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	**Soil Sciences**
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 Agricultural Sciences, Environmental Protection, and Management/ Department of Soil Science, Environmental Chemistry, and Hydrology
Field of study	Agriculture
Qualification level	First-cycle studies
Profile	General academic
Study mode	Full-time
Year and semester of studies	Year I, Semester 2
Course type	Major
Language of instruction	English
Coordinator	dr hab. Małgorzata Szostek, prof. UR
Course instructor	dr hab. Małgorzata Szostek, prof. UR

* - as agreed at the faculty

1.1. Learning format – number of hours and ECTS credits

Semester (no.)	Lectures	Classes	Laboratories	Seminars	Practical classes	Internships	Field classes	**ECTS credits**
2	25		35				10	7

1.2. Course delivery methods
- conducted in a traditional way
~~- involving distance education methods and techniques~~

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

- LECTURES - EXAM,
- LABORATORIES – PASS WITH A GRADE,
- FIELD CLASSES – PASS WITHOUT A GRADE

2. PREREQUISITES

BASIC KNOWLEDGE OF GEOGRAPHY, CHEMISTRY, PHYSICS, AND BIOLOGY.

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

3.1. Course/Module objectives

O1	To familiarise students with the basic physical, physicochemical, and biological properties of soils.
O2	To familiarise students with basic soil processes in relation to environmental factors.
O3	To familiarise students with soil classification and soil taxonomy.
O4	To familiarise students with soil identification in the field.

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	Knows and understands the phenomena and processes occurring in soils and their influence on the development of basic soil properties.	K_W01
LO_02	Understands the need to maintain and improve soil fertility as an essential factor determining the proper growth and development of cultivated plants.	K_W02
LO_03	Understands the importance of soil factors in determining soil fertility; Knows the threats posed by inappropriate human management practices to the productive capacity of soils.	K_W05
LO_04	Is able to interpret research results and draw appropriate conclusions regarding soil properties.	K_U02
Lo_05	Is able to analyse factors affecting soil fertility and productivity.	K_U03
LO_06	Is able to analyse and identify factors contributing to soil degradation and take measures to minimise their adverse effects on the soil environment.	K_U09
LO_07	Is prepared to critically assess their knowledge of priority measures for the protection and improvement of soil fertility and to apply this knowledge in their activities.	K_K01

3.3. Course content

A. Lectures

Content outline
1. Soil science as a natural science; definition and functions of soil in the natural environment.

2. Geological foundations of soil science; structure of the Earth and geosphere, with particular emphasis on the Earth's crust and lithosphere. Chemical composition of the Earth and the Earth's crust.
3. Geological processes and the rock cycle; weathering, erosion, mass movements, fundamentals of mineralogy, and soil-forming parent materials: igneous, sedimentary, and metamorphic rocks.
4. Soil-forming factors and processes; the influence of soil-forming factors on soil formation and development, phenomena involved in soil formation, and typological soil-forming processes.
5. Soil morphology; soil profile structure, soil colour, soil structure, and soil arrangement.
6. Soil as a three-phase system; physical properties of soils (particle-size distribution, porosity, density, compactness, etc.) and their influence on soil characteristics.
7. Functional physical properties of soils; the water cycle in nature, soil water reserves, soil water management, and the air and thermal properties of soils.
8. Organic matter in agricultural soils; sources and content of organic matter in agricultural soils, functions and role of organic matter in soils.
9. Soil reaction, acidity, and buffering properties; causes of soil acidification, soil reaction classification, soil acidity and its types, consequences of soil acidification, and methods of preventing soil acidification.
10. Soil sorption properties; sorption in soils and its types, and the importance of sorption processes in determining soil fertility.
11. Biological and biochemical properties of soils; soil microorganisms, soil mesofauna and macrofauna and their importance, microbial transformations of organic matter and nitrogen in soils, the role of soil organisms in the transformation of chemical compounds in soils, and the importance of soil enzymes in determining soil fertility.
12. Soil as a plant nutrient environment; the role of soil properties in determining soil fertility, plant nutrition, and fertilization.
13. Fundamentals of plant nutrition. Chemical composition of plants, plant nutrients and their uptake by plants. Basic laws of plant nutrition. Methods of assessing soil nutrient status; field and pot experimental methods, and laboratory methods, including biological and chemical methods.
14. Soil threats, soil protection, and soil reclamation.
15. Basic principles of the soil classification system.

