COURSE UNIT DESCRIPTION - PLANT PHYSIOLOGY

Course unit title	Code
PLANT PHYSIOLOGY	

Lecturer(s)	Department(s)
Coordinator: dr. Milda JODINSKIENĖ **Other(s):** lect. Rimantas Puzirauskas	Vilnius University, Department ofMicrobiology and Biotechnology, M.K. Čiurlionio g. 21/27, Vilnius, LT-03101

Cycle	Level of the course unit	Type of the course unit
Full-time studies (1st stage)	1 out of 1	Elective

Mode of delivery	Period of delivered	Language(s) of instruction
Face to face	5th semester, spring	Lithuanian

Prerequisites and corequisities	
Prerequisites: General biology or botany, plant anatomy, cytology	**Corequisities (if any):** None

Number of credits allocated to the course unit	Student's total workload	Contact hours	Self-study and research hours
5	**133**	**64**	**69**

Purpose of the course unit: programme competences to be developed

The course unit aims to develop:

Subject-specific competences:

- knowledge of the basic principles of plant physiology and concepts of the relationship between plant form and function;
- knowledge of the plant metabolism and homeostasis processes;
- knowledge of the basic analysis methods in plant physiology;
- skills to perform experiments and interpret the data obtained;
- skills to perform reliable measurements, document and analyse the results of the measurements;
- skills to analyze, compare, and critically evaluate the information in plant physiology;

General competences:

- skills to generalise, organize, systematize, find and analyze information from additional sources in foreign languages;
- skills to learn, to apply knowledge in practice, make research, work independently.

Learning outcomes of the course unit	Teaching and learning methods	Assessment methods
Describes the plant functioning at the organism level – how plants manage vital processes, transport the material, grow and develop, interact with the environment.	Problem-based teaching lectures, laboratory works, independent analysis of the literature	Tests, lab reports, discussions, observation
Explains the relation of plant physiology science with other sciences, as well as the location and importance of plant physiology in a global context.	Problem-based teaching lectures, independent analysis of the literature	Tests, discussions, observation
Demonstrates skills in using the basic concepts of the subject, introducing them in the laboratory, will ability to analyze and summarize information.	Laboratory works, tutorial	Tests, lab reports, discussions, observation
Works independently and in the group, conducts	Laboratory works,	Tests, lab reports, discussions,

research, links theory with specific research	independent analysis of the literature	observation

Content: breakdown of the topics	Contact hours							Self-study work: time and assignments	
	Lectures	Tutorials	Seminars	Exercises	Laboratory work	Internship/work placement	Contact hours	Self-study hours	Assignments
1. Plant cell - structure and function. Cellular chemical and structural composition, functions of the organelles. **Lab. work**: The influence of different cations on the form and time of plazmolysis. Plazmolysis in the onion epidermal cells evoked by potassium salt solution.	2				2		**4**	**4**	Analysis of the scientific literature. Preparation for laboratory work.
2. Water and plant cells. Water structure and properties. Water in the soil. Water transport in the plant. Plant water balance. **Lab. work:** Determining of the force of absorbtion by the length change. Setting of the osmotic pressure by the initial plazmolysis method.	2				2		**4**	**4**	Analysis of the scientific literature. Preparation for laboratory work.
3. Plant nutrition through the roots. Soils and minerals. Main mineral elements. Nitrogen metabolism. Solute transport. **Lab. work:** Estimation of the transpiration intensity by the weighing method.	2				2		**4**	**4**	Analysis of the scientific literature. Preparation for laboratory work.
4. Plant responses to light. Photosensors and photomorphogenesis **Lab. work:** Green leaf pigments and their chemical and physical properties.	2				2		**4**	**4**	Analysis of the scientific literature. Preparation for laboratory work.
5. Photosynthesis – the light reactions. History of photosynthesis research. Light and pigments. Photosystems I and II. Antenna complexes. Reaction centers. Electron and proton transport mechanisms - cyclic and non-cyclic electron transfer. **Lab. work**: Thin layer chromatography for leaf pigment study.	2				2		**4**	**4**	Analysis of the scientific literature. Preparation for laboratory work.
6. Photosynthesis – Carbon reactions. C3 photosynthetic carbon reduction cycle. C4 photosynthetic carbon assimilation cycle. CO_2 assimilation by the CAM pathway. C2 photorespiration or glycolate cycle. **Lab. work:** Determination of chlorophyll amount.	2				2		**4**	**4**	Analysis of the scientific literature. Preparation for laboratory work. Preparing for the test.
7. Plant respiration. Lipid metabolism. Glycolysis, the tricarboxylic acid cycle and the electron transport chain. Glyoxilate Cycle. Pentose phosphate glucose oxidation pathway. **Test from the first part.** **Lab. work:** Determination of the amount of carotene.	2				2		**4**	**4**	Analysis of the scientific literature. Preparation for laboratory work.
8. Plant growth and development. Ontogenesis, morphogenesis. Endogenous rhythms. **Lab. work**: Establishing of carbon content in plant	2				2		**4**	**4**	Analysis of the scientific literature. Preparation for

