COURSE UNIT DESCRIPTION - GENETIC ENGINEERING

Course unit title	Code
GENETIC ENGINEERING	

Lecturer(s)	Department(s)
Coordinator: Assoc. prof. Gintautas ŽVIRBLIS **Other(s):** Dr. Julija Armalytė	Institute of Biotechnology of Vilnius University, V.A.Graičiūno 8, Vilnius LT-02241; Department of Biochemistry and Molecular Biology, Vilnius University, M.K. Čiurlionio 21/27, 03101 Vilnius

Cycle	Level of the course unit	Type of the course unit
Full-time studies (1st stage)	1 out of 1	Compulsory

Mode of delivery	Period of delivered	Language(s) of instruction
Face to face	5th semester, autumn	Lithuanian

Prerequisites and corequisities	
Prerequisites: Biochemistry, organic chemistry, genetics, molecular biology (part I).	**Corequisities (if any):**

Number of credits allocated to the course unit	Student's total workload	Contact hours	Self-study and research hours
5	**133**	**64**	**69**

Purpose of the course unit: programme competences to be developed

Upon the successful completion of this course, students will acquire:

Subject-specific competences:

- the modern life sciences research-based knowledge of gene cloning, selection, targeted DNA mutagenesis and recombination, control of gene expression.
- the basic knowledge on gene manipulations, methods of genetic engineering and its application;
- skills to plan the gene constructing experiments, as well as analyze and evaluate the data on genetic information.

General competences:

- skills for self-development, study skills in order to study molecular biology;
- skills to present in written and verbal forms the knowledge and concepts of genetic engineering;
- skills to participate in the scientific discussion;

Learning outcomes of the course unit	Teaching and learning methods	Assessment methods
• Describes basic aspects of prokaryotic and eukaryotic gene structure and genetic information transfer applied for genetic engineering, as well as the methods of gene selection, mutagenesis, recombination and control of gene expression used for genetic manipulations. • Plans, analyses, compares and critically evaluates the gene construction experiments and the information related to this topic.	Lectures, seminars, self-directed learning	Colloquium
• Explains and applies methods of DNA and gene cloning and possibilities of gene transfer to different species using	Lectures, seminars, self-directed learning	Colloquium

genetic vectors; • Analyses, compares and critically evaluates the genetic information related to this topic.		
• Describes gene expression and regulation principles; • Explains strategies to construct recombinant DNA molecules and organisms with controlled expression; • Analyses, compares and critically evaluates the structure of recombinant DNA vectors related to this topic.	Lectures, seminars, self-directed learning	Colloquium
• Describes the methods of construction of recombinant proteins and their structural possibilities, using genetic vectors and enzymes. • Analyses, compares and critically evaluates the features of recombinant proteins related to this topic.	Lectures, seminars, self-directed learning	Exam
• Describes principles of GMO construction, features, application possibilities and safety requirements; • Analyses, compares and critically evaluates the GMO features related to this topic.	Lectures, seminars, self-directed learning	Exam
• Explains methods of genome sequencing and application of obtained genetic information; • Analyses, compares and critically evaluates the features of sequenced genomes related to this topic.	Lectures, seminars, self-directed learning	Exam

Content: breakdown of the topics	**Contact hours**							**Self-study work: time and assignments**	
	Lectures	Tutorials	Seminars	Exercises	Laboratory work	Internship/work placement	**Contact hours**	**Self-study hours**	**Assignments**
1. Genetic vectors	**5**		**6**				**11**	**10**	Self-directed learning of the topic-related textbook material, analysis of the topic-related scientific papers.
Prokaryotic genetic vectors	2						**2**	3	
Eukaryotic genetic vectors	1						**1**	3	
Application of genetic vectors	2						**2**	4	
2. Gene cloning	**6**		**7**				**13**	**14**	Self-directed learning of the topic-related textbook material, analysis of the topic-related

									scientific papers.
Gene cloning enzymes	2						**2**	4	
Gene libraries and gene selection methods	2						**2**	4	
Current methods of gene cloning and their application	2						**2**	6	
3. Gene expression	**6**		**6**				**12**	**14**	Self-directed learning of the topic-related textbook material, analysis of the topic-related scientific papers..
Structure of gene expression vectors	2						**2**	5	
Gene expression systems in prokaryotes	2						**2**	5	
Gene expression systems in eukaryotes	2						**2**	4	
4. Construction of recombinant proteins	**6**		**7**				**13**	**12**	Self-directed learning of the topic-related textbook material, analysis of the topic-related scientific papers.
Construction of prokaryotic proteins	2						**2**	3	
Construction of eukaryotic proteins	2						**2**	3	
Purification of recombinant proteins, tag sequences, fused proteins.	2						**2**	6	
5. Genetically modified organisms	**4**		**2**				**8**	**10**	Self-directed learning of the topic-related textbook material, analysis of the topic-related scientific papers.
GMM prokaryotes and yeast, and their application	1						**1**	3	
GMO plants and animals and their application	2						**2**	4	
GMO contained use and safety measures	1						**1**	3	
6. Sequencing of genomes	**5**		**4**				**9**	**9**	Self-directed learning of the topic-related textbook material, analysis of the topic-related scientific papers.
Current Technologies for Genome Sequencing	2						**2**	4	
Human genome project	1						**1**	2	
Application of DNA sequencing methods and genomic data	2						**2**	3	
Total	**32**		**32**				**64**	**69**	

Assessment strategy	**Weight,%**	**Assessment period**	**Assessment criteria**
Colloquium	50	9th week of the course	Test of 50 questions from topics 1-3. <24 answered questions - 2-4 (insufficient) 24 answered questions - 5 (sufficient) 25-29 answered questions -6 (satisfactory) 30-34 answered questions - 7(highly satisfactory) 35-39 answered questions -8 (good) 40-44 answered questions -9 (very good)

			45-50 answered questions --10 (excellent)
Exam	50	16th week of the course The final exam is allowed only when 75% of seminars are attended.	Test (virtual learning environment) of 50 questions from topics 4-6 <24 answered questions - 2-4 (insufficient) 24 answered questions - 5 (sufficient) 25-29 answered questions -6 (satisfactory) 30-34 answered questions - 7(highly satisfactory) 35-39 answered questions -8 (good) 40-44 answered questions -9 (very good) 45-50 answered questions -10 (excellent)
Total	100		Mean of the scores of colloquium and exam.

Author	Year of publica-tion	Title	Issue of a periodical or volume of a publication	Publishing place and house or web link
Compulsory reading				
Ed. by Krebs JE, Goldstein ES and Kilpatrick ST	2011	Lewin‘s genes X.	U-angl. / 575 / Kr-82 (VU Library)	Jones and Bartlett Publishers
Optional reading				
William Wu, Michael J.Welsh, Peter B. Kaufman, Helen H. Zhang	2004	Gene Biotechnology	ISBN 08493-1288-4	CRS Press