FACULTY OF CHEMISTRY

SUBJECT CARD

Name of subject in Polish	Inżynieria genetyczna
Name of subject in English	Genetic Engineering
Main field of study (if applicable):	Biotechnology
Specialization (if applicable):	
Profile:	academic
Level and form of studies:	1st level, full time
Kind of subject:	obligatory
Subject code	
Group of courses	NO

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	45		60		
Number of hours of total student workload (CNPS)	120		120		
Form of crediting	Examination		crediting with grade		
For group of courses mark (X) final course					
Number of ECTS points	4		4		
including number of ECTS points for practical (P) classes			4		
including number of ECTS points for direct teacher-student contact (BU) classes	1,95		2,8		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basics of molecular biology and biochemistry
2. Basics of laboratory work.
3. Ability to perform basic biochemical calculations, including conversion of mass and molar concentrations

SUBJECT OBJECTIVES

C1 Familiarizing students with basic techniques used for DNA recombination
C2 Acquiring the theoretical and practical skills necessary to molecular cloning
C3 Familiarizing students with basic expression systems
C4 Acquiring the theoretical and practical skills necessary to overexpression of protein in bacteria
C5 Familiarizing students with recombinant DNA technologies used in biotechnology medicine, agriculture archaeology
C6 Familiarizing students with techniques used for gene/genome structure analysis
C7 Familiarizing students with methods needed for analysis of expression and function of genes and genomes

SUBJECT LEARNING OUTCOMES

Relating to knowledge:

PEK_W01 – Student describes and explains basic molecular tools needed for construction and analysis of recombinant DNA molecules
PEK_W02 – Student describes and explains structural and functional elements of vectors
PEK_W03 – Student describes and explains techniques needed for isolation, amplification and biochemical/biophysical characterization of DNA
PEK_W04 – Student describes and explains DNA transfer techniques
PEK_W05 – Student describes and explains genes/genome sequencing techniques
PEK_W06 – Student describes and explains methods needed for the analysis of gene/genome expression
PEK_W07 – Student describes and explains various practical applications of genetic engineering in biotechnology, medicine, agriculture and archaeology.

Relating to skills:
PEK_U01 – Student is able to plan and conduct restriction digestion experiment
PEK_U02 – Student is able to conduct agarose gel electrophoresis and to interpret the results
PEK_U03 – Student is able to plan PCR experiment (starter design, PCR reaction setup)
PEK_U04 – Student is able to use DNA isolation kits (Gel-out, Clean-up)
PEK_U05 – Student is able to prepare competent bacterial cells
PEK_U06 – Student is able to setup and conduct DNA ligation reaction
PEK_U07 – Student is able to setup and conduct DNA transfer into bacteria
PEK_U08 – Student is able to setup and analyse (SDS-PAGE) overexpression of recombinant protein in bacteria.

PROGRAMME CONTENT

	Lectures	**Number of hours**
Lec 1	What is DNA cloning	3
Lec 2	Plasmids and bacteriophages as tools for gene transfer	3
Lec 3	Manipulating DNA, tools and techniques	3
Lec 4	Vectors and methods used in cloning in Escherichia coli	3
Lec 5	Vectors and methods used in cloning in eukaryotic cells	3
Lec 6	Looking for a specific clone	3
Lec 7	DNA sequencing and mutagenesis	3
Lec 8	Polymerase chain reaction (PCR)	3
Lec 9	Studying localization and structure of a gene	3
Lec 10	Studying expression and function of a gene	3
Lec 11	Studying genomes and transcriptomes	3
Lec 12	Production of recombinant proteins	3
Lec 13	Recombinant DNA technology in biotechnology	3
Lec 14	Recombinant DNA technology in medicine	3
Lec 15	Recombinant DNA technology in agriculture	3
	Total hours	45

	Laboratory	**Number of hours**
Lab 1	Familiarizing students with genetic engineering laboratory course.	6
Lab 2	Digestion of pGEX-2T plasmid vector with *Bam*HI restriction endonuclease	6
Lab 3	Agarose gel electrophoresis of linearized and dephosphorylated pGEX-2T plasmid vector	6
Lab 4	PCR of EcRDBD and isolation of PCR product – Clean-up protocol	6
Lab 5	Preparation of competent XL1-Blue cells	6
Lab 6	Ligation of pGEX-2T/*Bam*HI plasmid vector with EcRDBD fragment digested with *Bam*HI	6
Lab 7	Identification of bacterial transformants by colony PCR	6
Lab 8	Overexpression of EcRDBD (cloned in pGEX2T) in XL1-Blue cells	6
Lab 9	Analysis of EcRDBD expression using SDS-PAGE	6
Lab 10	Test	6
	Total hours	60

TEACHING TOOLS USED

N1. Performing experiment
N2. Short theoretical introduction to experiment
N3. Multimedia presentation
N4. Solving questions and problems
N5. Preparing reports on the experiments

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F – forming (during semester), P – concluding (at semester end)	Learning outcomes number	Way of evaluating educational effect achievement
F1	PEK_W01–PEK_W08	Multiple-choice test

P (lecture) = 3,0 if = 60,0 – 70,0 points
3,5 if = 70,1 – 75,0 points
4,0 if = 75,1 – 80,0 points
4,5 if = 80,1 – 85,0 points
5,0 if = 85,1 – 90,0 points
5,5 if = 90,1 – 100,0 points

F1 (laboratory)	PEK_U01- PEK_U08	Final test
F2 (laboratory)	PEK_U01- PEK_U08	Reports on the experiments
F3 (laboratory)	PEK_U01- PEK_U05	Activity and involvement during classes

P (laboratory) = 0,8·F1+0,15·F2 +0,05·F3
Attendance every class and submission of all the assessment is necessary to pass the course.

P (laboratory) = 3,0 if (0,8·F1+0,15·F2 +0,05·F3) = 60,0 – 70,0 points
3,5 if (0,8·F1+0,15·F2 +0,05·F3) = 70,1 – 75,0 points
4,0 if (0,8·F1+0,15·F2 +0,05·F3) = 75,1 – 80,0 points
4,5 if (0,8·F1+0,15·F2 +0,05·F3) = 80,1 – 85,0 points
5,0 if (0,8·F1+0,15·F2 +0,05·F3) = 85,1 – 90,0 points
5,5 if (0,8·F1+0,15·F2 +0,05·F3) = 90,1 – 100,0 points

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Brown, T.A. "Gene Cloning and DNA Analysis: An Introduction. John Wiley & Sons, 7th edition
[2] Experiment manuals available on the course-specific website only to qualified students

SECONDARY LITERATURE:

[1] Voet, D., Voet, J.G. „Biochemistry" Wiley & Sons, Inc., 4th edition
[2] Brown, T.A. "Genomy" PWN 2018
[3] Węgleński, P. "Genetyka molekularna" PWN 2012
[4] Berg, J.M., Tymoczko, J.L., Stryer, L. „Biochemia" PWN 2018
[5] Berg, J.M., Tymoczko, J.L., Stryer, L. „Biochemistry" W.H. Freeman and Co., New York – 9th edition
[6] http://www.blackwellpublishing.com/genecloning/

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)

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