Medicine, PNAS, Blood, Nature Medicine.

ENVIRONMENTAL MUTAGENESIS

1. GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	BIOLOGY		
POSTGRADUATE PROGRAMME	BIOLOGICAL TECHNOLOGY: RESEARCH & APPLICATIONS		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	**BT_2.6**	**SEMESTER**	2nd
COURSE TITLE	**ENVIRONMENTAL MUTAGENESIS**		
INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**		**CREDITS**
Lectures	3		5
COURSE TYPE	Specialised general knowledge		
PREREQUISITE COURSES:	There are no prerequisite courses. Students should have general knowledge on Cell Biology, Genetics and Molecular Biology.		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek		

IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/BIO499/

2. LEARNING OUTCOMES

Learning outcomes

The educational activities cover the education and training of postgraduate students on selected topics of genetic toxicology and environmental mutagenesis.

With the successful completion of the course students will be able to know and understand:

1. the fundamental meanings and principles of Environmental Mutagenesis
2. the potential effects of environmental factors (anthropogenic or not) on living organisms, human and environment
3. the basic principles of mutagenesis (indicatively: nature of mutations, induced mutation, repair mechanism of mutation)
4. the role of mutagenesis in carcinogenesis
5. the importance of screening for genetic toxicity with the uses of selected mutagenicity tests and genotoxicity assays in *in vitro* and *in vivo* conditions
6. meanings such as genotoxicity, cytotoxicity, antigenotoxicity
7. the potential sources of human exposure to mutagens, the importance of the hazard assessment as well as the analysis and interpretation of results

Finally, with the successful completion of the course students will be able to Investigate and locate accurate information and educational material in international and Greek literature.

General Competences

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

3. SYLLABUS

1. Introduction - The history of Environmental Mutagenesis and Toxicology 2 Environmental mutagenesis: fact or fantasy? - The creation of a new chemical environment 3. The nature and the molecular basis of mutation 4. Classification of mutations, spontaneous mutation, DNA repair 5. Potential sources of exposure to mutagens - Chemical, physical, biological factors and genotoxicity 6. Mutagenesis, genotoxicity and carcinogenesis 7. *In vitro* assays for mutagenicity and/or genotoxicity 8. *In vivo* assays for mutagenicity and/or genotoxicity 9. Harmonization of screening for genetic toxicity 10. Occupational exposure and genotoxicity in humans. 11. Antimutagenicity-antigenotixicity (antimutagenic and antigenotoxic actions of extracts) 12. Genetic risk assessment: treatment protocols, analysis and interpretation of results 13. International organizations and databases associated with Environmental Toxicology and Mutagenesis - Guidelines for the mutagen risk assessment and regulation.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-Face
USE OF INFORMATION AND	Support of educational procedure with use of the e-class electronic

COMMUNICATIONS TECHNOLOGY	platform and with online material.
TEACHING METHODS	

Activity	*Semester workload*
Lectures [13 weeks x 3 hours per week]	39
Study and analysis of bibliography	20
Project and/or essay writing	40
Home study	26
Course total (25 hours per one ECT)	**125**

STUDENT PERFORMANCE EVALUATION	Written exam, written essay and presentation at the end of the semester. Grading scale: 1-10. Passing grade: 5. Grading: 3 corresponds to ECTS grade F. Grade 4 corresponds to ECTS grade FX. Passing grades correspond to ECTS grades as follows: 5=E, 6=D, 7=C, 8=B, 9=A.

