# COURSE UNIT DESCRIPTION - FUNDAMENTALS OF GENETICS

| Course unit (module) title | Code |
|---|---|
| **FUNDAMENTALS OF GENETICS** | |

| Lecturer(s) | Department(s) |
|---|---|
| **Coordinator:** Prof., habil. dr. Juozas LAZUTKA<br><br>**Other(s):** Assoc. Prof. Eglė Čėsnienė | Vilnius University, Department of Botany and Genetics, M.K.Čiurlionio g. 21/27, LT-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 when the course unit (module) is delivered | Language(s) of instruction |
|---|---|---|
| Lectures, laboratory works, exercise | 4th semester, spring | Lithuanian (English) |

| Requirements for students | |
|---|---|
| **Prerequisites:**<br>Biochemistry | **Additional requirements (if any):** |

| Number of credits allocated to the course unit | Student's total workload | Contact hours | | Self-study and research hours |
|---|---|---|---|---|
| **9** | **232** | Lectures | **64** | **120** |
| | | Exercises | **12** | |
| | | Laboratory works | **36** | |

| Purpose of the course unit: programme competences to be developed |
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| Upon the successful completion of this course, students will acquire:<br>*Subject-specific competences:*<br>• basic knowledge of genetic principles underlying life;<br>• skills to perform experiments in genetics and interpret the data obtained;<br>• skills to perform reliable measurements, document and analyse the results of the measurements..<br><br>*General competences:*<br>• skills for self-development, learning skills in order to study general science resources. |

| Learning outcomes of the course unit | Teaching and learning methods | Assessment methods |
|---|---|---|
| Upon the successful completion of this course, students will:<br>• Explain the Mendelian and non-Mendelian modes of inheritance that govern passage of genetic traits across generation; the basic structure and function of DNA and chromosomes as well as how chromosomes move through mitosis and meiosis; the basics of the molecular processes of DNA replication, transcription and translation as well as the important characteristics of the genetic code and gene regulation; the basics of molecular processes of mutation and repair; basic principles of making genetically modified organism; how a genetic sequence is determined and how it helps to understand genetic relationships between species<br>• Apply this knowledge of inheritance to track alleles through generations and categorize and predict | Problem-based teaching, laboratory works, practice and self-study | Three written assessments during the term; three written assessments after the laboratory work; written exam |

| | | |
|---|---|---|
| genotypes and phenotypes; draw and name all the relevant machinery for DNA replication, transcription, and translation; identify the parts of a gene, transcribe it, and then translate it into protein; describe the steps in making a genetically modified organism and be able to predict the outcome of making a mistake in the process; describe the process of genetic sequencing | | |

| **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. Patterns of inheritance** | **20** | | | | | | **20** | **30** | Analyses of appropriate chapters of the textbook. Studying lecture materials and other sources of information. |
| Mendelian inheritance | 6 | | | | | | **6** | 6 | The same |
| Reproduction and chromosome transmission | 2 | | | | | | **2** | 6 | The same |
| Extension of Mendelian inheritance | 2 | | | | | | **2** | 3 | The same |
| Non-Mendelian inheritance | 2 | | | | | | **2** | 3 | The same |
| Genetic linkage and mapping | 4 | | | | | | **4** | 6 | The same |
| Variation in chromosome structure and number | 4 | | | | | | **4** | 6 | The same |
| **2. Molecular structure and replication of genetic material** | **6** | | | | | | **6** | **10** | Analyses of appropriate chapters of the textbook. Studying lecture materials and other sources of information. |
| Molecular structure of DNA and RNA | 2 | | | | | | **2** | 3 | The same |
| Chromosome organisation and molecular structure | 2 | | | | | | **2** | 3 | The same |
| DNA replication | 2 | | | | | | **2** | 4 | The same |
| **3. Molecular properties of genes** | **20** | | | | | | **20** | **30** | Analyses of appropriate chapters of the textbook. Studying lecture materials and other sources of information. |
| Gene transcription and RNA modification | 2 | | | | | | **2** | 3 | The same |
| Translation of mRNA | 2 | | | | | | **2** | 3 | The same |
| Gene regulation in bacteria and bacteriophages | 4 | | | | | | **4** | 6 | The same |
| Gene regulation in eukaryotes | 4 | | | | | | **4** | 6 | The same |
| Gene mutations and repair | 4 | | | | | | **4** | 6 | The same |
| Recombination and transposition | 4 | | | | | | **4** | 6 | The same |
| **4. Genetic technologies** | **8** | | | | | | **8** | **10** | Analyses of appropriate chapters of the textbook. Studying lecture materials and other sources of information. |
| Recombinant DNA technology | 4 | | | | | | **4** | 5 | The same |
| Structural and functional genomics | 4 | | | | | | **4** | 5 | The same |

