

## COURSE OUTLINE

### 1. GENERAL<sup>4<sup>th</sup></sup>

<b>SCHOOL</b>	Engineering		
<b>DEPARTMENT</b>	Environmental Engineering		
<b>LEVEL OF STUDIES</b>	Undergraduate, First cycle, General Education		
<b>COURSE CODE</b>	Δ3ΥΠ	<b>SEMESTER</b>	4 <sup>th</sup>
<b>COURSE TITLE</b>	Environmental Microbiology		
<b>TEACHING ACTIVITIES</b> <i>If the ECTS Credits are distributed in distinct parts of the course e.g. lectures, labs etc. If the ECTS Credits are awarded to the whole course, then please indicate the teaching hours per week and the corresponding ECTS Credits.</i>	<b>TEACHING HOURS PER WEEK</b>	<b>ECTS CREDITS</b>	
	6	5	
<i>Please, add lines if necessary. Teaching methods and organization of the course are described in section 4.</i>			
<b>COURSE TYPE</b> <i>Background, General Knowledge, Scientific Area, Skill Development</i>	General knowledge (Compulsory)		
<b>PREREQUISITES:</b>	Biology-Ecology		
<b>TEACHING &amp; EXAMINATION LANGUAGE:</b>	Greek		
<b>COURSE OFFERED TO ERASMUS STUDENTS:</b>	No		
<b>COURSE URL:</b>			

### 2. LEARNING OUTCOMES

<b>Learning Outcomes</b> <i>Please describe the learning outcomes of the course: Knowledge, skills and abilities acquired after the successful completion of the course.</i>														
<p>Knowledge based:</p> <ul style="list-style-type: none"> <li>• Understanding the structure and physiology of microbial taxa.</li> <li>• Understanding the abundance, distribution and biodiversity of microorganisms and their interactions with the environment.</li> <li>• Learning the fundamentals of microbial growth in environmental engineering systems.</li> <li>• Understanding the role of microbial communities in nutrient cycling.</li> <li>• Understanding the biodegradation processes and the role of microorganisms in preventing environmental pollution.</li> <li>• Understanding the microbial processes and the role of microbial communities in wastewater treatment plants.</li> <li>• Use of microorganisms for biotechnological applications and energy recovery from organic resources.</li> <li>• Being familiar with modern molecular techniques in environmental engineering.</li> </ul>														
<p><b>General Skills</b> <i>Name the desirable general skills upon successful completion of the module</i></p> <table border="0"> <tr> <td><i>Search, analysis and synthesis of data and information, ICT Use</i></td> <td><i>Project design and management</i></td> </tr> <tr> <td><i>Adaptation to new situations</i></td> <td><i>Equity and Inclusion</i></td> </tr> <tr> <td><i>Decision making</i></td> <td><i>Respect for the natural environment</i></td> </tr> <tr> <td><i>Autonomous work</i></td> <td><i>Sustainability</i></td> </tr> <tr> <td><i>Teamwork</i></td> <td><i>Demonstration of social, professional and moral responsibility and sensitivity to gender issues</i></td> </tr> <tr> <td><i>Working in an international environment</i></td> <td><i>Critical thinking</i></td> </tr> <tr> <td><i>Working in an interdisciplinary environment</i></td> <td><i>Promoting free, creative and inductive reasoning</i></td> </tr> </table>	<i>Search, analysis and synthesis of data and information, ICT Use</i>	<i>Project design and management</i>	<i>Adaptation to new situations</i>	<i>Equity and Inclusion</i>	<i>Decision making</i>	<i>Respect for the natural environment</i>	<i>Autonomous work</i>	<i>Sustainability</i>	<i>Teamwork</i>	<i>Demonstration of social, professional and moral responsibility and sensitivity to gender issues</i>	<i>Working in an international environment</i>	<i>Critical thinking</i>	<i>Working in an interdisciplinary environment</i>	<i>Promoting free, creative and inductive reasoning</i>
<i>Search, analysis and synthesis of data and information, ICT Use</i>	<i>Project design and management</i>													
<i>Adaptation to new situations</i>	<i>Equity and Inclusion</i>													
<i>Decision making</i>	<i>Respect for the natural environment</i>													
<i>Autonomous work</i>	<i>Sustainability</i>													
<i>Teamwork</i>	<i>Demonstration of social, professional and moral responsibility and sensitivity to gender issues</i>													
<i>Working in an international environment</i>	<i>Critical thinking</i>													
<i>Working in an interdisciplinary environment</i>	<i>Promoting free, creative and inductive reasoning</i>													

*Production of new research ideas*

- Search, analysis and synthesis of data and information
- Autonomous work
- Teamwork
- Production of new research ideas
- Equity and Inclusion
- Respect for the natural environment
- Sustainability
- Demonstration of social, professional and moral responsibility and sensitivity to gender issues
- Critical thinking
- Promoting free, creative and inductive reasoning

### 3. COURSE CONTENT

Introductory to microbiology. Microscopic examination. Microbial diversity. Heterotrophic metabolism. Microbial nutrition and physiology. Microbial growth. Microbial enumeration techniques. Microbial interactions. Activated sludge microbiota. Obligately aerobic chemoautotrophs. Anaerobic ammonium oxidation: Anammox. Enhanced Biological Phosphorus Removal (EBPR) and Polyphosphate Accumulating Organisms (PAOs). Nitrate and sulphate as electron acceptors for microbial anaerobic respiration (denitrifiers and sulphate-reducers). Methanogenic archaea and methanogenesis. Biodegradation of xenobiotics and slowly degradable naturally-occurring organic compounds. Molecular techniques in environmental microbiology.

