COURSE UNIT DESCRIPTION - MOLECULAR BIOLOGY II

Course unit title	Code
MOLECULAR BIOLOGY II	

Lecturer(s)	Department(s)
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Cycle	Level of the course unit	Type of the course unit
Full-time studies (1st stage)	2 out of 2	Compulsory

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

Prerequisites and corequisities	
Prerequisites: Biochemistry, organic chemistry, genetics	**Corequisities (if any):**

Number of credits allocated to the course unit	Student's total workload	Contact hours	Self-study and research hours
7	**187**	**96**	**90**

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 on the fundamental molecular processes of the storage, multiplication, transfer and realization of biological information in the prokaryotic and eukaryotic cell;
- the basic knowledge on the structure and functions of essential biological macromolecules;
- skills to analytically, critically and systemically analyze and evaluate information in molecular biology and related scientific fields;
- skills to perform basic molecular biology laboratory procedures, to work with standard molecular biology and biomedical equipment; perform reliable measurements, document and analyse the results of the measurements;
- skills to select appropriate molecular biology methods for the investigation of biological molecules and biological systems; perform experiments, interpret the data obtained and draw science-based conclusions.

General competences:

- skills for self-development, study skills in order to study molecular biology and general science resources;
- skills to present in written and verbal forms the knowledge and concepts of molecular biology;
- skills to participate in the scientific discussion;
- skills to organize and plan their work and time.

Learning outcomes of the course unit	Teaching and learning methods	Assessment methods
• Describes principles of RNA processing and its biological role in prokaryotes and eukaryotes, structure and functions of biomolecules involved in the RNA processing events; • Analyses, compares and critically evaluates the molecular biology information related to RNA processing.	Lectures, tutorials, seminars self-study.	Midterm exam; written analysis of scientific paper.

• Describes principles of nuclear splicing and its biological role, describes structure and functions of spliceosome; • Analyses, compares and critically evaluates the molecular biology information related to nuclear RNA splicing.	Lectures, tutorials, seminars; self-study.	Midterm exam; written analysis of scientific paper.
• Describes principles of protein biosynthesis and its regulation in prokaryotes and eukaryotes, describes structure and functions of ribosome; • Analyses, compares and critically evaluates the molecular biology information related to protein biosynthesis.	Lectures, tutorials, seminars; self-study.	Final exam; Written analysis of scientific paper.
• Selects and applies methods of recombinant DNA and protein analysis for gene cloning, expression and purification of recombinant proteins.	Laboratory works, lectures, tutorials, seminars; self-study.	Preparation and defense of Lab Reports;

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. RNA Processing	**10**		**5**				**15**	**24**	Self-directed learning of the topic-related textbook material, Reading of the topic-related selected scientific papers and preparation for written analysis **1** of scientific papers.
tRNA processing. Pre-tRNA processing in prokaryotes. Maturation of tRNA 3'- and 5'-ends. Pre-tRNA processing in archae and eukaryotes. Intron removal from pre-tRNA.	2		1				3	6	The same
rRNA processing. Pre-rRNA processing in prokaryotes. Pre-rRNA processing in eukaryotes. Nucleotide modifications. rRNA assembly into ribosomes. Introne removal from pre-rRNA. Self-splicing of intron from *Tetrahymena thermophila* pre-rRNA. Catalytic RNA. Group I self splicing introns: structure and features. Group II self splicing introns: structure and features.	3		1				3	6	The same
mRNA processing. Maturation of pre-mRNA 5'- and 3'- ends. Cap structure and synthesis. PolyA structure and synthesis.	3		2				5	6	The same
RNA editing. Types of RNA editing. Conversions. Insertions and deletions. Biological functions of editing.	2		1				3	6	The same
RNA quality control. RNA degradation pathways.									The same
2. Nuclear Splicing.	**10**		**5**				**15**	**25**	Self-directed learning of the