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|---|---|---|---|---|---|---|---|---|---|
| **5. Genetic analyses of individuals and populations** | **10** | | | | | | **10** | **16** | Analyses of appropriate chapters of the textbook. Studying lecture materials and other sources of information. |
| Human genetic diseases and cancer | 2 | | | | | | **2** | 3 | The same |
| Population genetics | 2 | | | | | | **2** | 3 | The same |
| Conservation genetics | 2 | | | | | | **2** | 3 | The same |
| Evolutionary genetics and genomics | 2 | | | | | | **2** | 3 | The same |
| Human genome | 2 | | | | | | **2** | 4 | The same |
| **Laboratory works and exercises** | | | | | | | | | |
| Analysis of sex chromatin | | | | | **4** | | **4** | 1 | Self study of the topic-related textbook material |
| Analysis of chromosome damage in *Allium* cells | | | | | **4** | | **4** | 1 | The same |
| Chromosome analysis in plant meiosis | | | | | **4** | | **4** | 1 | The same |
| Analysis of human karyotype | | | | | **3** | | **3** | 2 | The same |
| Analysis of DNA damage in human cells | | | | | **3** | | **3** | 1 | The same |
| Morphology of *Drosophila melanogaster* | | | | | **2** | | **2** | 1 | The same |
| Monohybrid crosses | | | | | **8** | | **8** | 4 | The same |
| Dihybrid and plyhybrid crosses | | | | | **8** | | **8** | 4 | The same |
| Solving of genetical problems | | | | **12** | | | **12** | 9 | The same |
| **Total** | **64** | | | **12** | **36** | | **112** | **120** | |

| **Assessment strategy** | **Weight,%** | **Assessment period** | **Assessment criteria** |
|---|---|---|---|
| Written assessment of theoretical course I | 10 | After completion of first and second topic of the course | 10 open questions. Completely correct answer – 2 points, incomplete answer – 1 point, incorrect answer – 0 points |
| Written assessment of theoretical course II | 10 | After completion of third topic of the course | 10 open questions. Completely correct answer – 2 points, incomplete answer – 1 point, incorrect answer – 0 points |
| Written assessment of theoretical course III | 10 | After completion of fourth and fith topic of the course | 10 open questions. Completely correct answer – 2 points, incomplete answer – 1 point, incorrect answer – 0 points |
| Written assessment of practical course I | 10 | After first, second and third laboratory work | 10 open questions. Completely correct answer – 2 points, incomplete answer – 1 point, incorrect answer – 0 points |
| Written assessment of practical course II | 10 | After fourth and fith laboratory work | 10 open questions. Completely correct answer – 2 points, incomplete answer – 1 point, incorrect answer – 0 points |
| Written assessment of practical course III | 10 | After completion of all laboratory works and exercises | 10 open questions. Completely correct answer – 2 points, incomplete answer – 1 point, incorrect answer – 0 points |
| Final exam | 40 | After the course | 20 open questions and problem solving tasks. Completely correct answer – 2 points, incomplete answer – 1 point, incorrect answer – 0 points |
| Total | 100 | | Final mark is based on cummulative score.<br><50 % of posible points – failed (insufficient)<br>50-55 % – 5 (weak)<br>56-60 % – 6 (satisfactory)<br>61-70 % – 7 (average)<br>71-80 % – 8 (good)<br>81-90 % – 9 (very good)<br>>90 % – 10 (excellent) |

| **Author** | **Year of publica-** | **Title** | **Issue of a periodical** | **Publishing place and house or web link** |
|---|---|---|---|---|

| | tion | | or volume of a publication | |
|---|---|---|---|---|
| **Compulsory reading** | | | | |
| R.J. Brooker | 2011 | Genetics: Analysis and Principles, 4th edn. | | McGraw-Hill Higher Education |
| Paulauskas A., Slapšytė G., Morkūnas V. | 2003 | Methods and exercises in general Genetics (in Lithuanian) | | |
| **Optional reading** | | | | |
| D. Hyde | 2009 | Introduction to Genetic Principles | | McGraw-Hill Higher Education. |