Laboratory work:

- Microbial enumeration, effects of environmental factors on growth, control of microbial growth, culture media.
- Microbial staining and examination of activated sludge systems, microbial identification tests, Polymerase Chain Reaction (PCR), agarose gel electrophoresis.
- Microscopic evaluation of activated sludge, identification of filamentous bacteria, protozoa and microbial indicators.

### 4. LEARNING & TEACHING METHODS - EVALUATION

<p><b>TEACHING METHOD</b> <i>Face to face, Distance learning, etc.</i></p>	<p>Face-to-face teaching of the course contents using slides presentation. Educational materials on various topics are given through the e-learning platform “e-class”. The course also comprises laboratory experimental work.</p>															
<p><b>USE OF INFORMATION &amp; COMMUNICATIONS TECHNOLOGY (ICT)</b> <i>Use of ICT in Teaching, in Laboratory Education, in Communication with students</i></p>	<p><b>Use of ICT in Teaching, in Laboratory Education, in Communication with students</b></p>															
<p><b>TEACHING ORGANIZATION</b> <i>The ways and methods of teaching are described in detail. Lectures, Seminars, Laboratory Exercise, Field Exercise, Bibliographic research &amp; analysis, Tutoring, Internship (Placement), Clinical Exercise, Art Workshop, Interactive learning, Study visits, Study / creation, project, creation, project. Etc.</i></p>	<table border="1"> <thead> <tr> <th><i>Activity</i></th> <th><i>Workload/semester</i></th> </tr> </thead> <tbody> <tr> <td>Lectures</td> <td>39</td> </tr> <tr> <td>Bibliographic research &amp; analysis</td> <td>72</td> </tr> <tr> <td>Laboratory exercises</td> <td>39</td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> </tr> </tbody> </table>	<i>Activity</i>	<i>Workload/semester</i>	Lectures	39	Bibliographic research & analysis	72	Laboratory exercises	39							
<i>Activity</i>	<i>Workload/semester</i>															
Lectures	39															
Bibliographic research & analysis	72															
Laboratory exercises	39															

The supervised and unsupervised workload per activity is indicated here, so that total workload per semester complies to ECTS standards.


## STUDENT EVALUATION

Description of the evaluation process

Assessment Language, Assessment Methods, Formative or Concluding, Multiple Choice Test, Short Answer Questions, Essay Development Questions, Problem Solving, Written Assignment, Essay / Report, Oral Exam, Presentation in audience, Laboratory Report, Clinical examination of a patient, Artistic interpretation, Other/Others

Please indicate all relevant information about the course assessment and how students are informed

Written examination and laboratory reports of experimental activities

## 5. SUGGESTED BIBLIOGRAPHY

- Environmental Microbiology (In Greek), Ntougias S., Aivasidis A., Melidis P., Embryo Publications, ISBN: 978-960-8002-66-1.
- Brock Biology of Microorganisms, Madigan M.T., Martinko J.M., Parker J., Pearson/Benjamin Cummings, ISBN: 978-960-524-200-8.

## ANNEX OF THE COURSE OUTLINE

### Alternative ways of examining a course in emergency situations

<b>Teacher (full name):</b>	Associate Professor Spyridon Ntougias
<b>Contact details:</b>	Vas. Sofias 12, 67132; tel: +30 2541079313; sntougia@env.duth.gr
<b>Supervisors: (1)</b>	Yes
<b>Evaluation methods: (2)</b>	Oral examination and essay evaluation
<b>Implementation Instructions: (3)</b>	Oral examination will be carried out with distance learning methods in groups of 10 people, answering two questions via MS TEAMS, overseen by invigilators to ensure the inviolability and reliability of the exam. Regarding grading system, the two oral questions will account for 5/10 each. The technical means for the implementation of the examination include microphone, camera, internet connection and communication platform. The hyperlink for the examination will be provided via e-class.

(1) Please write YES or NO

(2) Note down the evaluation methods used by the teacher, e.g.

- *written assignment* or/and exercises
- written or oral examination with distance learning methods, provided that the integrity and reliability of the examination are ensured.

(3) In the **Implementation Instructions** section, the teacher notes down clear instructions to the students:

a) in case of **written assignment and / or exercises**: the deadline (e.g. the last week of the semester), the means of submission, the grading system, the grade percentage of the assignment in the final grade and any other necessary information.

b) in case of **oral examination with distance learning methods**: the instructions for conducting the examination (e.g. in groups of X people), the way of administration of the questions to be answered, the distance learning platforms to be used, the technical means for the implementation of the examination (microphone, camera, word processor, internet connection, communication platform), the hyperlinks for the examination, the duration of the exam, the grading system, the percentage of the oral exam in the final grade, the ways in which the inviolability and reliability of the exam are ensured and any other necessary information.

c) in case of **written examination with distance learning methods**: the way of administration of the questions to be answered, the way of submitting the answers, the duration of the exam, the grading system, the percentage of the written exam of the exam in the final grade, the ways in which the integrity and reliability of the exam are ensured and any other necessary information.

There should be an attached list with the Student Registration Numbers only of students eligible to participate in the examination.