B. Laboratories, field classes

Content outline
1. Preparation of soil samples for laboratory analyses.
2. Determination of soil particle-size distribution using the organoleptic method and the Casagrande hydrometer method modified by Prószyński. 2.1. Identification of soil texture classes based on the percentage content of particle-size fractions.
3. Determination of selected physical properties of soils. 3.1. Primary physical properties of soils: particle density, bulk density, and soil porosity. 3.2. Secondary physical properties of soils: maximum water-holding capacity; plotting and interpretation of the soil water retention curve (pF curve).
4. Soil organic matter.

4.1. Methods for determining organic matter content in soils. 4.2. Determination of organic carbon content in mineral soils using the Turin method.
5. Soil reaction, acidity, and buffering properties. 5.1. Determination of soil pH in water and 1 M KCl. 5.2. Determination of hydrolytic acidity using the Kappen method. 5.3. Determination of soil buffering properties using the Arrhenius method and plotting the buffer curve. 5.4. Determination of soil liming requirement classes.
6. Soil sorption complex. 6.1. Determination of the sum of exchangeable bases using the Kappen method, cation exchange capacity, and base saturation of the soil sorption complex.
7. Calcium carbonate in soils. 7.1. Field determination of calcium carbonate content in soils. 7.2. Determination of calcium carbonate content in soils using the Scheibler apparatus.
8. Forms of elements in soils. 8.1. Determination of plant-available phosphorus and potassium using the Egner–Riehm method. 8.2. Assessment of soil phosphorus and potassium fertilisation requirements.
9. Nitrogen in the soil environment. 9.1. Determination of total nitrogen content in soils using the Kjeldahl method. 9.2. Mineral nitrogen in soils. 9.3. Assessment of soil nitrogen fertilisation requirements.
10. Soil quality classification. 10.1. Classification of arable land. 10.2. Agricultural suitability complexes of arable land. 10.3. Soil and agricultural maps.
11. Characteristics and identification of the main soil types used for agricultural purposes.
Field classes 1. Techniques for conducting field soil surveys. **2.** Selection of a site and excavation of a soil pit. 3. Soil morphological features: soil profile structure, horizon thickness, colour, structure, arrangement, and soil concretions. 4. Preparation of soil profile drawings and descriptions of selected soil profiles.

3.4. Methods of Instruction

Lecture: a lecture supported by a multimedia presentation
Laboratory classes: designing and conducting experiments, group work.

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	written exam, test	LECTURES, LABORATORIES

LO-02	written exam, test	LECTURES, LABORATORIES
LO_03	written exam, test	LECTURES, LABORATORIES
LO_04	test, report	LABORATORIES
LO_05	written exam, test, report	LECTURES, LABORATORIES
LO_06	test, report	LABORATORIES
LO_07	test, report	LABORATORIES

4.2 Course assessment criteria

Successful completion of the course requires the achievement of all intended learning outcomes. The learning outcomes are verified on the basis of a passing grade in the written examination, which consists of open-ended and closed-ended questions. Admission to the examination requires a passing grade in the practical classes, based on the results of tests, submitted reports, and attendance, as well as successful completion of the report on the field classes. The final course grade is determined by the percentage of points obtained in relation to the maximum score: satisfactory (3.0) – >55%, satisfactory plus (3.5) – >65%, good (4.0) – >75%, good plus (4.5) – >85%, and very good (5.0) – >95%.

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

Activity	Number of hours
Course hours	70
Other contact hours involving the teacher (consultation hours, examinations)	10
Non-contact hours - student's own work (preparation for classes or examinations, projects, etc.)	95
Total number of hours	175
Total number of ECTS credits	7

* 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