# COURSE UNIT DESCRIPTION – BIOSTATISTICS

| Course unit title | Code |
|---|---|
| **BIOSTATISTICS** | |

| Lecturer(s) | Department(s) |
|---|---|
| **Coordinator:**<br>Lect. Dr. Daiva Dabkevičienė | Faculty of Natural Sciences, Dept. Biochemistry and Molecular Biology, 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 of delivered | Language(s) of instruction |
|---|---|---|
| Face to face | 6th semester, spring | Lithuanian (English) |

| Prerequisites and corequisities | |
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| **Prerequisites:** Mathematical analysis and differential equations, Probability theory and mathematical statistics, fundamentals of Biology | **Corequisities (if any):** None |

| Number of credits allocated to the course unit | Student's total workload | Contact hours | Self-study and research hours |
|---|---|---|---|
| **5** | **133** | **48** | **85** |

**Purpose of the course unit: programme competences to be developed**

The course unit aims to develop:

*Subject-specific competences:*

- knowlede on the role of Biostatistics in research;
- ability to apply descriptive and inferential Biostatistics according to the type of data and/or experimental design for answering a particular research question.
- skills to determine appropriate mathematical equations and statistical models for diverse biological processes.
- skills to interpret results of statistical analyses;
- skills to draw science-based conclusions and present it in written and verbal forms.

*General competences:*

- ability to use computer skills as tools for expression and communication, for accessing information sources, for data and document filling, for presentation tasks, for learning and research;
- skills for self-development, learning skills in order to study general science resources;
- ability to communicate in written and verbal forms using correct Lithuanian in professional field.

| Learning outcomes of the course unit | Teaching and learning methods | Assessment methods |
|---|---|---|
| After successful completion of this course student should be able to:<br>• Summarise data with descriptive statistics;<br>• Describe basic concepts including probabilities, conditional and independent events; discrete and continuous random variables, common models for probability distributions. | Lectures,<br>Exercises,<br>Self-study. | Midterm exam.<br>Test.<br>Final test of exercises. |
| • Describe Inferential Biostatistics.<br>• Perform systemic analysis of biomedical data: formulate the scientific issue in the form of a statistical null hypothesis and alternate hypothesis; optimise the number of variables; determine the kind of variables; based on the hypothesis to be tested, choose the best statistical test to use; | Lectures,<br>Exercises,<br>Self-study. | Test.<br>Final test of exercises.<br>Final exam. |

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| examine the data to see if it meets the assumptions of the chosen statistical test (normality, homoscedasticity, etc.). | | |
| • Perform each statistical test in Excel, STATISTICA and SigmaPlot 12.3.<br>• Prepare and present correct research findings and results. | Lectures,<br>Exercises,<br>Self-study. | Final test of exercises. |

| Content: breakdown of the topics | Contact hours | | | | | | Self-study work: time and assignments | |
|---|---|---|---|---|---|---|---|---|
| | Lectures | Tutorials | Seminars | Exercises | Laboratory work | **Contact hours** | **Self-study hours** | **Assignments** |
| Introduction to Biostatistics: history of the Biometrics and Biostatistics; development of an actual Biomedical study; role of Biostatistics in research work.<br>Descriptive statistics; numeric and graphic tools for disaplaying experimental data. | 4 | | | | | **4** | **7** | Self-directed learning of the topic-related textbook material |
| II<br>Introduction to Probability theory and Matematical treatment.<br>Conditional probability; Bayes' Theorem; Inverse probability.<br>Independent probability; Bernoulli Trials.<br>Discrete probability distributions.<br>Continuous probability distributions. | 6 | | | | | **6** | **10** | Self-directed learning of the topic-related textbook material |
| III<br>Introduction to Statistical inference. The relationship between population and sample.<br>The basic methods of Estimation including Confidence intervals.<br>Estimation of the Mean of a distribution; t distribution.<br>Estimation of the Variance of a distribution; Chi-square distribution.<br>Estimation for a Binomial distribution.<br>Estimation for a Poisson distribution. | 6 | | | | | **6** | **14** | Self-directed learning of the topic-related textbook material |
| IV<br>Hypothesis testing:<br>One-sample inference;<br>Two-sample Inference;<br>Multisample inference;<br>Categorical data.<br>Non-parametric methods. | 8 | | | | | **8** | **17** | Self-directed learning of the topic-related textbook material |
| V<br>Regression and Correlation methods. | 4 | | | | | **4** | **8** | Self-directed learning of the topic-related textbook material |
| VI<br>Introduction to Experimental Design.<br>Survival analysis.<br>Design and analysis techniques for Epidemiologic studies | 4 | | | | | **4** | **12** | Self-directed learning of the topic-related textbook material |
| **Exercises** | | | | | | | | |
| 1. Descriptive statistics. Distributions of random variables. | | | | **2** | | **2** | **2** | Self-directed learning of the topic-related material (course virtual learning environment) |
| 2. Random variables estimates. Confidence intervals. | | | | **2** | | **2** | **2** | Self-directed learning of the topic-related material (course virtual learning environment) |
| 3. Statistical hypothesis testing. Analysis of | | | | **6** | | **6** | **6** | Self-directed learning of the |

