Appendix No. 1.5 to the Resolution No. 61/2025
of the Rector of the University of Rzeszów

SYLLABUS

REGARDING THE QUALIFICATION CYCLE FROM *2026/2027* TO *2029/2030*
ACADEMIC YEAR 2026/2027

1. BASIC COURSE/MODULE INFORMATION

Course/Module title	**Agricultural Microbiology**
Course/Module code *	
Faculty (name of the unit offering the field of study)	Faculty of Technology and Life Sciences
Name of the unit running the course	Institute of Food Technology and Nutrition Institute of Agricultural Sciences, Environmental Protection and Management
Field of study	Agriculture
Qualification level	First-cycle studies (Bachelor's degree)
Profile	General academic profile
Study mode	Full-time studies
Year and semester of studies	Year 1, Semester 2
Course type	Basic
Language of instruction	English
Coordinator	dr Dorota Grabek-Lejko
Course instructor	dr Dorota Grabek-Lejko dr Beata Jacek

* - as agreed at the faculty

1.1. Learning format – number of hours and ECTS credits

Semester (no.)	Lectures	Classes	Laboratories	Seminars	Practical classes	Internships	others	**ECTS credits**
2	15		30					3

1.2. Course delivery methods
- conducted in a traditional way

1.3. Course/Module assessment (exam, **pass with a grade**, pass without a grade)

2. PREREQUISITES

Fundamental knowledge of general biology.

3. OBJECTIVES, LEARNING OUTCOMES, COURSE CONTENT, AND INSTRUCTIONAL METHODS

3.1. Course/Module objectives

O1	To provide knowledge about the role of microorganisms in agroecosystems and their importance in soil processes, plant growth, and environmental protection.
O2	To develop an understanding of microbial metabolic processes and their practical applications in agriculture, such as the production of biofertilizers and biopesticides.
O3	To introduce modern methods for studying soil microflora and techniques for their use in improving soil quality and plant health.

3.2. COURSE/MODULE LEARNING OUTCOMES

Learning Outcome	The description of the learning outcome defined for the course/module	Relation to the degree programme outcomes
LO_01	The student identifies the major groups of microorganisms and their characteristics, including their structure, physiology, and life processes. Student also possess knowledge of the metabolic and biogeochemical processes occurring in soil with the participation of microorganisms.	K_W01
LO_02	The student is familiar with techniques used in classical microbiology and can appropriately select them to achieve specific research objectives. They also understand methods for the isolation, identification, and analysis of microorganisms in agricultural microbiology.	K_U03
LO_03	The student is able to operate specialized equipment used in a microbiology laboratory, prepare microscopic specimens, and analyze them correctly.	K_U05
LO_04	The student is able to work with biological material in accordance with microbiological laboratory safety and operational procedures, both independently and as part of a team, effectively planning and coordinating the work of all team members.	K_U10
LO_05	Based on their knowledge and practical skills, the student is prepared to design a series of research experiments aimed at addressing specific scientific problems in agricultural microbiology. They also demonstrate responsibility in decision-making regarding the application of microorganisms in agricultural practice.	K_K01

3.3. Course content

A. Lectures

Content outline
Introduction to Agricultural Microbiology: The Role of Microorganisms in Agroecosystems
Structure and Functions of the Prokaryotic Cell

Taxonomy and Classification of Soil Microorganisms
Characteristics and Properties of Selected Groups of Soil Microorganisms and Their Importance in Soil-Forming Processes
Life Processes and Growth of Microorganisms
Major Metabolic and Fermentation Processes of Microorganisms and Their Practical Applications
Fundamentals of Microbial Genetics and Its Applications in Agricultural Microbiology
Microorganisms and the Environment: Extremophilic Microorganisms, Their Adaptive Features, and Potential Applications in Agriculture
The Importance of Microorganisms in Agriculture: Ecology of Soil Microorganisms and Their Functions in Biogeochemical Cycles
Microorganism–Plant Interactions: Antibiosis, Competition, Mycorrhiza, the Rhizosphere, and the Biodiversity of Soil Microflora

B. Laboratories

Content outline
Introductory session. Safety regulations and good laboratory practices in a laboratory of microbiology. Equipment and working conditions in a laboratory of microbiology.
Sterilization and disinfection. Sterilization methods, the structure and general operating principles of the autoclave and Koch's steam sterilizer.
Microscopy: structure, types of microscopes, and their applications. Morphology of bacteria. Shapes of bacterial cells and characteristic cellular arrangements.
Techniques for the preparation of microscopic specimens: live staining, simple staining, and differential staining.
Structure of the cell wall of Gram-positive and Gram-negative bacteria. The mechanism of Gram staining.
Cytology of the bacterial cell. Microscopy and staining of selected bacterial cell structures (capsules, endospores, storage granules). Ziehl-Neelsen staining method.
Microbiological culture media: types, characteristics, and applications. Methods for the preparation of microbiological culture media.
Methods for obtaining pure cultures. Inoculation techniques. Determination of the total microbial count in soil.
Effects of physical factors (temperature, osmotic pressure, pH, redox potential, and UV radiation) on bacterial cells.
Effects of chemical factors on bacterial cells. Bacteriostatic and bactericidal effects of antibiotics, phytoncides, and metals, as well as the influence of dyes and disinfectants.

3.4. Methods of Instruction

Lecture: lecture supported by a multimedia presentation

Laboratory classes: laboratory work, group work, and practical exercises.

4. Assessment techniques and criteria

4.1 Methods of evaluating learning outcomes

Learning outcome	Methods of assessment of learning outcomes (e.g. test, oral exam, written exam, project, report, observation during classes)	Learning format (lectures, classes...)
LO-01 - LO-02	WRITTEN ASSESSMENT	LECTURES
LO-02 - LO-05	OBSERVATION DURING LABORATORY CLASSES, LABORATORY REPORTS	LAB. CLASSES
LO-02 - LO-05	COLLOQUIUM – LABORATORY CLASSES	LAB. CLASSES

4.2 Course assessment criteria

The final grade is based on the results of the mid-term test (colloquium), laboratory reports, and active participation in all laboratory classes. Successful completion of the course requires the achievement of all intended learning outcomes.
A positive course grade is awarded based on the percentage of points obtained (more than 50% of the maximum number of points), according to the following scale: Satisfactory (3.0): 51–60% Satisfactory Plus (3.5): 61–70% Good (4.0): 71–80% Good Plus (4.5): 81–90% Very Good (5.0): 91–100%
Lectures: Pass/fail assessment
A passing grade is awarded upon obtaining at least 51% of the points in the written assessment. The final completion of the course is conditional upon achieving all intended learning outcomes.

5. Total student workload needed to achieve the intended learning outcomes – number of hours and ECTS credits

Activity	Number of hours
Course hours	45
Other contact hours involving the teacher (consultation hours, examinations)	5
Non-contact hours - student's own work (preparation for classes or examinations, projects, etc.)	35
Total number of hours	85
Total number of ECTS credits	3

* One ECTS point corresponds to 25-30 hours of total student workload

6. Internships related to the course/module

Number of hours	
Internship regulations and procedures	

7. Instructional materials

Compulsory literature: materials provided by the teacher and online resources on the topics covered
Complementary literature: online resources on the topics covered

Approved by the Head of the Department or an authorised person