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**

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|---|---|
| Course/Module title | **Plant Physiology** |
| 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 Environmental Management; Department of Plant Physiology and Biotechnology |
| 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 | Basic |
| Language of instruction | English |
| Coordinator | Wojciech Litwińczuk, DSc, Prof. UR |
| Course instructor | Wojciech Litwińczuk, DSc, Prof. UR (lectures);<br>Marzena Mazurek, PhD (laboratories),<br>Aleksandra Siekierzyńska, PhD (laboratories);<br>Beata Jacek, PhD (laboratories) |

* - 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 | | | | | 4 |

**1.2. Course delivery methods**
x- 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)
Lecture: pass without a grade;
Laboratory classes: pass with a grade

## 2. PREREQUISITES

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| Natural Fundamentals of Agriculture, Chemistry |

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

### 3.1. Course/Module objectives

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| O1 | Presentation of fundamental knowledge regarding the significance and mechanisms of physiological processes occurring in plants. |
| O2 | Expanding of knowledge regarding the environmental and endogenous factors determining plant growth and development and the primary production of agricultural crops. |
| O3 | Preparing of students to conduct research using plant material. |

### 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 characterizes the key physiological processes occurring in the plant organism and in agrocenoses. | K_W02 |
| LO_02 | The student explains the influence of endogenous and exogenous factors on the course of physiological processes and plant yield. | K_W01 |
| LO_03 | The student sets up and conducts plant experiments, carries out simple observations and measurements, employs basic laboratory research techniques, correctly interprets the results obtained, and formulates conclusions. | K_U02, K_U10 |
| LO_04 | The student is able to use imparted knowledge, and independently acquired knowledge, and information obtained from experts to solve problems related to plant functioning. | K_K02 |

### 3.3. Course content

A. Lectures

| Content outline |
|---|
| 1. Plant physiology – basic concepts and definitions. Characteristics of selected plant cell structures. |
| 2. Plant water relations. Properties and significance of water. Water movement within the plant. Plant water balance. |
| 3. Plant mineral nutrition. Classification, functions, uptake, and transport of nutrients within the plant. |
| 4. Photosynthesis. Definition and biological significance. Light and dark reactions of photosynthesis. $C_3$, $C_4$, and CAM plants. Environmental factors affecting photosynthesis. Products of photosynthesis. |

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| 5. Respiration. Respiratory substrates. Significance and key processes of aerobic and anaerobic respiration. Regulation of respiration. |
| 6. Plant growth and development. Phases of ontogeny. Plant movements. Types and significance of dormancy. Plant senescence. Regulation of growth and development by endogenous and exogenous factors. |
| 7. Physiology of crop yield. Plant productivity and production capacity. Physiological basis of crop yield. |

B. Laboratories

| Content outline |
|---|
| 1. Plant cell water relations. Influence of external factors on the rate and degree of swelling. Artificial, selectively permeable membranes (Traube's cell). Observation of plasmolysis and deplasmolysis. |
| 2. Whole-plant water relations. Determination of water potential in plant tissues. Determination of transpiration rate. Guttation. Influence of external factors on transpiration rate. |
| 3. Plant mineral nutrition. Demonstrating the essentiality of mineral nutrients for plants. Influence of substrate pH on seed germination and plant growth. Demonstrating the phenomenon of ion antagonism. |
| 4. Photosynthesis. Isolation and separation of chloroplast pigments. Examination of the physical and chemical properties of pigments. Detection of photosynthesis products. Observation of the influence of external factors on the rate of photosynthesis. |
| 5. Respiration. Measurement of respiration rate. Influence of temperature on respiration intensity. Detection of respiration products. |
| 6. Plant growth and development. Influence of external factors (light, temperature) and internal factors (growth regulators) on plants. |
| 7. Plant responses to adverse environmental factors. Determination of plant tolerance to abiotic and biotic stresses. |

**3.4. Methods of Instruction**

Lecture: a lecture supported by a multimedia presentation
Laboratory classes: designing and conducting experiments (work in subgroups).

**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 | midterm tests (multiple-choice tests or open-ended questions), reports | lectures, lab.classes |
| LO-02 | midterm tests (multiple-choice tests or open-ended questions), reports | lectures, lab.classes |
| LO-03 | observation during classes | lab. classes |
| LO-04 | observation during classes, reports | lab. classes |

### 4.2 Course assessment criteria

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| Laboratory classes:<br>completion of laboratory experiments and presentation of results; in-class test; final written test.<br><br>Lectures**:** Written test with open-ended questions.<br><br>To pass the course, students must achieve all prescribed learning outcomes<br>The final course grade is determined based on the following components:<br>lecture assessment (written test): 50%, Laboratory assessment (in-class test): 40%, class participation: 10%.<br><br>Grades:<br>51%-60%-3.0<br>61%-70%-3.5<br>71%-80%-4.0<br>81%-90%-4.5<br>91%-100% 5.0 |

### 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) | 12 |
| Non-contact hours - student's own work (preparation for classes or examinations, projects, etc.) | 45 |
| Total number of hours | 102 |
| Total number of ECTS credits | 4 |

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

### 6. Internships related to the course/module

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|---|---|
| Number of hours | |
| Internship regulations and procedures | |

### 7. Instructional materials

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| Compulsory literature:<br>materials provided by the teacher and online resources on the topics covered |

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| Complementary literature:<br>online resources on the topics covered |

Approved by the Head of the Department or an authorised person