

Course code	Course group	Volume in ECTS credits	Course hours
GAB2002	C	6	162

Course type (compulsory or optional)	Compulsory
Course level (study cycle)	Bachelor
Semester the course is delivered	Spring
Study form (face-to-face or distant)	Face-to-face

#### Course title in Lithuanian

AUGALŲ EKOFIZIOLOGIJA

#### Course title in English

PLANT ECOPHYSIOLOGY

#### Short course annotation in Lithuanian

Augalų ekofiziologija supažindina su augalų ląstelių veikla, augalų vandens balansu, mineraline mityba, fotosinteze, jos šviesinėmis ir tamsinėmis reakcijomis; fotosintezės ekologiniais ypatumais; organinių junginių pernaša; kvėpavimu; pirminiais ir antriniais metabolitais, augalų apsaugos priemonėmis; augimu ir vyksmu, augalų hormonais, jų veikimo molekuliniais keliais ir panaudojimo žmogaus praktikoje kryptimis; fitochromu ir šviesos vaidmeniu augalų žydėjimui, negyvosios ir gyvosios gamtos bei žmogaus sukelta augalo įtampa ir augalų prisitaikymą, atsparumą.

#### Short course annotation in English

Vital background information in classical plant physiology and ecophysiology will be provided. Course aims at understanding of the principles of functioning of the plant body. Main topics will include: water and plant cells; mineral nutrition; solute transport; photosynthesis: light and carbon reactions, translocation of assimilates; respiration; secondary metabolites; growth and development, phytochrome and light control of plant development, plant hormones, the control of flowering; responses and adaptations to abiotic, biotic and anthropogenic stress.

#### Prerequisites for entering the course

Algae, Fungi, Plant Systematics and Morphology and Field Work in Plant Biology

#### Course aim

The aim of this course is to study plant physiology and ecophysiology.

#### Links between course outcomes and criteria of learning achievement evaluation

Course outcomes	Criteria of learning achievement evaluation
Explain fundamental knowledge on the historical bases of plant ecophysiology, the laws, concepts and principles of how plant cell, tissue, organ is functioning, depending on its own genetic structure and influence of environment. Explain water uptake, transportation and usage by plant at various levels of structural organization. Knowledge about importance of water supply and consequences on plants in case of excess or deficit water in the environment.	Explained the basic fundamentals of ecophysiology and its main components. Relationships influencing the plant body functioning are explained. Various functions of the organism nutrition, water status, photosynthesis and respiration, synthesis of the primary and secondary compounds are stated and explained. Physiological reactions of different taxonomical group of embryophytes are analysed. Explained the major physiological adaptations of plants to light, humidity, nutritional, temperature and some anthropogenic adverse conditions

To realize the basic physiological concepts, importance of plant ecophysiology as a science, basic principles of plant cell, plant organ, plant part interactions, plant as total interaction with environment, processes affecting the size, structure and functioning of the plant body, vitality, consequences on community level	Realized theoretical background of plant physiology, basic terminology and methodology. Formated understanding how physiological processes are complex and in what way they are playing a role in the productivity and health of plants, evolutionary processes size. Main causes and consequences of the effects on plants of adverse anthropogenic and natural unfavorable factors
Define plant responses to abiotic and biotic stresses	Defined plant responses to abiotic and biotic stresses
Describe plant adaptation possibilities to changing environment	Described plant adaptation possibilities to changing environment
Characterise the regularities of single and combined effects of different environmental and climatic stress factors on plant growth and development	Characterised the regularities of single and combined effects of different environmental and climatic stress factors on plant growth and development

### **Content (topics)**

1. Plant cell physiology and biochemistry
2. Soil and plant nutrition elements. Water and nutrients uptake and translocation
3. Plant metabolism enzymes primary metabolites
4. Secondary metabolites
5. Anabolism. Photosynthesis
6. Catabolism. Respiration
7. Plant growth and development. Photoperiodism. Plant movement
8. Phytohormones
9. Plants under stress
10. Abiotic and biotic stress factors
11. Plants adaptation to different stress factors
12. Sulphur dioxide, nitrogen oxides and acid rains effects on plants growth
13. Heavy metals impact on plants
14. UV-B radiation and Ozone effect on plants
15. Combined effect of different stress factors on plant growth and development

