

## COURSE OUTLINE

### 1. GENERAL

<b>SCHOOL</b>	APPLIED BIOLOGY AND BIOTECHNOLOGY		
<b>ACADEMIC UNIT</b>	BIOTECHNOLOGY		
<b>LEVEL OF STUDIES</b>	BACHELOR OF SCIENCE		
<b>COURSE CODE</b>	<b>3180</b>	<b>SEMESTER</b>	6 <sup>th</sup> (Summer)
<b>COURSE TITLE</b>	ANALYTICAL BIOTECHNOLOGY		
<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	0,12
Practical (lab work)		2	0,08
Group and/or individual works		1	0,04
<i>Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).</i>			
<b>COURSE TYPE</b> <i>general background, special background, specialised general knowledge, skills development</i>	Scientific background / Skills development/ General and specialized knowledge		
<b>PREREQUISITE COURSES:</b>			
<b>LANGUAGE OF INSTRUCTION and EXAMINATIONS:</b>	Greek		
<b>IS THE COURSE OFFERED TO ERASMUS STUDENTS</b>	Yes (in Greek)		
<b>COURSE WEBSITE (URL)</b>	<a href="https://mediasrv.aua.gr/eclass/courses/BIOTECH149/">https://mediasrv.aua.gr/eclass/courses/BIOTECH149/</a>		

### 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> <i>Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area</i> <i>Descriptors for Levels 6, 7 &amp; 8 of the European Qualifications Framework for Lifelong Learning and Appendix B</i> <i>Guidelines for writing Learning Outcomes</i></p>
<p>This course aims at acquiring knowledge on:</p> <ol style="list-style-type: none"> <li>1) The basic principles of laboratory safety and security, management of laboratory waste and disposals.</li> <li>2) The basic principles of chemometrics and sampling.</li> <li>3) The evaluation of experimental data and errors, reliability and quality of laboratory measurements.</li> <li>4) The rules of good laboratory practice, quality control and quality assurance procedures.</li> <li>5) The basic principles of extraction and separation of biomolecules from various biological samples.</li> <li>6) The analytical techniques used in the analysis of biomolecules and of the qualitative and quantitative analysis.</li> </ol>

- 7) The selection and the evaluation the appropriate method for the study of unknown samples of biological interest.
- 8) Combine information from the different techniques for qualitative and quantitative analysis of complex biological samples.
- 9) The development of the appropriate method/laboratory protocol for the study of unknown samples of biological interest.
- 10) Designing research in analytical biotechnology.
- 11) Co-operation with other colleagues for the development of an analytical protocol/essay for the qualitative and quantitative analysis of a specific biological sample using multidisciplinary scientific literature.

### **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 Team work 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...*

- 1) Retrieve, analyze and synthesize data and information using contemporary technologies.
- 2) Make decisions.
- 3) Work autonomously.
- 4) Work in teams.
- 5) Create new research ideas.
- 6) Advance free, creative and causative thinking.

## **3. SYLLABUS**

### **1. Safety management of analytical laboratory.**

Safety rules for analytical biotechnology laboratory.  
Disposal and waste management.  
Rules of good laboratory practice.

### **2. Evaluation and Treatment of Analytical Data.**

Introduction to sampling and chemometrics for the optimization of analytical measurements.  
Reliability of analytical methods.  
Quality assurance and quality control of analytical data.  
Errors and statistical treatment of analytical data.  
Selection criteria and conditions for the development of analytical method and laboratory protocol.

### **3. Sample preparation.**

Fundamentals of extraction - separation of biomolecules (wet extraction methods, solid phase extraction, extraction with supercritical fluids, ultrasound - microwave and, enzyme assistant extraction, dialysis, ultrafiltration, lyophilization).

### **4. Methods and techniques.**

Chromatography (adsorption, distribution, gas chromatography, liquid chromatography)  
Combined techniques (LC / MS, GC / MS , etc. )  
Electrophoretic analysis methods (isoelectric focusing, two-dimensional electrophoresis, capillary electrophoresis, immunoblotting)  
Centrifugation techniques  
Enzymatic methods of analysis  
Analytical nanosystems and protein nanostructures  
Proteomics analysis

Peptide synthesis and carbohydrate/lipids analysis  
 Characterization of protein complexes

#### 5. Applications.

Specific applications and examples of analytical methods and protocols for biomolecules with agricultural, industrial and clinical interest.

