NAME OF THE COURSE	Plant Physiology					
Code	PMB034	Year of study	3.			
Course teacher	Prof. Valerija Dunkić, PhD	Credits (ECTS)	8			
Associate teachers	Marija Nazlić, assistant	Type of instruction (number of hours)	L	S	E	F
			45		45	
Status of the course	obligatory	Percentage of application of e-learning	10%			

COURSE DESCRIPTION	
Course objectives	The acquisition of knowledge of plant physiology and connect to related scientific disciplines; application of acquired knowledge in experimental work
Course enrolment requirements and entry competences required for the course	Passed the examination of the General Botany and the attended or laid Analytical Chemistry and Organic Chemistry
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Student will be able to: 1. Understanding and applying basic settings of plant function, encompassing the dynamic processes of growth, metabolism and reproduction in living plants - from seed to mature plants 2. Understanding the physiology of metabolism and energy - chemical and physical processes that occur in living systems 3. Understanding the physiology changes shape (development) - growth, development and reproduction of plants 4. Understanding the physiology of plant movements - change of location and position of entire plants or organs, cells or cellular organelles 5. Understanding the stress physiology - water deficit, the temperature difference, the impact of pollution on plant organisms 6. Application of acquired knowledge and skills in performing experiments using various methods and instruments, analyzing the tests, as well as laboratories contributing to a better knowledge of the nutritional value of plants 7. Understanding and application of acquired knowledge about the importance of clean coal plants and herbal products on human health and the importance of sustainable development
Course content broken down in detail by weekly class schedule (syllabus)	Lectures: 1. Introduction of Plant Physiology - historical overview, literature, characteristics of plants in relation to other organisms; plant cell - structure and role in physiological processes; energy flow throught living systems, free energy and chemical potential, redox reactions, the electrochemical potential, enzymes - operation and regulation of activities 2. Water and Plant Cells - The structure and properties of water, transport processes, water in the soil, absorption by the root, transpiration and stomatal control 3. Mineral Nutrition – Essential elements, soil and minerals, mycorrhizal fungi and their association with plant roots, salt stress and halophytes, the assimilation of nitrate and ammonia and biological nitrogen fixation, of sulfur assimilation, phosphate assimilation, oxygen assimilation, mineral cations and anions 4. Solute Transport – Pasiv and active transport, transport of solutes across a membrane barrier, transcellular transport, phloem translocation 5. Photosynthesis – Photosynthesis in algal and cyanobacterial, structure of the photosynthetic apparatus, the light reactions, carbon metabolism, C3, C4 and CAM photosynthesis, C2 photorespiratory

	6. Respiration and Lipid Metabolism – respiration and whole plant respiration, aerobic respiration: glycolysis, TCA cycle and electron transport chain, ATP synthesis, fermentative metabolism, anaerobic fermentation, lipid metabolism, 7. Growth and development – The cellular basis of growth and morphogenesis, control of the plane of cell division, morphogenesis in roots and shoots, differention of selected cell types 8. Plant growth regulators – auxins and gibberellins: biosynthesis and chemistry, metabolism and transport and mehanism of action 9. Plant growth regulators –cytokinins, ethylene and abscisic acid - biosynthesis and chemistry, metabolism and transport and mehanism of action 10. Effects of temperature and light on growth and development of plants - buds and seeds dormacy - mechanism of induction of dormancy in buds and seeds 11. Action on growth and development of plants - photomorphogenesis, phytochromes: properties, localization in tissues and cells, mechanism of action and responses 12. The control of flowering – effects of plant age, photoperiodism, vernalization, the transition to flowering 13. Surface protection and secondary defens compounds – cutin, suberin and waxes, terpenes and phenolic compounds and nitogen – containing compounds of secondary metabolites, the distribution of defensive secondary products within plants 14. Stress physiology – water deficit and drought resistance, chiling and freezing, heat stress and heat shock, salinity, oxygen deficiency, air pollution 15. Physiology of plant movenments - phototropism, geotropism, thigmotropism and chemotropism, nastic movements: thermonasty, chemonasty, thigmonasty, seismonasty, haptonasty, nyctinasty, hydronasty, geonasty, gravinasty Exercises: 1. Physiology and specificity of plant cells: observation of cell wall, vacuole and plastid, proving suberin, detection and role of ascorbic acid in plants, detection and the role of organic acids in plants (3) 2. Proving and role of plants: oxalic acid, tartaric acid, detection and role of carbohydrates in plants by Molisch and Trommer, proving inulin, reactions to proteins (4) 3. Reception, conduction and elimination of water: Traub station, watching the flow and form of plasmolysis and deplasmolysis of plant (3) 4. Proving and role of plants: cuticular and stomatal transpiration using cobalt paper, measuring the nitrocellulose prints of stomata, guttation, potetometer (3) 5. Mineral nutrition of plants: evidence of phosphate ions in plants, demonstration of iron ions in plants (3) 6. Proof of calcium ions in plants, proving ammonium ions in plants, proving nitrate in plants (3) 7. Determination of enzyme activity: amylase, sucrase, phosphorylase, catalase, lipase, glycosidase (3) 8. Photosynthesis: Freeze drying plant material and extraction plant pigments, Spectrometric determination of total chlorophyll and carotenoids, Proving starch in leaves, chlorophyll fluorescence in solution and in vivo, Thin-layer chromatography and determination of the absorption spectrum of photosynthetic pigments, Paper Chromatography (4) 9. Respiration metabolism: determination of the respiration rate and respiratory quotient, the model of the respiratory chain (3) 10. Proving cytochrome. Alcoholic fermentation

	11. Demonstration of secondary plant metabolites: enzymatic resolution glycoside prulaurazin and amygdalin (3) 12.Absorption spectrum of anthocyanins, anthocyanins, changing colors at different pH, anthocyanins and differentiation betacyanin, determination of antioxidant capacity (4) 13. Hormones and plant cell transformation: the effects of ethylene, auxins, gibberelines and kinetin (3) 14. Plant movenments motions: thermonasty and photonasty, seismonasty, phototropism of chloroplasts (3)
Format of instruction	☒ lectures ☐ seminars and workshops ☐ exercises ☐ *on line* in entirety ☐ partial e-learning ☐ field work ☐ independent assignments ☐ multimedia ☒ laboratory ☐ work with mentor ☐ (other)
Student responsibilities	Attendance at least 70%. 100% of laboratory exercises.

Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*						
	Class attendance	1	Research		Practical training	
	Experimental work	2	Report		(Other)	
	Essay		Seminar essay		(Other)	
	Tests	2	Oral exam	2	(Other)	
	Written exam	1	Project		(Other)	

Grading and evaluating student work in class and at the final exam	Fully completed laboratory exercises, preliminary exam, written and oral exam

Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	Pevalek-Kozlina, B. (2003) Fiziologija bilja. Sveučilišni udžbenik. Profil International, Zagreb.	5	

Optional literature (at the time of submission of study programme proposal)	Taiz, L. and Zeiger, E. (2002): Plant Physiology. Sinnauer Ass. Inc. Sunderland, Massachusetts. Buchanan, B., Gruissem, W., and Jones, R. L. (2002): Biochemistry and Molecular Biology
Quality assurance methods that ensure the acquisition of exit competences	Methods Quality assurance will be performed at three levels: (1) University Level, (2) Faculty Level by the Commission for Quality Control, (3) Teaching Level.

Other (as the proposer wishes to add)	