

# 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<br><small>if credits are awarded for separate components of the course</small>          | WEEKLY<br>TEACHING HOURS                                                                    |          | CREDITS |
|                                                                                                                         | 4                                                                                           |          | 5       |
| Total                                                                                                                   | 4                                                                                           |          | 5       |
| COURSE TYPE<br><small>general background, special background, specialised general knowledge, skills development</small> |                                                                                             |          |         |
| 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)                                                                                                    | <a href="https://eclass.hmu.gr/courses/AGRO217/">https://eclass.hmu.gr/courses/AGRO217/</a> |          |         |

## 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.

| <b>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</b><br>Use of ICT in teaching, laboratory education, communication with students | <ul style="list-style-type: none"> <li>• PowerPoint presentations, digital videos and other audiovisual teaching materials.</li> <li>• Learning support through the HMU e-Class platform and online scientific databases.</li> <li>• 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.</li> </ul>                                                                                                        |          |                   |          |    |                     |    |                     |    |                   |    |                     |            |
|--------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-------------------|----------|----|---------------------|----|---------------------|----|-------------------|----|---------------------|------------|
| <b>TEACHING METHODS</b><br>The manner and methods of teaching are described in detail.                                               | <table border="1"> <thead> <tr> <th>Activity</th><th>Semester workload</th></tr> </thead> <tbody> <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><b>Course total</b></td><td><b>125</b></td></tr> </tbody> </table>                                                                                                                                                            | Activity | Semester workload | Lectures | 39 | Practical Exercises | 13 | Project Preparation | 13 | Independent Study | 60 | <b>Course total</b> | <b>125</b> |
| Activity                                                                                                                             | Semester workload                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |          |                   |          |    |                     |    |                     |    |                   |    |                     |            |
| Lectures                                                                                                                             | 39                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |          |                   |          |    |                     |    |                     |    |                   |    |                     |            |
| Practical Exercises                                                                                                                  | 13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |          |                   |          |    |                     |    |                     |    |                   |    |                     |            |
| Project Preparation                                                                                                                  | 13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |          |                   |          |    |                     |    |                     |    |                   |    |                     |            |
| Independent Study                                                                                                                    | 60                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |          |                   |          |    |                     |    |                     |    |                   |    |                     |            |
| <b>Course total</b>                                                                                                                  | <b>125</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |          |                   |          |    |                     |    |                     |    |                   |    |                     |            |
| <b>STUDENT PERFORMANCE EVALUATION</b><br>Description of the evaluation procedure                                                     | Assessment of the theoretical component is conducted in Greek and consists of: <ul style="list-style-type: none"> <li>• a mid-term written examination, accounting for <b>30%</b> of the final grade;</li> <li>• a final written examination, accounting for <b>70%</b> of the final grade.</li> </ul> The examinations include a combination of: <ul style="list-style-type: none"> <li>• multiple-choice questions;</li> <li>• short-answer questions;</li> <li>• true/false questions;</li> <li>• matching questions.</li> </ul> |          |                   |          |    |                     |    |                     |    |                   |    |                     |            |

## 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.

