

COURSE OUTLINE

(1) GENERAL

SCHOOL	APPLIED BIOLOGY & BIOTECHNOLOGY		
ACADEMIC UNIT	BIOTECHNOLOGY		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE		SEMESTER	5ή7 ^ο (winter)
COURSE TITLE	Microbial Ecology: From Cell to Microbiome		
INDEPENDENT TEACHING ACTIVITIES <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>		WEEKLY TEACHING HOURS	CREDITS
Lectures		3 (x13 wks)	1,56
Practical Lab Courses		2 (x13 wks)	1,04
Group class presentation (selected topics/ scientific articles)		2,3 (x13 wks)	1,20
Autonomous study (personal assignment)		2,3 (x13 wks)	1,20
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		SUM: 9,6 (x13 wks)	5,0
COURSE TYPE <i>general background, special background, specialised general knowledge, skills development</i>	Specialization course		
PREREQUISITE COURSES:			
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek (Teaching & Exams)		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	English (Teaching & Exams)		
COURSE WEBSITE (URL)	Under construction		

(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

Upon completion of this course, the students are expected to acquire a series of learning competencies including:

- Understand the ecological principles governing the structure, composition, and function of microbial communities across multiple scales (cell, population, community, microbiome).
- Know modern molecular and computational methods for studying microbiomes (16S/ITS amplicon sequencing, metagenomics) and basic bioinformatics tools for data analysis.
- Analyze and interpret microbial diversity data (alpha/beta diversity), community composition, and functional potential using R and phyloseq.
- Describe the characteristics and ecological role of soil, plant (rhizosphere, phyllosphere), and human microbiomes.

- Critically evaluate the potential and limitations of microbiome applications in sustainable agriculture, environmental restoration, and climate change mitigation.
- Collaborate effectively in teams to analyze real microbiome datasets and present research findings.

General Competences <i>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?</i>	
<i>Search for, analysis and synthesis of data and information, with the use of the necessary technology</i> <i>Adapting to new situations</i> <i>Decision-making</i> <i>Working independently</i> <i>Team work</i> <i>Working in an international environment</i> <i>Working in an interdisciplinary environment</i> <i>Production of new research ideas</i>	<i>Project planning and management</i> <i>Respect for difference and multiculturalism</i> <i>Respect for the natural environment</i> <i>Showing social, professional and ethical responsibility and sensitivity to gender issues</i> <i>Criticism and self-criticism</i> <i>Production of free, creative and inductive thinking</i> <i>.....</i> <i>Others...</i> <i>.....</i>
1) Retrieve, analyze and synthesize data and information relying on use of necessary technologies. 2) Adjust to new situations. 3) Decision making. 4) Work autonomously. 5) Work in groups. 6) Create novel scientific projects. 7) Design and develop research projects/experiments. 8) Be critical and self-critical. 9) Apply knowledge to practice.	

(3) SYLLABUS

1)	<u>Ecological Principles in Microbial Systems Across Scales</u> (cell, population, community, microbiome): Microbial diversity, Ecological theories and community assembly models
2)	<u>What is a Microbiome?</u> Definitions, Concepts (Holobiome – One Health), Approaches
3)	<u>Soil Microbiomes: The Black Box of Biodiversity</u> , Drivers of composition and linkages to soil ecosystem functions (Functional Microbial Ecology)
4)	<u>Plant-Associated Microbiomes</u> : Rhizosphere - Phyllosphere – Endosphere
5)	<u>Microbiomes in Extreme and Disturbed Environments</u> : Resistance and resilience of microbiomes, Succession dynamics, Drought – Salinity – Desertification, Heavy metals and pollutants
6)	<u>Human-Associated Microbiomes</u>
7)	<u>Microbiomes in Ecosystem Restoration & Sustainable Agriculture</u> : Emerging topics and future challenges in microbial inoculant development – SynComs vs. microbiome engineering, Microbial diversity conservation (Biobanking)
8)	<u>Methods for Studying Microbiomes</u> : Sampling, DNA extraction, Target gene selection and sequencing library preparation
9)	<u>From Raw Reads to OTUs/ASVs</u> : Bioinformatics analysis using QIIME2, mothur, and DADA2
10)	<u>Metagenomics, Metatranscriptomics and Other Omics Approaches</u> : Shotgun metagenomics - advantages over amplicon sequencing, Functional profiling, Strain-level resolution, Selecting the appropriate method
(4) TEACHING and LEARNING METHODS - EVALUATION	

DELIVERY	Face-to-face
<i>Face-to-face, Distance learning, etc.</i>	

USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY <i>Use of ICT in teaching, laboratory education, communication with students</i>	Power point presentations, student contact electronically.	
TEACHING METHODS <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>	Activity	Semester workload
	Lectures	39 h = 1.56 ECTS (13 wks x 3 h)
	Practical Lab Courses	26 h = 1.04 ECTS (13 wks x 2 h)
	Group Class presentations	30 h = 1.2 ECTS (13 wks x 2,3 h)
	Autonomus study	30 h = 1.2 ECTS (13 wks x 2,3 h)
	Course total	175
		(5 ECTS)
STUDENT PERFORMANCE EVALUATION <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,</i>	I) Written final examination (50%) with ranking difficulty on the basis of the issues and subjects presented during theoretical courses. The exams will include: - Questions of multiple choice. - Questions of theoretical knowledge. - Theoretical problems to be resolved. II) Laboratory exercises/ practical courses (30%). Students individually or in groups will provide a written report before the beginning of the next exercise. The grade of lab courses will be based on the writing reports, attendance and class participation. III) Group and small autonomous assignments (20%).	

1. Recommended Literature

1. Kirchman, David L., **Processes in Microbial Ecology**, 2nd edn (Oxford, 2018; online edn, Oxford Academic, 23 Aug. 2018), <https://doi.org/10.1093/oso/9780198789406.001.0001>
2. T.J. Gentry, C.P. Gerba, I.L. Pepper, «**Environmental Microbiology**», Academic Press, 2018.

-Relevant Scientific Journals:

Microbial Ecology, The ISME Journal, ISME Communications, FEMS Microbiology Ecology, Microbiome, npj Biofilms and Microbiomes, Environmental Microbiome, Phytobiomes Journal, Applied soil ecology, Soil ecology letters, mSystems, mSphere, mBio, Cell Host & Microbe