Subject code	ECTS credits
MAT5017	6

Course title in Lithuanian

DIFERENCIALINIŲ LYGČIŲ TAIKYMAI

Course title in English

APPLICATIONS OF DIFFERENTIAL EQUATIONS

Short course annotation in Lithuanian (up to 500 characters)

Realios situacijos matematinio modelio esmė ir modeliavimo metodai. Diferencialinių lygčių analitiniai ir skaitiniai sprendimo metodai. Kokybinė diferencialinių lygčių teorija ir jos taikymai. Mechanikos, fizikos, chemijos, biologijos ir ekonomikos matematiniai modeliai, taikant diferencialines lygtis. Matematinių modelių realizavimo ir kalibravimo metodai.

Short course annotation in English (up to 500 characters)

Mathematical modelling of the real situation (sense and methods). Differential equations solving methods (analytical and numerical). Qualitative theory of differential equations. Applications of differential equations to mechanics, physics, biology and economics. Mathematical models and their realization and calibration.

Prerequisites for entering the course

Mathematical Analysis (integration), Differentials Equations, Numerical methods

Course aim

Course aim is to provide knowledge of basic concepts of mathematical modelling

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.	Knowledge and understanding of mathematical models	Student demonstrates the ability to understanding of mathematical models sense.	Lectures, practical works, individual work, consulting	Mid-term exam, Assessment of practical works
2.	Knowledge and understanding of an analytical methods of differential equations solving	Student demonstrates the ability to understanding of analytical methods of differential equations solving	Lectures, practical works, individual work, consulting	Mid-term exam, Assessment of practical works
3.	Knowledge and understanding of an numerical methods of differential equations solving	Student demonstrates the ability to understanding of a numerical methods of differential equations solving	Lectures, practical works, individual work, consulting	Mid-term, Assessment of practical works
4.	Knowledge and understanding of the qualitative theory of differential equations	Student demonstrates the ability to understanding of the qualitative theory of differential equation	Lectures, practical works, individual work, consulting	Final exam, Assessment of practical works
5.	Knowledge and understanding of the applications of differential equations to mechanics, physics, biology and economics	Student demonstrates the ability to understanding of the applications of differential equations to mechanics, physics, biology and economics	Lectures, practical works, individual work, consulting	Final exam, Assessment of practical works

Links between study programme outcomes and course outcomes

Study programme outcomes	Running number of course outcome				
	1	2	3	4	5

1. Deepen and expand general knowledge of mathematics and apply it in a new non-standard environment	+				+
2. Broaden and apply the knowledge of mathematical modelling for the economy and technical systems	+	+	+	+	+
4. Identify, select and understand the state-of-the-art literature of mathematics and apply the gained knowledge to specific scientific and practical tasks		+	+	+	+
7. Analyse, understand and use mathematical methods	+	+	+	+	+

Content

No	Content (topics)
1.	Differential equations as mathematical models
2.	Ordinary Differential equations of elasticity theory
3.	Bars with continuously varying loads and/or dimensions
4.	An analytical solution for Kepler's problem
5.	Equations of motion in an internal frame (two body problem)
6.	Circular, elliptical, parabolic and hyperbolic trajectories
7.	Restricted three body problem
8.	Second order nonlinear autonomous systems (qualitative approach)
9.	Adaptive Runge-Kutta method for solving Cauchy problem of nonlinear autonomous systems

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

Lectures	**45 hours**
Practical work	**15 hours**
Individual students work	**100 hours**
Total:	**160 hours**

Structure of cumulative score and value of its constituent parts

Final written exam (50%), mid-term written exam (25%), and assessments of practical works (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.	2001	Samarskii,A.A., Mikhailov,A.P., Principles of Mathematical Modelling - Ideas, Methods, Examples	Taylor & Francis, London		1	
2.	2013	Leonavičienė, T., Čiegis, R., Kirjackis J. Diferencialinės lygtys ir jų taikymas	Technika, Vilnius	2	2	Textbook online
3.	1976	Mathematical modelling Ed. by J. Andrews and R. MacLone,	Butterwort, London		1	
4.	2009	Kleiza, V. Laplaso transformacija: kompiuterinės algebros metodai.	Technologija, Kaunas		2	
Supplementary materials						
1.	2002	J. Farlow, J. Hall, J. McDill, B. West. Differential equations & linear algebra	Prentice Hall, New Jersey			

Course programme designed by

Prof. habil.dr.Vytautas Kleiza