COURSE OUTLINE

1. GENERAL INFORMATION

FACULTY/SCHOOL	SCHOOL OF PLANT SCIENCES		
DEPARTMENT	DEPARTMENT OF CROP SCIENCE		
LEVEL OF STUDY	Undergraduate		
COURSE UNIT CODE	**665**	**Semester:**	3rd
COURSE TITLE	BIOCHEMISTRY		
INDEPENDENT TEACHING ACTIVITIES *in case credits are awarded for separate components/parts of the course, e.g. in lectures, laboratory exercises, etc. If credits are awarded for the entire course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHNG HOURS**	**ECTS**
Lectures and Laboratory Exercises		2+2	4
Add rows if necessary. The organization of teaching and the teaching methods used are described in detail under section 4			
COURSE TYPE *Background knowledge, Scientific expertise, General Knowledge, Skills Development*	Background knowledge		
PREREQUISITE COURSES:			
LANGUAGE OF INSTRUCTION:	Greek		
LANGUAGE OF EXAMINATION/ASSESSMENT:			
THE COURSE IS OFFERED TO ERASMUS STUDENTS	NO		
COURSE WEBSITE (URL)	https://oeclass.aua.gr/eclass/		

2. LEARNING OUTCOMES

Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate (certain) level, which students will acquire upon successful completion of the course, are described in detail. It is necessary to consult:

APPENDIX A

- *Description of the level of learning outcomes for each level of study, in accordance with the European Higher Education Qualifications' Framework.*
- *Descriptive indicators for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and*

APPENDIX B

- *Guidelines for writing Learning Outcomes*

The subject of the course is the study of the structure of biomolecules found in organisms and the investigation of the relationship between their structure and function. In addition, the set of chemical reactions of intermediate metabolism carried out in plant, animal and bacterial cells as well as their regulation mechanisms are studied comparatively.

Specifically, carbohydrates, nucleotides and nucleic acids, lipids and fatty acids, the structure and organization of membranes, amino acids and proteins as well as the properties and regulation mechanisms of enzymes are examined. Also, the similarities and differences of the processes of degradation and biosynthesis of carbohydrates, fatty acids, lipids, amino acids and the biosynthesis of nucleotides in plants, animals and bacteria are examined.

At the end of the course, the students will acquire the necessary theoretical background to understand the intermediate metabolism of plants, animals and bacteria as well as the involved biomolecules and enzymes in order to understand the different ways of regulation of metabolic pathways at the level of the organism.

At a practical level, the students will become familiar with basic laboratory techniques to be able to perform different techniques for the isolation and separation of proteins from plant tissues and to study the enzymatic activity of enzymes.

General Competences

Taking into consideration the general competences that students/graduates must acquire (as those are described in the Diploma Supplement and are mentioned below), at which of the following does the course attendance aim?

Search for, analysis and synthesis of data and information by the use of appropriate technologies,	*Project planning and management*
Adapting to new situations	*Respect for diversity and multiculturalism*
Decision-making	*Environmental awareness*
Individual/Independent work	*Social, professional and ethical responsibility and sensitivity to gender issues*
Group/Team work	*Critical thinking*
Working in an international environment	*Development of free, creative and inductive thinking*
Working in an interdisciplinary environment	*……*
Introduction of innovative research	*(Other…….citizenship, spiritual freedom, social awareness, altruism etc.)*
	…….

Search for, analysis and synthesis of data and information by the use of appropriate technologies
Decision-making
Individual/Independent work
Group/Team work
Critical thinking
Development of free, creative and inductive thinking

3. COURSE CONTENT

LECTURES

PART I: BIOMOLECULES-STRUCTURE AND BIOLOGICAL ROLE

Unit 1: The Macromolecules of Living Organisms and their Building Units

- Chapter 1: Carbohydrates
- Chapter 2: Nucleotides and Nucleic Acids
- Chapter 3: Amino Acids and Proteins
- Chapter 4: Lipids
- Chapter 5: Biological Membranes

PART II: ENZYMES-PROPERTIES, ROLE, AND MECHANISMS OF REGULATION

Unit 1: Catalysis and Control of Biochemical Reactions

- Chapter 6: Enzymes: The Biological Catalysts

PART III: INTERMEDIATE METABOLISM

Unit 1: Introduction to Metabolism

- Chapter 7: Basic Principles of Metabolism
- Chapter 8: Principles of Bioenergetics

Unit 2: Carbohydrate Metabolism: Anaerobic Processes in Metabolic Energy Production

- Chapter 9: Glycolysis
- Chapter 10: Entry of Hexoses and Disaccharides into Glycolysis
- Chapter 11: Entry of Storage Polysaccharides into Glycolysis-Catabolism of Glycogen, Starch and Fructans
- Chapter 12: The Fate of Pyruvate Under Anaerobic Conditions

