COURSE UNIT DESCRIPTION - LINEAR ALGEBRA AND GEOMETRY

Course unit title	Code
LINEAR ALGEBRA AND GEOMETRY	

Lecturer(s)	Department(s)
Coordinator: Assoc. prof. dr. Aleksas DOMARKAS	Vilnius University, faculty of Mathematics and Informatics, Naugarduko g. 24, LT-03225, 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	1st semester, autumn	Lithuanian

Prerequisites and corequisities	
Prerequisites: School level course of Mathematics; Linear Algebra	**Corequisities (if any):** None

Number of credits allocated to the course unit	Student's total workload	Contact hours	Self-study and research hours
5	**134**	**64**	**70**

Purpose of the course unit: programme competences to be developed

The course unit aims to develop:

Subject specific competences:

- Competence to analyse data on the basis of numerical analysis skills;

General competences:

- skills for self-development, learning skills in order to study both molecular biology and general science resources.

Learning outcomes of the course unit	Teaching and learning methods	Assessment methods
Upon the successful completion of this course, students will: • explain the concepts, methods and structure of linear algebra and analytic geometry ; • formulate (verbally or in text) ideas, propositions and proofs of linear algebra and analytic geometry using the appropriate language; • solve mathematical problems using techniques from of linear algebra and analytic geometry; • explain the basic information technology systems and methods applicable to solving linear algebra and geometry tasks. • acquire advanced logical reasoning, integrated problem-solving and proof writing skills; • be able to apply methods of calculus to analyse biological data.	Lecture, Practice classes, Individual reading	Tests (written) Exam (written)

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. Matrices, operations with matrices. The determinant of a matrix. Properties of determinants. Inverse matrix. The rank of a matrix.	4			4			**4**	**4**	Individual reading, Problem solving
2. Systems of linear equations. Cramer's rule. The Gauss method. Kronecker-Capelli theorem. Homogeneous Systems of Linear Equations. Examples.	6			6			**12**	**12**	
3. Vector spaces. Linear operations with vectors. Linearly dependent and independent vectors. The dimension and basic of vector spaces.	2			2			**4**	**4**	
4. Inner product, the angle between vectors. Euclidean vector spaces. Cross product of two vectors and its properties.	2			2			**4**	**4**	
5. Eigenvalues and eigenvectors. Orthogonal matrices. Quadratic forms. Reduction to canonical form.	2			2			**6**	**6**	
6. The complex numbers. The arithmetic operations with complex numbers. Polar form of a complex number. Powers and roots.	2			2			**4**	**4**	
7. Equations of a line in the plane. The angle between two lines. The distance between a point and a line.	2			2			**8**	**8**	
8. Various equation forms of a plane in the space. Equations of a line in the space. The distance between a point and a plane.	2			2			**4**	**4**	
9. Second-order curves. Circle. Ellipse. Hyperbola. Parabola.	4			4			**6**	**6**	
10. Transformation formulas of Cartesian coordinates. Plane transformations – rotation, homothety, reflection, translation. Transformation general equation of second degree to canonical form.	2			2			**4**	**4**	
11. Polar and parametric equations of a curves in the plane. Examples.	2			2			**4**	**4**	
12. Surfaces of the second order. Ellipsoid, hiperboloid, paraboloid, cone. Rotation and cylindric surfaces.	2			2			**4**	**4**	
Exam.								**6**	Preparation for the exam
Total	**32**			**32**			**64**	**70**	

Assessment strategy	**Weight,%**	**Assessment period**	**Assessment criteria**
Tests (written)	20+20	8th and 15th weeks of the course	Each test consists of 5-10 problems. Pass:

			10 (excellent) - ≥92% 9 (very good) – 82 – 91% 8 (good) – 74 – 81% 7 (highly satisfactory) – 66 - 73% 6 (satisfactory) – 58 - 65% 5 (sufficient) – 50 -57% <u>Faill:</u> 4 (insufficient) 40 - 49% 3 – 30 - 39% 2 – 20 - 29% 1 - ≤ 19%
Exam (written)	60	January	Final exam consists of 2 theory questions and 3-5 problems. <u>Pass:</u> 10 (excellent) - ≥92% 9 (very good) – 82 – 91% 8 (good) – 74 – 81% 7 (highly satisfactory) – 66 - 73% 6 (satisfactory) – 58 - 65% 5 (sufficient) – 50 -57% <u>Faill:</u> 4 (insufficient) 40 - 49% 3 – 30 - 39% 2 – 20 - 29% 1 - ≤ 19%
Total	100		Accumulative score

Author	**Year of publica-tion**	**Title**	**Issue of a periodical or volume of a publication**	**Publishing place and house or web link**
Compulsory reading				
Pekarskas V.	2005	Short Course in Mathematics (in Lithuanian)		Technologija
Rumšas P.	1976	Short Course in Mathematics (in Lithuanian)		Mintis
Kubilienė M, Stankevičienė V.	2005	Linear and Vectorial Algebra (Problems)(in Lithuanian).		Technika
Optional reading				
Pekarskas V., Pekarskienė A.	2004	Elements of Linear Algebra and Aanalytical Geometry (in Lithuanian)		Technologija
Pridotkas G., Švitra D.	1997	Practice in Mathematics (in Lithuanian)	1 d.	TEV
Matuliauskas A.	1985	Algebra (in Lithuanian)		Mintis
Pincevičius A., Domarkas A., Pakenienė V.	2007	Applied Works of Mathematics (in Lithuanian)		LKA
Beezer R.	2009	A First Course in Linear Algebra		http://linear.ups.edu/
Matthews K,	1991	Elementary Linear Algebra		http://www.numbertheory.org/book/