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|---|---|---|---|---|---|---|---|---|
| Variance | | | | | | | | topic-related material (course virtual learning environment) |
| 4. Correlation and regression analysis. | | | | **2** | | **2** | **2** | Self-directed learning of the topic-related material (course virtual learning environment) |
| 5. Special techniques for design and analysis | | | | **2** | | **2** | **2** | Self-directed learning of the topic-related material (course virtual learning environment) |
| 6. Final test of exercises. | | | | **2** | | **2** | **3** | Self-directed learning of the topic-related material (course virtual learning environment) |
| **Total** | **32** | | | **16** | | **48** | **85** | |

| **Assessment strategy** | **Weight,%** | **Assessment period** | **Assessment criteria** |
|---|---|---|---|
| Midterm exam | 20 | 9-10$^{th}$ week of the course. | Multiple choice statistical questions, open answer questions.<br>2-4 (insufficient)<br>5 (sufficient)<br>6 (satisfactory)<br>7(highly satisfactory)<br>8 (good)<br>9 (very good)<br>10 (excellent) |
| Test | 15 | 2$^{nd}$, 4$^{th}$ and 6$^{th}$ exercises (first 15 minutes during the exercises). | Test of 10 questions from heard course of lectures.<br>2-4 (insufficient)<br>5 (sufficient)<br>6 (satisfactory)<br>7(highly satisfactory)<br>8 (good)<br>9 (very good)<br>10 (excellent) |
| Exercises | Pass/Fail | The final exam is allowed only when all exercises are completed and defended during the final test until 16$^{th}$ week of the course. | All exercises must be done. |
| | 25 | The last week of the exercises. | Final test of 5 open questions from heard course of exercises.<br>2-4 (insufficient)<br>5 (sufficient)<br>6 (satisfactory)<br>7(highly satisfactory)<br>8 (good)<br>9 (very good)<br>10 (excellent) |
| Final Exam | 40 | Spring term. | Open answer questions from topics III-VI.<br>2-4 (insufficient)<br>5 (sufficient)<br>6 (satisfactory)<br>7(highly satisfactory)<br>8 (good)<br>9 (very good)<br>10 (excellent) |
| Total | 100 | | 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 |
|---|---|---|---|---|
| **Main reading list** | | | | |
| Course virtual learning environment (lectures, PDT materials of instructor textbook) | 2012 | Biostatistics (in Lithianian) | | http://vma.esec.vu.lt |
| V. Čekanavičius, G. Murauskas | 2001 | Statistics I and its applications (in Lithuanian) | Vilnius, TEV | 10 |
| V. Čekanavičius, G. Murauskas | 2002 | Statistics I and its applications (in Lithuanian) | Vilnius, TEV | 10 |
| S.A. Glantz. | 2001 | Primer of Biostatistics. | Mc.Graw-Hill | 1 |
| **Additional reading list** | | | | |
| R.A. Johnson, D.W. Wichern | 1998 | Applied Multivariate Statistical Analysis. | Prentice Hall | 1 |