5. RECOMMENDED BIBLIOGRAPHY

Suggested bibliography:

- Bert Hakkinen P.J., Mahapatra A., Gilbert S.G.G. (2009) Information Resources in Toxicology, ISBN: 0080920039, 9780080920030, Academic Press
- Klug W.S., Cummings M.R., Spencer C.A., Palladino M.A. (2016), Βασικές Αρχές Γενετικής (Concepts of Genetics,11 edition), ISBN: 978-618-5135-03-4, Ακαδημαϊκές εκδόσεις Ι. Μπάσδρα & ΣΙΑ Ο.Ε. Selected chapters
- Phillips D.H., Venitt S. (1995) Environmental Mutagenesis (1st edition), ISBN-10: 0122204328, ISBN-13: 978-0122204326, Academic Press
- Russel P.J. (2009) iGenetics Μια Μεντελική Προσέγγιση, (ΤΟΜΟΣ Α+Β): ISBN: 978-960-88412-8-4, Ακαδημαϊκές εκδόσεις Ι. Μπάσδρα & ΣΙΑ Ο.Ε. Selected chapters
- Shaw I.C., Chadwick J. (1999) Principles of Environmental Toxicology, ISBN: 0-7484-0355-8 HB, 0-7484-0356-6 PB, Taylor and Francis Ltd
- Tyler Miller G. JR (2004) Περιβαλλοντικές Επιστήμες,ISBN:960-411-517-0, Εκδόσεις ΙΩΝ. Selected chapters
- Βλαστός Δ. (2015) Στοιχεία Περιβαλλοντικής Τοξικολογίας και Μεταλλαξιγένεσης, Έκδοση Πανεπιστημίου Πατρών, Πάτρα
- Βλαστός Δ. - Διαμάντη Β. (2013) Επιλεγμένες Τεχνικές Έλεγχου και Προσδιορισμού της Γενετικής Δράσης των Φυτοπροστατευτικών Προϊόντων σε Ανθρωπίνους Ιστούς, Στο: Β. Μακρόπουλος και Δ. Ματθόπουλος (επιμ.).,Δημόσια Υγεία καιΦυτοπροστατευτικά Προϊόντα,σελ. 219-281, ISBN: 978-960-6818-32-5, Τμήμα Εκδόσεων - Τεκμηρίωσης - Πληροφόρησης, ΕΛΙΝΥΑΕ
- Selected papers from the international bibliography

Related academic journals

Aquatic Toxicology, Chemosphere, Drug and Chemical Toxicology, Environmental pollution, Environmental Research, Environmental Toxicology, Food and Chemical Toxicology, Journal of Hazardous Materials, Mutagenesis, Genetic Toxicology and Environmental Mutagenesis, PLoS ONE, Science of the Total Environment, Scientific Reports, Toxicology, Toxicology Letters

DIPLOMA THESIS II

1. GENERAL

SCHOOL	NATURAL SCIENCES
ACADEMIC UNIT	BIOLOGY

POSTGRADUATE PROGRAMME	BIOLOGICAL TECHNOLOGY: RESEARCH & APPLICATIONS		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	**BT_DIP2**	**SEMESTER**	3rd
COURSE TITLE	**DIPLOMA THESIS II**		
INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**		**CREDITS**
Lectures Laboratory exercises			30
COURSE TYPE	Specialised general knowledge		
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
Upon Diploma Thesis completion, the students should be able to: 1) study and manage the relevant international bibliography, 2) design experiments related to the subject of their Diploma Thesis, 3) carry out the relevant experiments successfully, 4) interpret results from experimental data and draw conclusions, and 5) organize, write and present the subject of their Diploma Thesis
General Competences
▪ Working independently ▪ Team work ▪ Generating new research ideas ▪ Project planning and management ▪ Search for, analysis and synthesis of data and information, with the use of the necessary technology ▪ Promoting free, creative and inductive thinking.

3. SYLLABUS

Completion of research activity [implementation of experiments, evaluation and interpretation of results, drawing conclusions, writing and presentation of a thesis].

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of ICT in laboratory education, and communication with students	
TEACHING METHODS	***Activity***	***Semester workload***
	Experimental project	550
	Writing and submission of thesis	200

	Course total (25 hours per one ECT)	**750**
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 commitee. Grading scale: 1-10. Passing grade: 5. Grading: 3 corresponds to ECTS grade F. Grade 4 corresponds to ECTS grade FX. Passing grades correspond to ECTS grades as follows: 5=E, 6=D, 7=C, 8=B, 9=A.	

5. RECOMMENDED BIBLIOGRAPHY

Suggested bibliography
Scientific literature articles