Module name	**Plant physiology – an extensive course**
Module code	B-B.35
ISCED code	0511: Biology
Study cycle	I^{o}
Semester	summer
Responsible for this module	Małgorzata Wójcik Department of Plant Physiology and Biophysics email: mwojcik@umcs.pl
Language of instruction	English
Website	
Prerequisites	-
ECTS	8
ECTS points hour equivalents	Contact hours (work with an academic teacher) – 90 - lectures: 30 - labs: 60 Non-contact hours (students' own work) – 110 - preparation for the exam: 30 - preparation for partial tests: 30 - preparation for labs: 10 - preparation of reports from laboratory exercises: 20 - literature study: 20 **Total number of ECTS points for the module - 8**
Learning outcomes verification methods	Lecture: - written examination (W1, W2, U3, K2) Laboratories: - Intermediate short tests (W1, W2, U3, K2) - reports on experiments and observations during laboratory exercises (W3, U1, U2, K1)
Course full description	During the lecture, the student will learn about the basic physiological processes taking place in plant organisms, their mechanisms, regulation and dependence of these processes on environmental factors. Issues related to water and mineral management, photosynthesis, respiration, growth and development of plants will be discussed. Modern trends in physiological research and curiosities related to the functioning of plants in our everyday life will be presented. The content of the lecture Subject, objectives and research tools of plant physiology. Water management: mechanisms of water collection and transport; types and mechanisms of transpiration. Mineral plant nutrition: principles of classification of chemical elements, significance of selected elements for plants, mechanisms of water intake and transport of elements, nitrogen management. Photosynthesis: structure and properties of photosynthetic pigments, structure of photosynthetic apparatus, light and dark phase of photosynthesis,

	photorespiration, factors regulating intensity of photosynthesis. Donors and acceptors of assimilates, mechanisms of assimilates transport in the plant. Respiration: types of respiration, aerobic respiration stages and their course, oxidative and substrate phosphorylation, respiration balance, fermentation. Plant growth and development: growth phases, growth location, embryonic development, seed dormancy, germination, vegetative and generative development, flowering induction. The role of phytochrome and phytohormones in plant growth and development. Plant movements. In the course of laboratory exercises, the student will perform experiments and observations on his own to better understand physiological processes taking place in plants. Exercises are performed according to the instructions presented in the scripts and under the guidance of the teacher. 1. Diffusion and osmosis. Artificial Traube cells. 2. Osmotic relations of a plant cell: influence of chemical and physical factors on permeability of cell membrane; plasmolysis - permeability of plasmolema and tonoplast; deplasmolysis; influence of Ca2+ and K+ ions on the course of plasmolysis. 3. Water uptake and transportation: measurement of water uptake by potometric method; demonstration of transpiration by cobalt method; observation of Amarylis and Gramineae type stomata - determination of the degree of stomata opening and size of stomata. 4. Plant chemical analysis (mineral components): determination of dry matter and percentage water content in leaves and seeds; chemical analysis of plant ash. 5. Plant chemical analysis (organic compounds): detection of sugars and proteins in plant material. 6. Photosynthesis conditions and factors: influence of light intensity and wavelength (colour) on the intensity of photosynthesis, light- and shade plants. 7. Photosynthetic pigments properties, detection of assimilative starch. 8. The role of the central metal atom in the porphyrin ring of the chlorophyll molecule, obtaining pheophytin and determining its concentration, obtaining and properties of Cu-porphyrin. 9. The oxygen respiration of plants: quantitative determination of the intensity of respiration using Pettenkofer's method; oxygen uptake during the respiration of germinated seeds. 10. Plant growth and development: determination of the elongation zone of the root and shoot; measurement of the growth rate of the colleoptil using

	a microscope; determination of the germination capacity of seeds. 11. Plant movements: phototrophism of the coloptile (Darwin test); phototrophism and geotrophism of the shoot and root; stomatal cell movements.
Bibliography	- Biochemistry & Molecular Biology of Plants by B.B. Buchanan, W. Gruissem, J. Wilhelm, L. Russell (eds.) - Plant Physiology by L. Taiz, E. Zeiger (eds)
Learning outcomes	**KNOWLEDGE** W1: The student knows and understands the physiological processes taking place at the level of the cell, organ and the whole plant, and sees the influence of environmental factors on the functioning of plant organisms W2: Student knows and understands professional terms and terminology used in biology and other natural disciplines and relations between these disciplines to explain physiological processes W3: Student knows and understands basic laboratory techniques and has knowledge of work safety and hygiene rules and is aware of dangers resulting from work with chemical reagents **SKILLS** U1: The student is able to properly select and apply basic research tools and techniques and to conduct laboratory experiments and observations, as well as to interpret the results obtained and draw conclusions U2: The student is able to plan and organize his work individually and in a team in order to perform specific tasks effectively U3: The student is able to use the indicated academic textbooks and other sources of information to learn certain parts of material on his own **SOCIAL COMPETENCES** K1: The student is ready to work independently and in a group, and to follow and enforce the rules of professional ethics from other team members K2: Student is ready to improve his competence and actively acquire and update his knowledge in order to solve cognitive and practical problems
Practice	-
Teaching methods	Lecture: information lecture, multimedia presentation, film, discussion, case study Labs: experiment, direct observation, measurement, discussion