SYLLABUS (MODULE-ERASMUS+)

Course/module (as specified in the approved curriculum for the field of study) **Metabolic responses of germinating seeds to stress**	ECTS **4**	Catalogue number HORT 6.1
Name in Polish **Metaboliczne odpowiedzi kiełkujących nasion na stres**		
Head of course/module **Dr hab. Iwona Morkunas, Assoc. Prof.**		
Unit(-s) providing the course/module (Institute/Department) **Department of Plant Physiology**		

Field of study	Level	Profile	Semester
Biology and Horticulture		**Academic-general**	**Summer**

TYPE OF CLASSES/LECTURES AND THE NUMBER OF HOURS
(organised classes/lectures and self-study)

Type of studies: full-time		Type of studies: extramural	
- lectures	**10**		
- laboratory practical	**15**		
- other – tutored	**5**		
- self-study	**70**		
Total number of hours:	**100**		

OBJECTIVE OF COURSE/MODULE

Presentation of the effect of environmental factors on the metabolism of germinating seeds. Understanding effects of seed banks on population. Program includes knowledge of germination ecology of plants with specialized life cycles and/or habitats (parasitic plants, halophytes, psammophytes of nonsaline soils)

TEACHING METHODS

Lecture supported by multimedia presentation, discussion, laboratory training consisting of performing of experimental tasks independently, observation of the effect of environmental factors on the growth of germinating seeds on selected plant model under the supervision of a teacher, microscopic observations, written work related to the summary of results (team or individual)

	LEARNING OUTCOMES	Reference to field outcomes	Reference to area outcomes
Knowledge	E1. Student acquires knowledge about the effect of environmental factors on germination E2. Student knows the main abiotic and biotic stressors influencing the germinating process E3. Student has a knowledge concerning the activation of important physiological processes during seed germination in response to stress factors E4 Student has a knowledge concerning important roles of germinating process in ontogenetic development E.5. Student characterizes germination ecology of plants with specialized life cycles and/or habitats	Not applicable	Not applicable
Skills	E6. Student identifies main groups of environmental factors affecting germination E7. Student recognises metabolic changes of plants in response to abiotic and biotic stressors E8. Student identifies the role of seed banks on population		
Social competences	E9. Student is able to work as a leader and/or as a partner in a group. E10. Student is able to predict the effects of different environmental stressors on food production understand the economic significance of the subject nowadays		

Methods to verify learning outcomes written test and the preparation of oral presentation	Outcome Reference Numbers E1 - E10

TEACHING CONTENT

Lectures:

1. Introduction to seeds germination: mobilization of stored reserves, environmental regulation of dormancy and germination (Assoc. Prof I. Morkunas 1h)

2. The effect of abiotic and biotic stressors on metabolism of germinating seeds (Assoc. Prof. I. Morkunas 3h, Dr M. Formela 2h, Dr T. Chadzinikolau 2h)

3. Metabolic and ultrastructural responses of embryo axes of germinating seeds to sugar starvation (Assoc. Prof. I. Morkunas 1h)

4. Effects of seed banks on population. Germination ecology of plants with specialized life cycles and/or habitats (parasitic plants, halophytes, psammophytes of nonsaline soils) (Assoc. Prof. I. Morkunas 1h)

Exercises:

1. Observation of seed germination types and the effect of natural germination inhibitors

2. Demonstration of the influence of external factors on seed germination: the effect of oxygen, temperature, light, heavy metals on seeds germination

3. Impact of deep seed sowing and unfavorable environmental factors on germination and susceptibility of seeds to infection caused by pathogenic fungi

4. Observation of the inhibitory effect of essential oils for seed germination; allelopathic effect of water extracts from seeds of different plants species on seed germination and growth of white mustard seedlings

5. Evaluation of the development of infection and diseases caused by fungal pathogens on germinating seeds; the effects of environmental factors on the activity of defensive response enzymes during seed germination

6. Study of oxidative stress in germinating seeds during the interaction of abiotic and biotic stressors

Forms and criteria for passing of course/module Written test – passed above 60%	Percentage of final mark **100%**

LIST OF LITERATURE

Basic literature

Bewley J.D.,. Bradford K.J, Hilhorst H.W.M., Nonogaki H. 2013. Seeds. Physiology of Development, Germination and Dormancy. 3rd Edition, Springer. ISBN 978-1-4614-4692-7

Baskin C.C., Baskin J.M. Seeds. Ecology, Biogeography, and Evolution of Dormancy and Germination. 2014. Second edition. Academic Press, ISBN 978-0-12-416677-6