Unit 3: Oxidative Processes: The Citrate Cycle and the Pentose Phosphate Pathway

- Chapter 13: Citric Acid Cycle
- Chapter 14: The Oxidative Pentose Phosphate Pathway

Unit 4: Electron Transport and Oxidative Phosphorylation

- Chapter 15: Electron Carriers in Oxidative Phosphorylation Redox Reactions

Chapter 16: Electron Transport Through the Respiratory Chain
Chapter 17: Oxidative Phosphorylation

Unit 5: Biosynthesis of Hydrocarbons

Chapter 18: Neoglycogenesis
Chapter 19: Biosynthesis of Disaccharides
Chapter 20: Biosynthesis of Glycogen
Chapter 21: Biosynthesis of Storage Polysaccharides in Plants
Chapter 22: The C3 Carbon Reduction Cycle
Chapter 23: Starch and Sucrose Biosynthesis in Leaves of C3 Plants
Chapter 24: The C2 Cycle-Photorespiration
Chapter 25: CO2 Fixation and Assimilation Processes in C4 and CAM Plants
Chapter 26: Processes Using Light Energy to Produce ATP and NADPH

Unit 6: Lipid Metabolism

Chapter 27: Degradation of Fatty Acids
Chapter 28: Biosynthesis of Fatty Acids
Chapter 29: Biosynthesis of Membrane Lipids and Triacylglycerols

Unit 7: Amino Acid Metabolism

Chapter 30: Biosynthesis of Amino Acids
Chapter 31: Degradation of Amino Acids

Unit 8: Nucleotide Metabolism

Chapter 32: Biosynthesis of Nucleotides
Chapter 33: Biosynthesis of Nucleotide Coenzymes

LABORATORY EXERCISES

1. Preparation of solutions
2. Centrifugation
3. Photometry
4. Size-exclusion chromatography, affinity chromatography, ion exchange chromatography
5. Determination of total protein concentration by Bradford
6. Extraction of proteins from plant tissues
7. Protein analysis by electrophoresis
8. Determination of catalase enzyme activity
9. Determination of amylase enzyme activity
10. Kinetics of enzyme catalysis

4. TEACHING METHODS--ASSESSMENT

MODES OF DELIVERY *Face-to-face, in-class lecturing, distance teaching and distance learning etc.*	Lectures in the auditorium and laboratory exercises in the Microscopy Rooms of the Laboratory of General & Agricultural Microbiology
USE OF INFORMATION AND COMMUNICATION TECHNOLOGY *Use of ICT in teaching, Laboratory Education, Communication with students*	Use of Powerpoint slides. Communication with students via e-mail. Learning process support through e-class access.
COURSE DESIGN *Description of teaching techniques, practices and methods:* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, Internship, Art Workshop, Interactive teaching, Educational visits, projects, Essay writing, Artistic creativity, etc.*	

Activity/ Method	Semester workload
Lectures	13X2=26
Laboratory practice	13X2=26
Individual laboratory project (data processing and commenting)	8
Personal study	40

The study hours for each learning activity as well as the hours of self-directed study are given following the principles of the ECTS.	***Total of Course (25 hours of workload per ECTS)***	**100**

STUDENT PERFORMANCE EVALUATION/ASSESSMENT METHODS *Detailed description of the evaluation procedures:* *Language of evaluation, assessment methods, formative or summative (conclusive), multiple choice tests, short- answer questions, open-ended questions, problem solving, written work, essay/report, oral exam, presentation, laboratory work,* *other……etc.* *Specifically defined evaluation criteria are stated, as well as if and where they are accessible by the students.*	I. The exam on the course lectures includes an intermediate progress (20%, written) and a final exam (80%, written). Exams will be short answer questions and various types of multiple choice tests. II. A final exam on the laboratory exercises (written). Exams will be short answer questions (100%).

5. SUGGESTED BIBLIOGRAPHY:

1. **ΒΙΟΧΗΜΕΙΑ, 2004. Π. ΚΑΤΙΝΑΚΗΣ, Εκδ. ΣΤΥΛΙΑΝΟΣ ΒΑΣΙΛΕΙΑΔΗΣ**
2. **ΒΙΟΧΗΜΕΙΑ, 2007. Γ. Χ. ΔΙΑΜΑΝΤΙΔΗΣ, Εκδ. UNIVERSITY STUDIO PRESS Α.Ε.**

6. TEACHERS:

-Lectures:
M. Dimou (Assistant Professor, Microbiology – Biotechnology of Microorganisms)
A. Karnaouri (Assistant Professor, Microbial Fermentations – Molecular Biotechnology of Microorganisms)

-Laboratory Exercises:
M. Dimou (Assistant Professor, Microbiology – Biotechnology of Microorganisms)
A. Karnaouri (Assistant Professor, Microbial Fermentations – Molecular Biotechnology of Microorganisms)