### **Practical work (contents):**

1. Initial plasmolysis. Plasmolysis and deplasmolysis. Plant cell behavior in hypotonic, isotonic and hypertonic solutions. Determination of osmotic potential of the plant cells
2. Free and bound water of the cells
3. Determination of the number of stomatas and their size on the leaf surface
4. Comparison of transpiration rate of the upper and lower leaf surfaces
5. Extraction of the leaf pigments, their physical and chemical features, concentration, fluorescence of chlorophylls
6. Nutrient uptake by the cells. Microchemical analyses of ash
7. Respiration intensity, coefficient of respiration. Temperature effect on respiration
8. Aerobic and anaerobic dehydrogenases
9. Hydrolases, alpha amylase
10. Determination of the amount of organic acids, ascorbic acid
11. Allelopathic interactions between plants
12. The impact of different natural and anthropogenic factors on germination of seeds
13. The impact of different stressors on plant photosynthesis
14. Resistance of plants to cold and heat
15. The impact of different stressors (drought, salinity, heavy metals, and ultraviolet radiation) on plant growth

### **Distribution of workload for students (contact and independent work hours)**

Lectures – 45 hours, laboratory work in computer class – 30 hours, individual work – 87 hours.
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### Structure of cumulative score and value of its constituent parts

Final assessment sums the assessments of written final examination (50 %), written mid-term examination (27 %) and assessment of laboratory works (23%).

#### Recommended reference materials

No	Publication year	Authors of publication and title	Publishing house	Number of copies in		
				University library	Self-study rooms	Other libraries
<b>Basic materials</b>						
1.	2013	Kupčinskienė E. paskaitų konspektai "Augalų ekofiziologija Id."	Course in intranet <a href="http://moodle2.vdu.lt">http://moodle2.vdu.lt</a>			
2.	2013	Januškaitienė I. paskaitų konspektai "Augalų ekofiziologija IId."	Course in intranet <a href="http://moodle2.vdu.lt">http://moodle2.vdu.lt</a>			
3.	2011	Kupčinskienė E., „Aplinkos fitoindikacija“	Kaunas	10	5	
4.	2006	Šlapakauskas V.A. Augalų ekofiziologija	Lututė, Kaunas			
5.	2003	Larcher W. Physiological Plant Ecology.	Springer – Verlag Berlin Heidelberg		2	
6.	2010	Taiz L., Zeiger E. Plant Physiology, 5th ed.	Sinauer Associates, Sunderland		1	
7.	2005	Schulze E.D., Beck E., Muller-Hohenstein K. Plant Ecology	Springer		1	
8.	2008	Kadziauskas J. Biochemijos pagrindai	Vilnius	3		
9.	1991	Bluzmanas P., Borusas S., Dagys J., Gruodienė J., Stašauskaitė S., Šlapakauskas V., Vonsavičienė V. Augalų fiziologija	Mokslas, Vilnius	10		
<b>Supplementary materials</b>						
1.	1995	Kramer P.J., Boyer J.S. Water Relations of Plants and Soils	Academic Press, San Diego, CA			
2.	2004	Davies P.J. Hormones: Biosynthesis, Signal Transduction, Action	Springer, New York			
3.	2005	Epstein E., Bloom A.J. Mineral	Sinauer Associates, Sunderland, MA			

		Nutrition of Plants: Principles and Perspectives. 2 <sup>nd</sup> ed.		
4.	2009	Azcon-Aquilar C., Gianinazzi S., Guaninazzi-Pearson V. Mycorrhizas: Functional Processes and Ecological Impacts	Springer, Berlin	
5.	1988	Coombs J., Hall D.O., Long S.P., Scurlock J.M.O. Techniques in Bioproductivity and Photosynthesis. 2 <sup>nd</sup> ed.	Pergamon Press, Oxford	
6.	1997	Kalra Y. Handbook of Reference Methods for Plant Analysis. 1 <sup>st</sup> ed.	John Wiley & Sons. CRC Press.	
7.	2007	Bowsher et al., Plant Biochemistry 1 <sup>st</sup> ed.	Garland Science	
8.	1998	Kendrick R.E., Kronenberg G.M. Photomorphogenesis in Plants. 2 <sup>nd</sup> ed.	Kluwer Dordrecht	

**Course programme designed by**

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