SOIL MICROBIOLOGY

COURSE OUTLINE

Responsible: Anastasia Tampakaki

1. GENERAL			
SCHOOL	School of Agricultural Sciences		
ACADEMIC UNIT	Department of Agriculture		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	0810.6.007.0	**SEMESTER**	2nd
COURSE TITLE	SOIL MICROBIOLOGY		

INDEPENDENT TEACHING ACTIVITIES if credits are awarded for separate components of the course	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Total	**4**	**5**

COURSE TYPE general background, special background, specialised general knowledge, skills development	
PREREQUISITE COURSES	Microbiology, Soil Science, Biochemistry, Molecular Biology and Biotechnology
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek
OFFERED TO ERASMUS STUDENTS	Yes (in English) — Spring Semester
COURSE WEBSITE (URL)	https://eclass.hmu.gr/courses/AGRO217/

2. LEARNING OUTCOMES

Learning outcomes

Upon successful completion of the course, students will be able to:

- understand the importance of microorganisms in soil and remain informed about recent developments in soil microbiology;
- understand the contribution of microorganisms to soil fertility and the factors determining soil health, and learn how to maintain healthy soils within the framework of sustainable agriculture;
- acquire useful knowledge of the taxonomic, physiological and environmental characteristics of soil microorganisms;
- understand the roles of microbial populations in soil, including the decomposition of dead organic matter, enrichment of soil with nutrients, enhancement of water infiltration and improvement of soil structure;
- distinguish between harmful and beneficial soil microorganisms and understand how to suppress or promote them, respectively;
- understand the types of interactions occurring among microorganisms, such as symbiotic nitrogen fixation, mycorrhizal associations and competition, as well as interactions between microorganisms and other organisms, particularly plants;
- understand the metabolic processes through which microorganisms affect the productivity, quality and functioning of the soil ecosystem;
- develop skills in applying techniques and methodologies for the isolation, characterisation and identification

of soil microorganisms;
- understand and interpret data in the field of soil microbiology and develop skills in the oral and written presentation of research data and measurements;
- strengthen their ability to perform professional duties in agricultural and environmental science-related fields.

General Competences

- Search for, analyse and synthesise data and information using appropriate technologies.
- Adaptation to new situations.
- Decision-making.
- Independent work.
- Teamwork.
- Generation of new research ideas.
- Project planning and management.
- Respect for the natural environment.
- Promotion of free, creative and inductive thinking.

3. SYLLABUS

- Introduction to soil microbiology and its historical development.
- The soil and rhizosphere microbiome.
- Soil microorganisms: bacteria, archaea, fungi, viruses and protists.
- Metabolic diversity of soil microorganisms.
- Microbial nitrogen metabolism in soil:
  - ammonification;
  - nitrification;
  - denitrification;
  - symbiotic and non-symbiotic nitrogen fixation.
- Microbial metabolism of sulphur, phosphorus, iron and other elements in soil.
- Microbial interactions in soil:
  - symbiosis;
  - competition;
  - microbial communication.
- Interactions between plants and soil microorganisms:
  - the rhizosphere;
  - the spermosphere;
  - plant–microorganism communication.
- Soil microorganisms promoting plant growth and health.
- Methods for determining and analysing microbial diversity in soil.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY Face-to-face, Distance learning, etc.	The course is delivered face-to-face through lectures in the lecture hall and practical sessions in the laboratory.

<table>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>• PowerPoint presentations, digital videos and other audiovisual teaching materials.
• Learning support through the HMU e-Class platform and online scientific databases.
• Face-to-face, asynchronous communication via e-mail and e-Class, and synchronous communication through videoconferencing services such as e-Class, Zoom and Microsoft Teams.</td></tr>
<tr><td>TEACHING METHODS
The manner and methods of teaching are described in detail.</td><td><table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures</td><td>39</td></tr>
<tr><td>Practical Exercises</td><td>13</td></tr>
<tr><td>Project Preparation</td><td>13</td></tr>
<tr><td>Independent Study</td><td>60</td></tr>
<tr><td>Course total</td><td>125</td></tr>
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<tr><td>STUDENT PERFORMANCE EVALUATION
Description of the evaluation procedure</td><td>Assessment of the theoretical component is conducted in Greek and consists of:
• a mid-term written examination, accounting for 30% of the final grade;
• a final written examination, accounting for 70% of the final grade.
The examinations include a combination of:
• multiple-choice questions;
• short-answer questions;
• true/false questions;
• matching questions.</td></tr>
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5. ATTACHED BIBLIOGRAPHY

Greek-Language Textbooks

- Pepper, I., Gerba, C., & Gentry, T. (2025). *Environmental Microbiology*. A. Papazisis Publications.
- Kirchman, D. L. (2021). *Microbial Ecology*. University of Crete Press, Foundation for Research and Technology – Hellas.
- Madigan, M. T., Martinko, J. M., & Parker, J. (2018). *Brock Biology of Microorganisms*. University of Crete Press, Foundation for Research and Technology – Hellas.
- Dougyas, S., Aivazidis, A., & Melidis, P. (2012). *Environmental Microbiology*. Embryo Publications.

English-Language Textbooks

- Pepper, I., Gentry, T., Gerba, C., & Brooks, J. 2026. Environmental Microbiology (4th ed.) Academic Press.
- Gentry, T., Fuhrmann, J., & Zuberer, D. (2021). *Principles and Applications of Soil Microbiology* (3rd ed.). Elsevier.

Supplementary Literature

- Course notes and teaching materials for lectures and practical exercises, available through the HMU e-Class asynchronous learning platform.