Subject code	ECTS credits
MAT 3003	6

Course title in Lithuanian

DIFERENCIALINĖS LYGTYS

Course title in English

DIFFERENTIAL EQUATIONS

Short course annotation in Lithuanian (up to 500 characters)

Diferencialinių lygčių pavyzdžiai. Pirmosios eilės diferencialinės lygtys, pagrindinės sąvokos. Koši uždavinys. Bendrasis, atskirasis ir ypatingasis sprendinys. Diferencialinių lygčių sistemos. Aukštesniosios eilės diferencialinės lygtys. Fundamentalioji sprendinių sistema. Tiesinės diferencialinės lygtys, lygtys su pastoviaisiais koeficientais. Fazinė erdvė. Vektoriniai ir krypčių laukai. Sprendinio egzistavimo ir vienaties teorema. Dvimačių diferencialinių lygčių sistemų kokybinė analizės pradmenys. Pirmieji integralai. Liapunovo stabilumas.

Short course annotation in English (up to 500 characters)

This course aims to develop understanding in ordinary differential equations. The content includes: examples of differential equations; first order differential equations; the Cauchy problem; general, particular and special solutions; systems of ordinary differential equations; higher order ordinary differential equations; fundamental system; linear differential equations; equations with constant coefficients; phase space; vector and direction fields; existence and uniqueness theorems; a qualitative approach in the plane; first integrals; Lyapunov's stability definition.

Prerequisites for entering the course

Mathematical Analysis. Algebra. Geometry.

Course aim

Course aim is to provide students with main theoretical and practical knowledge and skills of ordinary differential equations.

Links between course outcomes, criteria of learning achievement evaluation, study methods and methods of learning achievement assessment

No	Course outcomes	Criteria of learning achievement evaluation	Study methods	Methods of learning achievement assessment
1	Perform the ability to recognize first order differential equations	Student recognizes main types of ordinary differential equations and problems	Lectures, practical works, individual work, consulting	Mid-term exam, assessment of practical works
2	Knowledge and understanding on Cauchy problem, general, particular and special solutions	Student demonstrates the ability to solve simplest equations and find general, particular and special solutions	Lectures, practical works, individual work, consulting	Mid-term exam, assessment of practical works
3	Perform the ability to recognize and solve linear equations	Student demonstrates the ability to find fundamental system; to solve equations with constant coefficients	Lectures, practical works, individual work, consulting	Final exam, assessment of practical works
4	Knowledge and understanding on geometric theory of differential equations	Student demonstrates the ability to define phase space, vector and direction fields	Lectures, practical works, individual work, consulting	Final exam, assessment of practical works
5	Qualitatively analyze differential systems in the plane	Student demonstrates the ability to draw phase portraits	Lectures,	Final exam, assessment of practical works

			practical works, individual work, consulting	
6	Perform the ability to understand main properties of the solutions of differential equations	Student demonstrates the ability to formulate and prove main theorems of the course	Lectures, practical works, individual work, consulting	Mid-term exam, Final exam

Links between study programme outcomes and course outcomes

Study programme outcomes	Running number of course outcome					
	1	**2**	**3**	**4**	**5**	**6**
Comprehend and be able to apply classical analytical and numerical methods as well as the main algorithms for solving differential equations	+	+	+	+	+	
Identify the problem, collect and analyze real/theoretical data using various mathematical methods, tools and IT technologies	+		+		+	
Operating with formal mathematical symbols and terms, determine mathematical connections between various mathematical quantities; conceive mathematical propositions and logical proofs, construct and prove new statements	+		+			+
Think logically and analytically, evaluate alternative ways of task solving and implement optimal solutions	+		+		+	+

Content

No	Content (topics)
1.	Examples of differential equations.
2.	Main concepts of the first order differential equations.
3.	Cauchy problem. General, particular and special solutions.
4.	Systems of differential equations.
5.	Higher order differential equations.
6.	Linear differential equations.
7.	Fundamental system of solutions.
8.	Linear differential equations with constant coefficients.
9.	Phase space.
10.	Vector and direction fields.
11.	Introduction to qualitative analysis of two dimensional differential equations.
12.	First integrals.
13.	Existence and uniqueness theorem.
14.	Lyapunov's stability.

Distribution of workload for students (contact and independent work hours)

Lectures	**45 hours**
Practical work	**30 hours**
Individual students work	**85 hours**
Total:	**160 hours**

Structure of cumulative score and value of its constituent parts

Final written exam (50%), mid-term written exam (25%), assessment of practical work (25%).

Recommended reference materials

No	Publication year	Authors of publication and title	Publishing house	Number of copies in		
				University library	*Self study rooms*	*Other libraries*
Basic materials						
1	2000	Golokvosčius P. Diferencialinės lygtys.	Vilnius, TEV	9	3	

		(Differential Equations)				
2	2008	Ambrazevičius A. Diferencialinės lygtys	Vilnius			https://mif.vu.lt/lt3/dokumentai/dokumentai/DLSM_/dif_lygtys_pdf.pdf
3	1997	Arnold V.I. Ordinary Differential Equations	Springer Verlag		2	
4	2004	Robinson J.C. An introduction to ordinary differential equations.	Cambridge University Press		2	
Supplementary materials						
1	2012	Nagle K. Saff E.B., Snider A.D. Fundamentals of Differential Equations	Addison-Wesley			
2	1982	Arrowsmith D.K., Plasce C.M. Ordinary differential equations. A qualitative approach with applications.	London New York, Chapman and Holl			

Course programme designed by

Assoc. prof. dr. Sigita Pečiulytė