

## COURSE OUTLINE

### 1. GENERAL

<b>SCHOOL</b>	AGRICULTURAL SCIENCES		
<b>ACADEMIC UNIT</b>	AGRICULTURE		
<b>LEVEL OF STUDIES</b>	UNDERGRADUATE		
<b>COURSE CODE</b>	AGRI-506	<b>SEMESTER OF STUDIES</b>	5 <sup>th</sup>
<b>COURSE TITLE</b>	MOLECULAR BIOLOGY		
<b>INDEPENDENT TEACHING ACTIVITIES</b> <i>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</i>	<b>WEEKLY TEACHING HOURS</b>	<b>CREDITS</b>	
Lectures	3		
Laboratory exercises	2		
<b>Total</b>	<b>5</b>	<b>5</b>	
<i>Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (4).</i>			
<b>COURSE TYPE</b> <i>general background, special background, specialised general knowledge, skills development</i>	Specialised general knowledge		
<b>PREREQUISITE COURSES:</b>	Typically, there are no prerequisite courses. Students must have basic knowledge of Genetics, cell biology.		
<b>LANGUAGE OF INSTRUCTION and EXAMINATIONS:</b>	Greek. Teaching may be performed in English in case foreign students attend the course.		
<b>IS THE COURSE OFFERED TO ERASMUS STUDENTS</b>	Yes (English)		
<b>COURSE WEBPAGE (URL)</b>			

### 2. LEARNING OUTCOMES

<p><b>Learning outcomes</b> <i>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.</i></p> <p><i>Consult Appendix A</i></p> <ul style="list-style-type: none"> <li>• <i>Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area</i></li> <li>• <i>Descriptors for Levels 6, 7 &amp; 8 of the European Qualifications Framework for Lifelong Learning and Appendix B</i></li> <li>• <i>Guidelines for writing Learning Outcomes</i></li> </ul>
<p>The course aims at introducing the students to the concepts of Molecular Biology and enable them to acquire a comprehensive understanding of the genomic organization and the flow of biological information e.g., understand the chemical properties of biomolecules (DNA, RNA), cellular procedures such as DNA replication, regulation of transcription in prokaryotic and eukaryotic cells, translation and protein synthesis.</p> <p>Moreover, by completing this course, the students will be able to get insight in applications or recombinant DNA technology in agriculture, e.g. the production of transgenic plants, plant tissue culture and the implementation of biotechnology applications in modern agriculture. They will acquire deep understanding regarding the legal and ethical issues arising from the application of biotechnology in Agriculture, the genetic manipulation of organisms and its implications in society and science.</p>

### **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*

*Adapting to new situations*

*Decision-making*

*Working independently*

*Teamwork*

*Working in an international environment*

*Working in an interdisciplinary environment*

*Production of new research ideas*

*Project planning and management*

*Respect for difference and multiculturalism*

*Respect for the natural environment*

*Showing social, professional and ethical responsibility and sensitivity to gender issues*

*Criticism and self-criticism*

*Production of free, creative and inductive thinking*

*.....*

*Others...*

*.....*

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

Searching, analysis and synthesis of facts and information, as well as using the necessary technologies

Decision making

Independent work

Teamwork

Working in an interdisciplinary environment

Project planning and management

Production of new research ideas

Promotion of free, creative and inductive thinking

### **3. SYLLABUS**

Introduction in Molecular Biology: Structure and physicochemical properties of DNA and RNA molecules

DNA replication, transcription, regulation of transcription.

Protein synthesis. The ribosome. The genetic code. Overview of translation. Open reading frame mutations.

Protein synthesis. Translation critical factors, rRNA and their role in translation. Protein synthesis in prokaryotic and eukaryotic cells. Post translational modification. Epigenetic and chemical modifications.

Genetic manipulation and recombinant DNA technology

Genetic transformation methods. Production of genetically modified plants

Plant tissue culture, nutrient solutions, hormones. Plant regeneration. Anther and protoplast culture, somaclonal variation

Gene targeting - gene editing

Transient gene expression. Gene silencing.

