COURSE OUTLINE

(1) GENERAL

SCHOOL	Health Sciences		
ACADEMIC UNIT	Department of Biological Applications & Technology		
LEVEL OF STUDIES	*Undergraduate*		
COURSE CODE	BEY601	**SEMESTER**	7th
COURSE TITLE	Molecular Genetics		

INDEPENDENT TEACHING ACTIVITIES *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, Laboratory courses	6	7
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special background
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	
COURSE WEBSITE (URL)	

(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*

The aim of the course is to provide the students with advanced knowledge of the structure and function of genes at the molecular level as well as of the mechanisms by which the biochemical processes of the cell (prokaryotic and eukaryotic) translate the genetic information into a phenotype. Special emphasis is placed on students' understanding and consolidating the value of molecular genetics approaches in solving fundamental biology questions. In addition, the students are getting hands-on experience by conducting experiments that match the different topics covered in the theoretical part of the course in order to deepen their knowledge in these areas, such as the molecular mechanisms of mutation and DNA repair, the mobilization of transposable elements and the regulation of gene expression.

After the course, the students (*according to the descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning*):

- should be able to understand how mutations happen and how the DNA is repaired, which are the mechanisms of recombination, what is the genetic and physiological importance of transposable elements, the mechanisms of genetic and epigenetic

regulation of gene expression, and the bases of epigenetic inheritance.

- will have become familiar with the scientific strategies and experimental methodologies through which these mechanisms are determined, and
- will be able to comprehend the value of interdisciplinary approaches in Science

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?

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

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

(3) SYLLABUS

1. **Mutations and DNA Repair**
   Molecular mechanisms of spontaneous mutations. Induced mutations. Modification of DNA. DNA repair systems in prokaryotes, photoreactivation, mismatch repair, recombinational repair, SOS system. DNA repair systems in eukaryotes, non-homologous end-joining, the Ku heterodimer. Deficiencies in DNA repair systems and hereditary disorders.
2. **Genetic Recombination**
   Homologous recombination, site-specific recombination, bacteriophage integration, mechanism of integrase action. Chiasmata, crossing-over, Holliday junction, chromosomal pairing, synaptonemal complex. Gene conversion.
3. **Transposable Elements**
   Prokaryotic and eukaryotic transposable elements. Insertion sequences, transposase, transposition mechanisms, composite transposons. Controlling elements in *Zea Mays* and phenotypic diversity. The phenomenon of hybrid dysgenesis in Drosophila, P elements, copia transposons. The contribution of transposable elements in genomic instability. Transposable elements and regulation of gene expression. Importance of the mobile elements for the creation of genetic diversity
4. **Regulation of gene expression**
   Examples of general regulatory systems in prokaryotic organisms. Examples of positive and negative regulation of gene expression, lactose and arabinose operons. The phenomenon of attenuation in the tryptophan operon. Two-component sensory transduction systems. Transcriptional regulatory elements of eukaryotic genes. Structure and function of transcriptional activators, mechanisms of induction. Co-regulatory molecules, interactions with the basal transcription machinery, transcriptional repressors. Cooperative regulation in transcription. Insulators and mechanisms of action. Levels of DNA packaging and gene expression.
5. **Regulatory RNA Molecules**
   Bacterial regulatory RNA. Co-suppression of transgenes in plants. Principles and

mechanisms of RNA interference. RNAi and epigenetic regulation. MicroRNA, structure, mechanism of processing, miRNA genes and their function.

6. **Epigenetic Modifications of the Genome:**
   Alternative chromatin states, chromatin remodeling, histone code, histone modification enzymes (acetylation, methylation). Epigenetic phenomena, position effect variegation, sex-linked genes and dosage compensation, inheritance of methylated DNA, genomic imprinting, epigenetic inheritance. Reorganization of DNA Sequences, Modifications of Phenotype and Gene Expression, Mating type switching in *Saccharomyces cerevisiae*, the MAT locus.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face, in the lecture halls, the learning laboratories and in the Lecturer's office
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of powerpoint presentations for teaching and laboratory training, announcements at the Department's website, direct communication with students through e-mails
TEACHING METHODS *The manner and methods of teaching are described in detail.* *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.* *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*	

Activity	***Semester workload***
Lectures – Laboratory activities	84
Evaluation of results-Essay writing	35
Study and analysis of bibliography	65
Course total	184

STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *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* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	*Language of evaluation*: Greek *Method of evaluation:* I. Written test (80%) II. Performance of the student in the laboratory activities (20%)

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
- Related academic journals:

W. S. Klug, M. R. Cummings, C. A. Spencer και M. A. Palla ***Essentials of Genetics*****, Βασικές Αρχές Γενετικής**, 2015, Ακαδημαϊκές Εκδόσεις Ι. Μπάσδρα & Σία Ο.Ε. ISBN 978-618-5135-

03-4

Peter J Russell ***iGenetics: A Molecular Approach***, **iGenetics – ΜΙΑ ΜΕΝΤΕΛΙΚΗ ΠΡΟΣΕΓΓΙΣΗ**, 2009, Ακαδημαϊκές Εκδόσεις Ι. Μπάσδρα & Σία Ο.Ε. ISBN 978-960-99895-7-2

Hartwell Leland, Hood Leroy, Goldberg Michael, Reynolds Ann, Silver Lee ***Genetics: From Genes to Genomes***, **ΓΕΝΕΤΙΚΗ- Από τα Γονίδια στα Γονιδιώματα**, 2013, ΥΤΟΡΙΑ ΕΚΔΟΣΕΙΣ ΕΠΕ. ISBN 978-618-80647-0-6