### 4. TEACHING and LEARNING METHODS – EVALUATION

<p style="text-align: center;"><b>DELIVERY</b></p> <p style="text-align: center;"><i>Face-to-face, Distance learning, etc.</i></p>	<p>Face-to-face</p>												
<p style="text-align: center;"><b>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</b></p> <p style="text-align: center;"><i>Use of ICT in teaching, laboratory education, communication with students</i></p>	<p>Power point presentations.          Internet platform with practice test.          Student contact electronically by email and internet platform (eclass).</p>												
<p style="text-align: center;"><b>TEACHING METHODS</b></p> <p style="text-align: center;"><i>The manner and methods of teaching are described in detail.</i></p> <p style="text-align: center;"><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></p> <p style="text-align: center;"><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></p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;"><b>Activity</b></th> <th style="text-align: center;"><b>Semester workload</b></th> </tr> </thead> <tbody> <tr> <td>Lectures</td> <td style="text-align: center;">39 h (1.56 ECTS)</td> </tr> <tr> <td>Laboratory work</td> <td style="text-align: center;">12 h (0,48 ECTS)</td> </tr> <tr> <td>Group and/or individual works</td> <td style="text-align: center;">13 h (0.52 ECTS)</td> </tr> <tr> <td>Autonomous study</td> <td style="text-align: center;">61 h (2,44 ECTS)</td> </tr> <tr> <td><b>Total contact hours and training</b></td> <td style="text-align: center;"><b>125 h (5 ECTS)</b></td> </tr> </tbody> </table>	<b>Activity</b>	<b>Semester workload</b>	Lectures	39 h (1.56 ECTS)	Laboratory work	12 h (0,48 ECTS)	Group and/or individual works	13 h (0.52 ECTS)	Autonomous study	61 h (2,44 ECTS)	<b>Total contact hours and training</b>	<b>125 h (5 ECTS)</b>
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<p style="text-align: center;"><b>STUDENT PERFORMANCE EVALUATION</b></p> <p style="text-align: center;"><i>Description of the evaluation procedure</i></p> <p style="text-align: center;"><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></p> <p style="text-align: center;"><i>Specifically-defined evaluation criteria are given and if and where are accessible to students.</i></p>	<p>I) Written final examination (50%) of different difficulty, based on the lectures offered, containing:</p> <ul style="list-style-type: none"> <li>- Questions of multiple choice.</li> <li>- Questions of theoretical knowledge.</li> <li>- Problems based on lecture material.</li> </ul> <p>II) Laboratory exercises/practicals (30%). A written report for every laboratory exercise is required by each student (see below).</p> <ul style="list-style-type: none"> <li>- Each lab exercise is examined orally (during its implementation) and by a written report based on the results obtained (to be handed in before the beginning of the next exercise).</li> <li>- The laboratory examination of each subject must be successful (average grade of oral and report).</li> <li>- The average of the exercise grades counts 30% in the overall score of the course.</li> </ul> <p>III. Group and/or individual works (20%).</p>												

### 5. ATTACHED BIBLIOGRAPHY

**-Suggested bibliography:**

1) David G. Watson (2011), Φαρμακευτική Ανάλυση, Επιστημονικές Εκδόσεις Παρισιάνου Α.Ε.

- 2) P.R. Yadav (2005) Experimental Biotechnology, Discovery Publishing House.
- 3) Rodney F. Boyer (2000), Modern Experimental Biochemistry (3rd Edition) Addison Wesley Longman.
- 4) Keith Wilson and John Walker (2000) Principles and Techniques of Practical Biochemistry (5<sup>th</sup> edition), Cambridge University Press.
- 5) Clark jr. J.M. and Switzer R.L., (1992) Πειραματική Βιοχημεία, Πανεπιστημιακές Εκδόσεις Κρήτης, 1992.
- 6) Holme D. and Peck H. (2001) Analytical Biochemistry, Pearson Education Editions.

***-Suggested scientific journals***

Analytical chemistry

Analytical biochemistry

Nature biotechnology

Journal of Chromatography A

Journal of Chromatography B: Analytical Technologies in the Biomedical and Life Sciences