<table>
<tr><td colspan="2">NAME OF THE COURSE</td><td colspan="5">Genetics and Biotechnology in agriculture</td></tr>
<tr><td>Code</td><td>PMB 547</td><td>Year of study</td><td colspan="4">2.</td></tr>
<tr><td>Course teacher</td><td>Ivica Šamanić, Ph.D.
Assistant Professor of Faculty of Science, University of Split</td><td>Credits (ECTS)</td><td colspan="4">4.0</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2"></td><td rowspan="2">Type of instruction (number of hours)</td><td>L</td><td>S</td><td>E</td><td>F</td></tr>
<tr><td>30</td><td>10</td><td>20</td><td></td></tr>
<tr><td>Status of the course</td><td>Elective</td><td>Percentage of application of e-learning</td><td colspan="4">10%</td></tr>
<tr><td colspan="7">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="6">To impart theoretical knowledge and practical skills about plant breeding objectives in Mediterranean-Climate Regions, modes of reproduction and genetic consequences, breeding methods for crop improvement.</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="6">Fundamental knowledge of cell biology and botany are required.</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="6">After successful completion of this course students will be able to:
assess possibility of the practical application of different in vitro methods that can be implemented to achieve the genetic variability within the economically important plant species
use the basic laboratory equipment necessary to maintain or grow plant cells, tissues or organs under sterile conditions on a nutrient culture medium
determine the possible benefits and environmental risks of Genetically Modified Plants (GMPs)
write a lab report that includes an evaluation of the results obtained in the laboratory
present research in a seminar form</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="6">Lectures (30 hours)
1. Unique genetic features of plants (Ability to photosynthesize, Totipotency of plant cells, Hermaphroditism and ability to reproduce both sexually and asexually, Double fertilization, Polyploidy, Alternation of generations, Mitosis in haploid state)
2. Plant Genome Organization and Function (Three independent genomes of the plant cell; Repeated Sequences, Organization of Single-copy Sequences, Evolution of Repeated Sequences in Cereals, Chloroplast Genome Organization, Mitochondrial Genome Organization, RNA editing)
3. Regulatory Mechanisms in Plant Development (Molecular mechanisms whereby endogenous and environmental regulatory factors control development; emphasis on stimulus perception and primary events in the signal chain leading to modulated gene expression and cellular development)
4. Inheritance Patterns (Mendelian Patterns of Inheritance, Boveri and Sutton's chromosome theory of inheritance, The molecular basis of genetic dominance, Cellular and molecular basis of inheritance, Cytoplasmic inheritance, Polygenic Trait)
5. Interactions of allelic genes (Interactions between the alleles of one gene: incomplete dominance, codominance, lethal alleles, multiple alleles; Interaction between alleles at different genes (loci): epistasis, pleiotropy, complementary genes, duplicate genes)</td></tr>
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	6. Disease Resistance and Abiotic Stress Tolerance (Management of plant diseases using genetic engineering: Plant disease resistance genes; Gene expression and signal transduction in response to dehydration) **7. Chromatin structure and gene expression** (Hetrochromatin and euchromatin, Histone modifications, DNA methylation) **8. Principles and Techniques of Plant Breeding** (The principles, methods and applications of plant breeding and genetics to the improvement of crop plants, alternative approaches through hybridization and selection) **9. Methods for Plant Genetic Modification** (Use of Agrobacterium tumefaciens, Ti plasmids, Strategies for gene transfer to plant cells, Direct DNA transfer to plants, Gene targeting in plants) **10. Plant Genetic Engineering** (molecular pharming, plantibodies) **11. Mapping Plant Genome with Molecular Markers** (Classes of Molecular markers, detecting DNA polymorphisms, Genetics of mapping molecular loci, Comparative Genome mapping, mapping quantitative trait loci with molecular markers, application of molecular markers to Selection) **12. Fertility-Regulating Mechanisms and Their Manipulation** (Male Sterility and Fertility Restoration in Crops, Molecular basis of self-incompatibility and its utilization in crop improvement) **13. Mobile genetic elements;** retrotransposons and DNA transposons **14. Haploid and triploid plants** (Androgenesis induction in microspore culture, Gynogenesis using ovule culture, In vitro induction of haploid, diploid and triploid plantlets) **15. Plant tissue culture** (Plant micropropagation Method for in vitro Plant Regeneration, Plant Protoplast: Isolation, Culture and Fusion Techniques; Somaclonal Variation in Tissue Culture) **Exercises** (20 hrs) 1. Cross pollination to generate Arabidopsis transgenic plants harboring promoter::GUS constructs 2. In vitro plant tissue culture 3. Surface seed sterilization procedures 4. DNA extraction from plant tissue 5. Applications of Polymerase Chain Reaction (PCR) to easily isolate individual plants that carry a particular T-DNA mutation of interest 6. Histochemical localization of β-glucuronidase (GUS) reporter activity in plant tissues **Seminars** (10 hrs) Reading and discussing primary scientific literature, writing a short assay summarizing analyzed articles. Selected articles related to the above topics will be analyzed in 2-hour blocks. The aim is to develop writing skills and presentation skills needed to effectively communicate the purpose, scope, and conclusions of the project.	
Format of instruction	☒ lectures ☒ seminars and workshops ☒ exercises ☐ *on line* in entirety ☒ partial e-learning ☐ field work	☒ independent assignments ☒ multimedia ☒ laboratory ☐ work with mentor ☐ (other)

Student responsibilities						
Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*	Class attendance	1,5	Research		Practical training	0,5
	Experimental work		Report		Lab reports	0,5
	Essay		Seminar essay	0,5	(Other)	
	Tests		Oral exam		(Other)	
	Written exam	1	Project		(Other)	
Grading and evaluating student work in class and at the final exam	Methods of Evaluation					

	Title	Number of copies in the library	Availability via other media
Required literature (available in the library and via other media)	1.Slater A., Scott N. W., Fowler M. R. (2008) Plant Biotechnology: the genetic manipulation of plants (second edition). Oxford University Press		
	1.Grotewold E., Chappell J., Kellogg E. A. (2015) Plant Genes, Genomes and Genetics. JohnWiley&Sons,Ltd.		

Optional literature (at the time of submission of study programme proposal)	1.Jelaska, Sibila (1994). Kultura biljnih stanica i tkiva. Zagreb: Školska knjiga. 2.Andreja Abramovič Ristov (ur) (2007). Metode u molekularnoj biologiji. Institut Ruđer Bošković. 3.Ranabhatt, Hiru., Kapor, Renu. (2018). Plant Biotechnology. Woodhead Publishing India Pvt. Ltd. 4. Selected scientific papers
Quality assurance methods that ensure the acquisition of exit competences	Student evaluation • Lab reports All lab reports must contain complete and detailed outline of the experimental procedure, description of the results accompanied by analysis and interpretation. • Research-based class seminar will be elevated. Students will have to prepare presentation showing background of the problem they are dealing with. The presentation will be scored according to the content of the presentation (key words, critical review of literature, presentation of scientific results), format, innovativeness and language competence as well. • Class Participation will also be part of the grade. • Final Lecture Exam: written examination (multiple-choice questions from the presentation material). Final grades will be based on each student's performance as assessed by points total.

Other (as the proposer wishes to add)	