									topic-related textbook material, Reading of the topic-related selected scientific papers and preparation for written analyses **2-3** of scientific papers.
Introns, their types and splicing mechanims. Structure and features of introns. Conservative sequences of splicing *cis* elements.	3		1				4	8	The same
mRNA splicing. Chemistry of splicing. Spliceosome structure. Spliceosome assembly and dynamics. Catalytic center of spliceosome. Splicing complexes in the nucleus.	3		1				4	8	The same
Alternative splicing. Types of alternative splicing. *Cis* and *trans* regulators of alternative splicing. Biological role of alternative splicing.	4		1				5	9	The same
3. Protein biosynthesis	12		6				18	**25**	Self-directed learning of the topic-related textbook material, Reading of the topic-related selected scientific papers and preparation for written analyses **4-5** of scientific papers.
Ribosome structure. Structure and features of prokaryotic, archaeal, eukaryotic ribosomes. rRNA's. Ribosomal proteins. Ribosome fuctional centers. Methods of ribosome structure analysis.	4		2				6	8	The same
Protein biosynthesis in prokaryotes. tRNA, aminoacetylation. Aminoacyl tRNA synthetases. Translation initiation. Translation elongation. Elongation cycle. Decoding . peptide bond formation. Ribosomal peptidyltransferase. Translocation. Translation inhibition by antibiotics and toxins. Translation termination.	4		2				6	8	The same
Protein biosynthesis in eukaryotes. Translation initiation. IRES and their features. Polyribosomes. Protein degradation and its control	4		2				6	9	The same
Laboratory works									
1. Preparation of plasmid vector for cloning					**6**		**6**	2	Self-directed learning of the topic-related textbook material, preparation for laboratory work and preparation of Lab Report.
2. Amplification, purification and preparation of DNA fragment for cloning.					**6**		**6**	2	The same
3. Preparation of competent cells for transformation					**6**		**6**	2	The same
4. Transformation and selection of recombinant clones					**6**		**6**	2	The same
5. Clone analysis					**6**		**6**	2	The same
6. Induction of cloned gene					**6**		**6**	2	The same
7. Purification of recombinant protein by affinity					**6**		**6**	2	The same

chromatography									
8. Analysis of recombinant protein by SDS-PAGE electrophoresis					**6**		**6**	**2**	The same
Total	**32**		**16**		**48**		**96**	**90**	

Assessment strategy	**Weight,%**	**Assessment period**	**Assessment criteria**
Midterm exam	30	9-10th week of the course	Test (virtual learning environment) of 50 questions from topics 1-2. <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)
Completion of laboratory works, preparation and defence of Lab Reports.	15	The final exam is allowed only when all practical classes are completed, Lab Reports prepared and defended until 16th week of the course.	2-4 (insufficient) 5 (sufficient) 6 (satisfactory) 7(highly satisfactory) 8 (good) 9 (very good) 10 (excellent)
Written analysis of scientific papers	15	The final exam is allowed only upon completion of analyses 1-4 are completed until 16th week of the course.	2-4 (insufficient) 5 (sufficient) 6 (satisfactory) 7(highly satisfactory) 8 (good) 9 (very good) 10 (excellent)
Class participation	-	During lectures and seminars.	Class participation will be awarded by the 0/1 points depending on the level of involvement during in-class activities, by the quantity and quality of contributions during seminars. The points, received during semestre can be added to either midterm or exam test points.
Final exam	40	16th week of the course	Test (virtual learning environment) of 50 questions from topics 3-4 <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		All course parts must be completed at least with the minimal evaluation (sufficient, 5) to obtain the final evaluation. The final grade is the sum of all evaluated parts.

Author	**Year of publica-tion**	**Title**	**Issue of a periodical or volume of a publication**	**Publishing place and house or web link**
Compulsory reading				
Course virtual learning environment (lectures, topic related scientific papers, PDF materials of	2012	Molecular biology		http://vma.esec.vu.lt

instructor textbook)				
Molecular biology practical classes (in Lithuanian)	2008	Šeputienė V, Bagdonienė L, Labeikytė D, Sasnauskienė S.		Technologija, Kaunas
Fundamental Molecular Biology.	2011	Allison L.A.	U-angl. / 577.2 / Al-36 VU Library)	Blackwell Publishing
Molecular biology practical classes (in Lithuanian)	2008	Šeputienė V, Bagdonienė L, Labeikytė D, Sasnauskienė S.		Technologija, Kaunas
Optional reading				
Lewin‘s genes X.	2011	Ed. by Krebs JE, Goldstein ES and Kilpatrick ST	U-angl. / 575 / Kr-82 (VU Library)	Jones and Bartlett Publishers