Course name: Genetic engineering

ECTS	6
Course status	*facultative*
Course final assessment /evaluation of outcomes	*exam*
Prerequisite	*knowledge of molecular biology and biochemistry on the level of undergraduate agricultural/natural studies*

***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	dr hab. Marek Szklarczyk, prof. URK

Learning outcomes:

Symbol of outcome	Description of the learning outcome	Reference to main field of study outcomes	Area symbol*
KNOWLEDGE – student knows and understands:			
GEN_W1	biochemical manipulations on DNA molecules and enzymes used for these purposes	EPB2_W01 EPB2_W04	R, P
GEN_W2	issues of recombinant protein production and in vitro mutagenesis	EPB2_W01 EPB2_W04	R, P
GEN_W3	basic methods of genome analysis	EPB2_W01 EPB2_W04	R, P
GEN_W4	transgenicsin selected groups of organisms	EPB2_W01 EPB2_W04	R, P
GEN_W5	selected methods of gene cloning	EPB2_W01 EPB2_W04	R, P
GEN_W6	perspectives of recombinant DNA technology and associated social concerns	EPB2_W03 EPB2_W08	R, P
SKILLS – student is able to:			
GEN_U1	prepare competent cells and assess their quality	EPB2_U01 EPB2_U05	R, P
GEN_U2	perform molecular cloning in a plasmid vector	EPB2_U01 EPB2_U05	R, P
GEN_U3	interpret results of DNA sequencing	EPB2_U01 EPB2_U05	R, P
GEN_U4	operate laboratory instruments – centrifuges, spectrophotometers, electrophoresis equipment, gel documentation systems, thermocyclers and incubators	EPB2_U01 EPB2_U05	R, P
SOCIAL COMPETENCIES – student is ready to:			
GEN_K1	team work	EPB2_K02	R, P
GEN_K2	prevent threats associated with recombinant DNA technology	EPB2_K04 EPB2_K05	R, P
GEN_K3	influence social perception of genetic manipulations	EPB2_K03	R, P

Teaching contents

Lectures		30 hours
Topics	Techniques for manipulation of DNA molecules Methods of gene delivery Production of recombinant proteins In vitro mutagenesis Genome editing and genome-scale reverse genetics Genetically modified microorganisms and plants Strategies of molecular cloning High-throughput DNA sequencing Socioethical aspects of genetic engineering	
Accomplished learning outcomes		*GEN_W1, GEN_W2, GEN_W3, GEN_W4, GEN_W5, GEN_W6*
Means of verification, rules and criteria of assessment		*Evaluation is based on test questions, in order to earn a positive mark at least 51% of answers must be correct. Contribution to the final grade from the course – 65%.*
Classes:		35 hours
Topics	Production of *Escherichia coli* competent cells. Control of cell competence through transformation with plasmid DNA. Assessment of transformation efficiency. Isolation of plasmid vector DNA. Isolation of DNA to be cloned. Assessment of concentration and purity of the obtained DNA preparations. Control electrophoresis of the obtained DNA preparations. Restriction digest of the vector and DNA for cloning. Vector dephosphorylation. Preparative electrophoresis of the digested DNA preparations – gel isolation of the linearized vector and restriction fragments (selected fraction) of DNA to be cloned. Control electrophoresis of the gel-isolated DNA fragments. Ligation of the vector and restriction fragments being cloned. Transformation of the ligation mixture into *E. coli* cells. Analysis of transformation results. Analysis of sequence chromatograms. Isolation of the recombinant protein. Recent advances in genetic engineering (literature query).	
Accomplished learning outcomes		*GEN_U1, GEN_U2, GEN_U3, GEN_U4, GEN_K1, GEN_K2, GEN_K3*
Means of verification, rules and criteria of assessment		*Evaluation is based on:* *- individual reports from laboratory activities, contribution to the final grade from the course – 10%;* *- two tests from the laboratory topics (at least 51% of correct answers to earn a positive mark), contribution to the final grade from the course – 20%;* *- presentation of literature review – 5%.*

References:

Basic	*Brown TA (2016) Gene cloning and DNA analysis: an introduction, 7th edn. Wiley-Blackwell* *Howe C (2007) Gene cloning and manipulation, 2nd edn. Cambridge University Press* *Nicholl DST (2008) An introduction to genetic engineering, 3rd edn. Cambridge University Press*
Supplementary	*Brown TA (2017) Genomes 4, 4th edn. Garland Science* *Green MR, Sambrook J, MacCallum P (2012) Molecular cloning: a laboratory manual, 4th edn. Cold Spring Harbor Laboratory Press* *Genetic Engineering & Biotechnology News (GEN) – Mary Ann Liebert, Inc. (journal)*

Structure of learning outcomes

Area of academic study: agriculture and horticulture	3.0	ECTS**
Area of academic study: biological sciences	3.0	ECTS**

Structure of student activity

Contact hours		73	hrs.	2.9	ECTS**
Including:	lectures	30	hrs.		
	classes and seminars	35	hrs.		
	consultations	4	hrs.		
	participation in research	…	hrs.		
	obligatory traineeships	…	hrs.		
	participation in examination	4	hrs.		
e-learning		…	hrs.	…	ECTS**
student own work		77	hrs.	3.1	ECTS**

*areas of academic study in the fields of: P – biological sciences; R – agriculture and horticulture

** stated with an accuracy to 0.1ECTS, where 1 ECTS = 25 - 30 hours of classes