Applications of GMO plants. Identification of GMO plants. Legal and ethical issues. Bioethics, patents, social impact etc.

Bioinformatics, Databases and genomic repositories.

### Laboratory exercises

- DNA isolation
- Total RNA isolation
- Quantitative and qualitative evaluation of DNA και RNA
- Polymerase Chain Reaction (PCR).
- DNA manipulation. Restriction Enzyme digestion and ligation of DNA
- Agarose gel electrophoresis.
- Bioinformatics. Databases and genomic repositories.

## 4. TEACHING AND LEARNING METHODS - EVALUATION

<b>DELIVERY</b> <i>Face-to-face, Distance learning, etc.</i>	Face to face lectures.												
<b>USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES</b> <i>Use of ICT in teaching, laboratory education, communication with students</i>	Use of Information and Communication Technologies (ICTs) (e.g. Microsoft PowerPoint) in teaching. The contents of the course of each chapter are uploaded on the internet, that the students can freely download using a password which is provided to them at the beginning of the course.												
<b>TEACHING METHODS</b> <i>The manner and methods of teaching are described in detail.</i>  <i>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.</i>  <i>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</i>	<table border="1"><thead><tr><th><b>Activity</b></th><th><b>Semester workload</b></th></tr></thead><tbody><tr><td>Lectures (3 contact hours per week x 13 weeks)</td><td>39</td></tr><tr><td>Laboratory exercises (2 contact hours per week x 6 weeks)</td><td>12</td></tr><tr><td>Writing laboratory reports</td><td>6</td></tr><tr><td>Hours for private study of the student, preparation and attendance mid-term or/and final examinations.</td><td>68</td></tr><tr><td><b>Total number of hours for the Course (25 hours of workload per ECTS credit)</b></td><td><b>125 hours (total student workload)</b></td></tr></tbody></table>	<b>Activity</b>	<b>Semester workload</b>	Lectures (3 contact hours per week x 13 weeks)	39	Laboratory exercises (2 contact hours per week x 6 weeks)	12	Writing laboratory reports	6	Hours for private study of the student, preparation and attendance mid-term or/and final examinations.	68	<b>Total number of hours for the Course (25 hours of workload per ECTS credit)</b>	<b>125 hours (total student workload)</b>
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<b>STUDENT PERFORMANCE EVALUATION</b> <i>Description of the evaluation procedure</i>  <i>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.</i>  <i>Specifically, defined evaluation criteria are given, and if and where they are accessible to students.</i>	Final mandatory written examination, full length questions and / or multiple-choice questions, as well as questions based on the laboratory work. Minimum pass grade= 5, scale 0-10.  All the above are taking place in Greek as well as in English for foreign students (e.g. ERASMUS students) if any.												

## 5. ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

1. Genes VIII, Lewin 2003, Benjamin Cummings; United States Ed edition (December 15, 2003)
2. Principles of Molecular Biology. B. Tropp 2014 Jones and Bartlett Publishers, Inc.

3. Molecular Biology of the Cell, 4th edition. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter. New York: Garland Science; 2002.
4. Molecular Biology: Principles of Genome Function. Nancy L Craig, 2014. Oxford University Press.
5. Plant Biotechnology and Agriculture: Prospects for the 21st Century. Arie Altman and Paul Michael Hasegawa. Academic Press
6. OMICS-Based Approaches in Plant Biotechnology Rintu Banerjee, Garlapati Vijay Kumar, et al. Wiley-Scrivener
7. Molecular Biology of the Gene. Watson James, Baker Tania, Bell Stephen, Gann Alexander, Levine Michael, Losick Richard. Pearson 2013.
8. Recombinant DNA: Genes and Genomes - A Short Course. James D. Watson, Jan A. Witkowski, Richard M. Myers, Amy A. Caudy. Cold Spring Harbor Laboratory Press; 3rd edition (December 8, 2006)

- *Related academic journals:*

Nature

Nature Plants

Science

Cell

Plant Molecular Biology

The Plant Cell

Gene

Molecular Biology Reporter

New Phytologist

Nature Biotechnology

*Plant Biotechnology Journal*

Plant Biotechnology Reports