***Course name:***
**Embryology of flowering plants**

| | |
|---|---|
| ECTS | 2 |
| Course status | *facultative* |
| Course final assessment /evaluation of outcomes | The grade based on Student's work |
| Prerequisite | *basic knowledge on plant biology* |

***Main field of study****:*
Agriculture and Horticulture, Biology and Biotechnology (Erasmus+)

| | |
|---|---|
| Educational profile | General academic |
| Code of studies and education level | bachelor/engineer (SI) or master of science (SM) |
| Semester of studies | winter or summer |
| Language of instruction | English |

**Course offered by**:

| | |
|---|---|
| Name of faculty offering the course | Faculty of Biotechnology and Horticulture |
| Name of department offering the course | Department of Plant Biology and Biotechnology |
| Course coordinator | Ewa Grzebelus, PhD, DSc |

**Learning outcomes**:

| Symbol of outcome | Description of the learning outcome | Reference to main field of study outcomes | Area symbol* |
|---|---|---|---|
| KNOWLEDGE – student knows and understands | | | |
| EmRo_W1 | systems of plant reproduction | BIOT1_W04 | R, P |
| EmRo_W2 | formation and construction of generative organs, embryological processes (sporogenesis, gametogenesis and embryogenesis) | BIOT1_W04 | R, P |
| EmRo_W3 | objectives of experimental embryology and practical use of embryological processes in plant breeding | BIOT1_W04 | R, P |
| SKILLS – student is able to | | | |
| EmRo_U1 | analyze and identify formation of spores, gametophytes and embryos of angiosperms using microscopes | BIOT1_U05<br>BIOT1_U07 | R, P |
| EmRo_U2 | use a variety of microscopic techniques to assess plant fertility | BIOT1_U10 | R, P |
| EmRo_U3 | use different pollination techniques for plants | BIOT1_U09 | R, P |
| SOCIAL COMPETENCIES – student is ready to: | | | |
| EmRo_K1 | formulating objective assessments of plant fertility in the context of crop improvement | BIOT1_K05<br>BIOT1_K09 | R, P |

**Teaching contents**

| | |
|---|---|
| Lectures | 15 hours |
| Topics | Characteristics of various reproduction systems (amixis, amphimixis, apomixis). Life cycle of angiosperms. Alternation of generations - diploid and haploid phase.<br>Formation, structure and function of generative organs of angiosperms. Genetic regulation of flower morphogenesis. |

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|---|---|
| | Formation and structure of male and female gametophytes.<br>Pollination and fertilization. Characteristics of the progamic phase. Double fertilization. Gamete isolation. In vitro fertilization.<br>Prezygotic reproductive barriers. Sporophyte and gametophyte self incompatibility. Genetic background for self-incompatibility.<br>Embryo and endosperm development. Types of embryogenesis. Disorders in the development of endosperm and embryo - postzygotic incompatibility.<br>Apomixis and its importance. Classification of apomictic phenomena<br>Experimental embryology. Examples of the use of embryological structures and processes in biotechnology |
| Accomplished learning outcomes | *EmRo_W1-W3* |
| Means of verification, rules and criteria of assessment | *test - single choice (50%)* |
| Classes: | 15 hours |
| Topics | Construction of generative organs on the example of selected crop species. Microscopic preparations illustrating the meiotic events.<br>Development of male gametophyte. Events in microsporogenesis and microgametogenesis. Pollen structure on the example of selected plant species. Pollen viability assessment: aceto-carmine staining, Alexander method, pollen germination on sucrose-agar medium.<br>Events in megasporgenesis. Development of mono-, bi- and tetrasporic embryo sacs. Pollination techniques. Analysis of the progamic phase and double fertilization.<br>Types of embryogenesis in plants. Preparation of embryos and determination of their developmental stages. Structure of mature embryos of mono- and dicotyledonous plants. |
| Accomplished learning outcomes | *EmRo_U1-U3, EmRo_K1* |
| Means of verification, rules and criteria of assessment | *test - single choice, case report (50%)* |

**References**:

| | |
|---|---|
| Basic | *Glover B., 2014. Understanding flowers and flowering. Oxford University Press*<br>*Raghavan V., 2006. Double fertilization. Springer*<br>*Lersten N.R., 2004. Flowering plant embriology. Blackwell Publishing* |
| Supplementary | *Ainsworth C., 2006. Flowering and its manipulation. Blackwell Publishing*<br>*Eng-Chong P, Davey M.R., 2010. Plant developmental biology – Biotechnological perspectives, vol 1. Springer* |

**Structure of learning outcomes**

| | | |
|---|---|---|
| Area of academic study: R – Agricultural, forestry and veterinary sciences | 1,0 | ECTS ** |
| Area of academic study: P – biological sciences | 1,0 | ECTS ** |

**Structure of student activity**

| | | | | |
|---|---|---|---|---|
| Contact hours | | 34 | hrs. | 1,4 ECTS** |
| Including: | lectures | 15 | hrs. | |
| | classes and seminars | 15 | hrs. | |
| | consultations | 2 | hrs. | |

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|---|---|---|---|---|---|
| | participation in research | - | hrs. | | |
| | obligatory traineeships | - | hrs. | | |
| | participation in examination | 2 | hrs. | | |
| e-learning | | - | hrs. | …. | ECTS** |
| student own work | | 16 | hrs. | 0,6 | ECTS** |

*Areas of academic study in the fields of: H- humanities; S - social studies; P – biological sciences; T – technological sciences; M- medical, sport and health sciences; R – Agricultural, forestry and veterinary sciences; A – the arts
** stated with an accuracy to 0.1 ECTS, where 1 ECTS = 25 - 30 hours of classes