# COURSE OUTLINE

## 1. GENERAL

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|---|---|---|---|
| **SCHOOL** | APPLIED BIOLOGY AND BIOTECHNOLOGY | | |
| **ACADEMIC UNIT** | BIOTECHNOLOGY | | |
| **LEVEL OF STUDIES** | Undergraduate | | |
| **COURSE CODE** | **155** | **SEMESTER** | 4th |
| **COURSE TITLE** | POPULATION GENETICS | | |

| **INDEPENDENT TEACHING ACTIVITIES**<br>*if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits* | **WEEKLY TEACHING HOURS** | **CREDITS** |
|---|---|---|
| Lectures and Practicals | 5 | 5 |
| | | |
| | | |
| *Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (4).* | | |

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| **COURSE TYPE**<br>*general background, special background, specialised general knowledge, skills development* | Field of Science |
| **PREREQUISITE COURSES:** | No |
| **LANGUAGE OF INSTRUCTION and EXAMINATIONS :** | English |
| **IS THE COURSE OFFERED TO ERASMUS STUDENTS** | Yes |
| **COURSE WEBSITE (URL)** | https://mediasrv.aua.gr/eclass/courses/BIOTECH168/ |

## 2. LEARNING OUTCOMES

**LEARNING OUTCOMES**

*The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.*

*Consult Appendix A*

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Students will be able to:

- Calculate genotypic and allelic frequencies in autosomal or X- linked genes from a sample population under various circumstances
- Estimate if a population is under Hardy – Weinberg equilibrium for a specific gene
- Estimate linkage disequilibrium between two genes in a population
- Estimate inbreeding coefficient from genotypic frequencies and pedigrees
- Estimate the coefficient of consanguinity from pedigrees
- Estimate the effective population size under various circumstances
- Estimate inbreeding coefficient in small populations
- Estimate inbreeding coefficient under various systems of mattings
- Estimate the value and variance of Parsons Index for assortative and disassortative mattings
- Estimate the possible outcomes concerning alleles frequencies changes in populations due to random genetic drift
- Estimate the consequences of WAHLUND effect in the genetic structure of isolated subpopulations

- Estimate the genes frequencies variance in isolated subpopulations
- Estimate the genetic and evolutionary consequences of bottleneck and founder effect
- Estimate the possible outcomes concerning alleles frequencies changes in populations due to natural selection
- Estimate the fitness coefficient of different genotypes
- Estimate the genes frequencies equilibrium under various scenarios of natural selection
- Estimate the genetic and evolutionary consequences of natural selection effect
- Estimate the possible outcomes concerning alleles frequencies changes in populations due to mutation and random genetic drift
- Estimate the genes frequencies equilibrium under various scenarios of natural selection and mutation rate
- Estimate the genetic and evolutionary consequences
- Estimate the possible outcomes concerning alleles frequencies changes in populations due to migration and gene flow
- Estimate the genes frequencies equilibrium under various scenarios of natural selection and gene flow
- Estimate the genetic and evolutionary consequences of migration and gene flow effect
- Estimate the genetic load caused by mutation, recombination, migration, Mendelian , segregation and meiotic distortion

**General Competences**

*Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?*

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|---|---|
| *Search for, analysis and synthesis of data and information, with the use of the necessary technology* | *Production of new research ideas* |
| *Adapting to new situations* | *Project planning and management* |
| *Decision-making* | *Respect for differences and multiculturalism* |
| *Working independently* | *Respect for the natural environment* |
| *Team work* | *Showing social, professional and ethical responsibility and sensitivity to gender issues* |
| *Working in an international environment* | *Criticism and self-criticism* |
| *Working in an interdisciplinary environment* | *Production of free, creative and inductive thinking* |

- Work autonomously
- Work in teams
- Work in an international context
- Respect natural environment
- Advance free, creative and causative thinking

## 3. SYLLABUS

- Random mating populations
- Hardy- Weinberg (H-W ) principle. Testing H-W proportions
- Estimation of allele frequencies. Sex-linked loci. Extensions and generalizations of HWE
- Deviations from H-W equilibrium
- Inbreeding coefficient (F). Inbreeding depression
- Estimation of F from pedigree analysis
- Genetic drift. Genetic drift and expected allele frequencies
- Patterns of genetic drift in the Wright- Fisher model
- Effect of population size in the Wright – Fisher model. Founder effect
- Effective population size. Unequal sex ratio. Fluctuating population size
- Mutation. Selectively neutral mutations. Harmful mutations. Advantageous mutations
- Population subdivision.F- Statistics
- Genetic divergence among populations and gene flow
- Linkage Disequilibrium (LD). LD coefficients. Change in LD due to random mating
- Wahlund effect

- Natural selection. Fitness. Single locus with two alleles. Multiple alleles
- Calculation of allele frequency changes
- Special cases of selection. Heterozygote advantage
- Mutation –selection balance. Genetic hitchhiking. Selective sweeps
- The neutral theory and tests of neutrality

## 4. TEACHING and LEARNING METHODS - EVALUATION

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| **DELIVERY**<br>*Face-to-face, Distance learning, etc.* | Face to face, in class |
| **USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY**<br>*Use of ICT in teaching, laboratory education, communication with students* | Power point presentations. Course material also made available to the students via the e-class platform. |
| **TEACHING METHODS**<br>*The manner and methods of teaching are described in detail.*<br>*Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.*<br><br>*The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS* | (see table below) |
| **STUDENT PERFORMANCE EVALUATION**<br>*Description of the evaluation procedure*<br><br>*Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other*<br><br>*Specifically-defined evaluation criteria are given, and if and where they are accessible to students.* | I. Theory: Written Examination (40%) and essay writing/presentation (10%)<br><br>II. Practicals: Written Examination (50%)<br><br>Both to include:<br>- Multiple Choice or short-answer Questions.<br>-Problem solving |

| ***Activity*** | ***Semester workload*** |
|---|---|
| Lectures | 39 |
| Laboratory work (tutorials) focused on Genetics problem-solving in smaller groups | 26 |
| Essay preparation | 10 |
| Independent study | 50 |
| Course total (Total contact hours and training) | ***125*** |

## 5. ATTACHED BIBLIOGRAPHY

*-Suggested bibliography :*
*-Relevant scientific journals:*
Population Genetics, Matthew Hamilton 2009, Wiley-Blackwell