leaves by photocolorimetric method (by burning in a mixture of chrome).									laboratory work.
9. Plant hormones. General principles of hormonal regulation. Brassinosteroids, jazmonates, salicylic acid, polyamines. **Lab. work:** photosynthesis study in the aquatic plant, by estimating the O_2 content in its environment by chemical method (L.V. Winkler).	2				2		**4**	**4**	Analysis of the scientific literature. Preparation for laboratory work.
10. Auxins and their role. Discovery of auxins, biosynthesis, transport, physiological functions. **Lab. work:** Use of indigo carmine to show oxygen release by aquatic plants during photosynthesis.	2				2		**4**	**4**	Analysis of the scientific literature. Preparation for laboratory work.
11. Cytokinins and their significance. Cytokinin discovery, biosynthesis, physiological functions. **Lab. work:** Non-cyclic electron transport proof in C3 and C4 syndrome leaf sections	2				2		**4**	**4**	Analysis of the scientific literature. Preparation for laboratory work. Preparing for discussion in the seminar.
12. Gibberellins and their significance. Gibberellins discovery, biosynthesis, physiological functions. The control of flowering **Lab. work:** Isolation of alkaloids from plants (paper chromatography).	2				2		**4**	**4**	Analysis of the scientific literature. Preparation for laboratory work.
13. Abscizic acid and ethylene. Their discovery, biosynthesis, physiological functions. **Lab. work:** Ascorbic acid content in plants. Analysis of ascorbic acid as a strong reducing agent chemical properties.	2				2		**4**	**4**	Analysis of the scientific literature. Preparation for laboratory work.
14. Plant movements. Intracellular movements. Growth movements. Tropisms, nastic movements, nutations, turgoric movements. **Lab. work:** Determination of the amount of phenolic compounds. Anthocyanins as a pH indicators in plants.	2				2		**4**	**4**	Analysis of the scientific literature. Preparation for laboratory work.
15. Secondary metabolism and plant protection. Terpenes, phenolic compounds, alkaloids. Cyanogenic glycosides, glucosinolates, non-protein amino acids, phytoalexines. **Lab. work:** Plant sexual reproduction. Evidence of pollen viability.	2				2		**4**	**4**	Analysis of the scientific literature. Preparation for laboratory work. Preparing for the test.
16. Stress and plant protection. Biotic and abiotic stress factors. **Test from the second part**. **Lab. work**: Plant heterotrophic nutrition. Plant movements.	2				2		**4**	**4**	Analysis of the scientific literature. Preparation for laboratory work.
17. Preparation for the exam.								**5**	
Total	**32**				**32**		**64**	**69**	

Assessment strategy	**Weight,%**	**Assessment period**	**Assessment criteria**
Test I	20	March	Evaluation criteria: Evaluated by responses to the closed and open-ended questions. Questions require elective or short answers. Evaluated by ten point system.
Test II	20	May	Evaluation criteria: Evaluated by responses to the closed-and open-ended questions. Questions require elective or short answers. Evaluated by ten point system

Settlement of laboratory work	10	May	Laboratory work attendance mandatory. Settle up for guiding lecturer. Evaluated by ten point system.
Exam	50	June	Exam - three open questions. Responses measured from 0 to 10 points. The final assessment consists of seminars, both tests, lab works and exam in the relevant percentage shares. Scoring values: 10 (excellent) - ≥ 92%: excellent knowledge and skills. 9 (very good) - 82 - 91%: very good knowledge and skills. 8 (good) - 74 - 81%: good knowledge and skills, with minor errors. 7 (average) - 66 - 73%: average knowledge and skills with small errors. 6 (satisfactory) - 58 - 65%: sufficient knowledge and skills with errors. 5 (poor) - 50 -57%: weak knowledge and skills that do not satisfy the minimum requirements. There are a lot of mistakes. 0-4: Dissatisfied with the minimum requirements 4 (unsatisfactory) 40 - 49% 3 – 30 - 39% 2 – 20 - 29% 1 - ≤ 19%
Total	100		

Author	Year of publica-tion	Title	Issue of a periodical or volume of a publication	Publishing place and house or web link
Compulsory reading				
Taiz L. and Ziegler E.	2010	Plant Physiology		Benjamin/Cummins, Redwood City, California. http://5e.plantphys.net
Hopkins W.G., Hüner N. P.A	2008	Introduction to Plant Physiology.		John Wiley & sons, Inc. http://ebookee.org/Introduction-to-Plant-Physiology-4th-edition_1685748.html
Helgi Ö; Stephen R.	2005	The Physiology of Flowering Plants		Cambridge University Press.
Mildažienė V, Jarmalaitė S, Daugelavičius R.	2004	Cell Biology (in Lithuanian)		Vytauto Didžiojo universiteto leidykla
Buchanan B., Gruissem W. and Jones R	2002	Biochemistry and Molecular Biology of Plants		John Wiley & sons, Inc.
Optional reading				
	Recent	„Plant Physiology“ Journal		http://www.plantphysiol.org/content/by/year
Stašauskaitė S.	1999	Laboratory and Field Practicals in Plant Physiology (in Lithuanian)		Vilnius, Aldorija
Stašauskaitė S.	1995	Physiology of Plant Development (in Lithuanian)		Vilnius, Debesija
Bluzmanas P., Borusas S., Dagys J. ir kt.	1991	Plant Physiology (in Lithuanian)		Vilnius, Mokslas