

Course name: Plant physiology and biochemistry

ECTS	6
Course status	<i>Facultative</i>
Course final assessment /evaluation of outcomes	<i>Exam</i>
Prerequisite	<i>Interest in plant biology and organic chemistry</i>

Main field of study:

Educational profile	<i>General academic</i>
Code of studies and education level	<i>bachelor/ master</i>
Semester of studies	<i>Summer</i>
Language of instructions	<i>English</i>

Course offered by:

Name of faculty offering the course	<i>Faculty of Agriculture and Economics</i>
Name of department offering the course	<i>Department of Plant Breeding, Physiology and Seed Science</i>
Course coordinator	<i>Dr hab. inż. Renata Bączek-Kwinta, prof. URK</i>

Learning outcomes:

Symbol of outcome	Description of the learning outcome	Reference to main field of study outcomes	Area symbol*
KNOWLEDGE – student knows and understands			
PLAPB_K01	the structure and role of macromolecules important for living organisms, especially plants	RO1_W02 AB1_W04 AB1_W09	R, P
PLAPB_K02	basic biochemical processes occurring in plants	RO1_W09 RO1_W10 RO1_W01	R, P
PLAPB_K03	biochemistry of photosynthesis, respiration and nitrogen metabolism in plants	RO1_W07 RO1_W10 RO1_W11 RO1_W17	R, P
SKILLS – student is able to			
PLAPB_SK01	draw and recognize the structure of basic biomolecules	RO1_U10 RO1_U08 RO1_U09	R, P
PLAPB_SK02	describe and analyse photosynthesis, respiration, nitrogen assimilation, vernalisation, textually and using schemes and diagrams.	RO1_U06 RO1_U12, RO1_U27	R, P
PLAPB_SK02	apply the knowledge of plant biochemistry in plant life and cultivation	RO1_U12 RO1_U18 AB1_U03 AB1_U07 AB1_U08 AB1_U11	R, P
SOCIAL COMPETENCIES – student is ready to:			
PLAPB_SC01	perform some biochemical and physiological experiments to check the occurrence of basic macromolecules and intensity of physiological processes	RO1_K03 RO1_K04 RO1_K06 P6S_UW	R, P

PLAPB _SC03	analyse specific molecular pathways in scientific literature, molecular databases etc.	RO1_K01 AB1_K01 AB1_K03	R, P
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Teaching contents

Lectures	30 hours
Topics	<p>1. Molecular organisation of life: classification, structure and properties of organic compounds essential for the functioning of living organisms</p> <p>1.1. Carbohydrates and lipids, structure of biological membranes.</p> <p>1.2. Proteins and nucleic acids, protein biosynthesis</p> <p>1.3. Enzymes, their functions. Regulation of enzyme activity</p> <p>2. Water in plants</p> <p>2.1. Osmotic properties of cells, diffusion versus osmosis, mechanisms for the uptake and conduction of water in plants</p> <p>2.2. Transpiration, plant water balance and possibility of its regulation in agricultural practice</p> <p>3. Plant mineral nutrients</p> <p>3.1. The role of individual minerals, physiological mechanisms for the uptake and transport of ions</p> <p>3.2. Effect of external factors on mineral uptake, common laws governing the mineral nutrition of plants</p> <p>4. Photosynthesis</p> <p>4.1. Light phase. Dark phase: mechanism and its modifications in different plant groups. Translocation of assimilates.</p> <p>4.2. Photorespiration. Ecology of photosynthesis</p> <p>5. Anabolism and catabolism of carbohydrates, proteins and fats, respiratory processes</p> <p>5.1. Utilisation and degradation of sugars – the basics of cellular respiration</p> <p>5.2. Biosynthesis and catabolism of lipids and fatty acids</p> <p>5.3. Mechanisms of regulation of metabolic processes and energy transfer</p> <p>5.4. Biosynthesis of nitrogen-containing compounds (amino acids, nucleotides, proteins, nucleic acids)</p> <p>6. Plant growth and development:</p> <p>6.1. Plant growth regulators and phytohormones, their structure and mode of action</p> <p>6.2. Developmental signals, stress response, regulation of morphogenesis, circadian clock</p>
Accomplished learning outcomes	

Means of verification, rules and criteria of assessment	<i>Exam; the grade is 67% of contribution in the final grade. Written test, mixed version.</i>
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Classes	30 hours
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	<p>1. Structural biochemistry: carbohydrates, lipids, amino acids, proteins:– quantitative, qualitative and functional analysis.</p> <p>2. Water in plants: osmotic processes, water uptake and transport, transpiration, factors affecting water management.</p> <p>3. Mineral nutrients: deficiency symptoms; antagonism of ions; effects of salinity and pH of the substrate on plant growth, plants-microbes mutualism – the uptake of atmospheric nitrogen.</p> <p>4. Photosynthesis: extraction and separation of photosynthetic pigments, physical and chemical properties of chlorophyll. Identification of photosynthates in non-photosynthetic tissues, the pattern of CO₂ assimilation in different plant groups.</p> <p>5. Metabolism: enzymes, nucleic acids, cellular respiration. Factors affecting enzymatic catalysis and respiration, the use in agriculture.</p> <p>6. Plant growth and development: comparative analysis of plant growth; determination of plant growth zones; the impact of external factors and phytohormones. Plant movements. Seed dormancy and germination. Factors affecting flowering and other (vernalisation, photomorphogenesis). Agricultural impacts.</p>
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Accomplished learning outcomes	
Means of verification, rules and criteria of assessment	<p><i>Classes grade is 33% of the contribution in the final grade. 1. Classes reports, homeworks, tests.</i></p> <p><i>2. Grades for accomplished tasks completed individually or as a teamwork. The assessment will be based on the efficiency and organization of a team and skills in using the source materials and laboratory equipments.</i></p> <p><i>3. Correctness of tasks performance, tests.</i></p>

References:

Basic	Lecture notes, classes handouts Taiz L., Zeiger E. (eds) Plant Physiology. 2006, Sinauer Associates, Inc., Sunderland.
Supplementary	Bączek-Kwinta, R. 2022. An Interplay of Light and Smoke Compounds in Photoblastic Seeds. <i>Plants</i> , 11, 1773. https://doi.org/10.3390/plants11131773 , 2022. Bączek-Kwinta R., Janowiak F., Simlat M., Antonkiewicz J. 2023. Involvement of Dynamic Adjustment of ABA, Proline and Sugar Levels in Rhizomes in Effective Acclimation of <i>Solidago gigantea</i> to Contrasting Weather and Soil Conditions in the Country of Invasion. <i>International Journal of Molecular Sciences</i> , DOI:10.3390/ijms242015368, 2023. Lenda, M., Steudel, B., Skórka, P., Zagrodzka Z., Moroń D., Bączek-Kwinta R., et al.. Multiple invasive species affect germination, growth, and photosynthesis of native weeds and crops in experiments. <i>Sci. Rep.</i> 13, 22146 (2023). https://doi.org/10.1038/s41598-023-48421-w , 2023.

Structure of student activity

Area of academic study: R – Agricultural, forestry and veterinary sciences	3 ECTS **
Area of academic study: P – biological sciences	3 ECTS **

Structure of student activity

Contact hours		66 hrs.	2.6 ECTS**
Including:	lectures	30 hrs.	
	classes and seminars	30 hrs.	
	consultations	3 hrs.	
	participation in research	hrs.	
	obligatory traineeships	hrs.	
	participation in examination	3 hrs.	
e-learning		hrs.	
student own work		85 hrs.	3.4s ECTS**