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| Name of course: **Plant biotechnology** | **Credit value: 3** |
| **Course** **classification**: obligatory |
| **The proportion of the practical nature of the course, „educational character”:**  |
| **Type of course:** theoretical / practical, and the **total number: hours** in the given **semester.**Further (unique) means and properties of knowledge transfer: **14 th. / 14 pr.** |
| **Exam** type (colloquium / practical grade / **other** ):  **colloquium**Further (unique) means of knowledge verification**: midterm test from practical topics** |
| The curricular **place of the course** (which semester): **second semester** |
| Prerequisites (if any): **- BSc level knowledge of plant anatomy, physiology and biochemistry**  |

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| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks).** |
| The aim of the course is to acquaint students with the history and development of biotechnology. They will also learn about the theoretical and practical perspectives of plant biotechnology by presenting methods and strategies in in vitro cell biology, tissue culture, molecular biology, proteomics, biorefinery, and circular economy. Based on the 14-hour lecture, students can learn about the solutions that plant biotechnology offers to the current challenges of field crop production, taking into account national and international results. The lectures are complemented by a 14-hour laboratory exercise. During these, students have the opportunity to learn about and actively participate in the most important in vitro plant cell biology, tissue culture, protein extraction and proteomic techniques, as well as special biochemical analytical methods in the field.

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| Lecture | Practise |
| 1.-2. hours: History of biotechnology and plant tissue culture | 1.-2. hours: Presentation of a plant *in vitro* laboratory, acquaintance with the rules of sterile work |
| 3 – 4 hours: Biotechnology of asexual reproduction: Micropropagation. Somatic embryogenesis, somatic seeds / somatic seedlings. Tissue culture in a bioreactors.  | 3-4. hours: Micropropagation: direct/indirect organogenesis |
| 5-6. hours: Biotechnological methods of sexual reproduction. Haploidy, diploid technique | * 1. hours: Somatic embryogenesis,

production of artificial seeds by encapsulation. Automatization in plant tissue culture - plant cloning bioreactors. Elicitation.  |
| 7-8. hours: *In vitro* gene banks, virus elimination, cryopreservation | * 1. hours: Anther culture, *in vitro* androgenesis; embryo preparation.
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| * 1. hours: Fortification - enhancing crops value by agronomic and genetic methods
 | 9-10. hours: Green biomass processing for biorefinery purposes. Protein determination by spectrofotometric method. Proteomic analysis by 1D/2D SDS PAGE - isoelectric focusing |
| 11 – 12 hours: Protein biotechnology, green biorefinery | 11-12. hours: Proteomic analysis by 1D/2D SDS PAGE – gel electrophoresis and evaluation |
| * 1. hours: Role of biotechnology in agriculture waste management
 | 13-14. hours: Histochemical and biochemical analysis of fractionated green biomass |

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| **Required and recommended reading:** |
| **Required reading**:Lecture and practical material (pdf)**Recommended reading**:Altman A., Hasegawa P.M. (2012): Plant biotechnology and agriculture (Prospects for the 21st century) Kardung M. et al. (2020): Development of the Circular Bioeconomy: Drivers and Indicators |
| **Competencies to be acquired, related to the course:** |
| **a) Knowledge:** During the lectures, students will acquire knowledge about the answers that the state of art plant biotechnology can offer to the current challenges related to crop production. During laboratory practices students will learn about the basic procedures used in plant biotechnology and the most commonly used model organizations.**b) Ability:**He/she is aware of the cellular, tissue and molecular techniques that can be used in the propagation and breeding of crops. Also, he/she is aware of the biotechnological methods possibilities in the application of agricultural crops for feed / food and industrial purposes. Able to perform professional tasks in laboratory in the field of plant biotechnology. Along with, he/she is able to expand his / her own professional knowledge of plant biotechnology.**c) Attitude:** He/she seeks to continuously increase his/her knowledge of plant biotechnology, including further training at the PhD level and participation in professional further training. He/she behaves in an environmentally and nature-conscious manner at work and beyond.**d) Autonomy and responsibility:**He/she has ability to constructively collaborate and liaise with leaders, co-workers at the workplace. He/she expresses his/her opinion responsibly in professional and non-professional circles on issues related to the biotechnological use of crops. |

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| **Course leader** (name, post, academic degree): **Dr. Éva Domokos-Szabolcsy PhD assistant professor** |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **Prof. Dr. Miklós Fári full professor, László Kaszás assistant lecturer; Dr. Tarek Alshaal PhD associate professor** |