MODULE DESCRIPTION

Module title	Module code
Differential Equations	

Lecturer(s)	Department where the module is delivered
Coordinator: prof. dr. Stasys Rutkauskas **Other lecturers:**	Department of Differential Equations and Numerical Mathematics, Faculty of Mathematics and Informatics Vilnius University

Cycle	Type of the module
First	Optional

Mode of delivery	Semester or period when the module is delivered	Language of instruction
Face-to-face	5th and 7th semester	Lithuanian

Prerequisites
Prerequisites: Mathematics for Software Engineering I and II.

Number of credits allocated	Student's workload	Contact hours	Self-study hours
5	130	68	62

Purpose of the module: programme competences to be developed

Purpose of the module is to educate the competence by expansion of the systemic perception of mathematical knowledge, to educate the competence in the modeling of various processes by ordinary differential equations (ODE's) and the competence by solving of such models.

Generic competences:

- Communication and collaboration *(GK1).*
- Life-long learning *(GK2).*

Specific competences:

- Knowledge and skills of underlying conceptual basis *(SK4).*
- Software development knowledge and skills *(SK5).*

Learning outcomes of the module: students will be able to	Teaching and learning methods	Assessment methods
Communicate in a field of ODE's and related areas.	Lectures Practices Individual reading Solving of given problems	Tests (written) Exam (written)
Define the main concepts of the ODE's theory and illustrate them by the examples.		
State and prove the main propositions of the theory of ODE's.		
Apply acquired knowledge by solving of the problems related to ODE's.		
Model the simplest determinable dynamical processes and justify the adequacy of a model to the real process;		
Analyse and solve mathematical models describing by ODE's.		

Content: breakdown of the topics	Contact hours							Self-study work: time and assignments	
	Lectures	Tutorials	Seminars	Practice	Laboratory work (LW)	*Tutorial during LW*	**Contact hours**	**Self-study hours**	**Assignments**
Main concepts and definitions. First order differential equations. Particular and general solutions, general integral. Directions field. Caushy problem, existence and uniqueness of their solution.	4			2			**6**	**4**	Individual study of literature, solving of given problems
Main types of the first order equations and the methods of their integration.	4			4			**8**	**6**	
Equations of the higher order. Caushy problem, existence and uniqueness of their solution. Order reduction of the equations..	4			2			**6**	**4**	
Linear equations of higher order and their general properties. Equations with constant coefficients. Characteristic polynomial. The structure of linear independent solutions.	4			4			**8**	**6**	
Second order linear equations (homogeneous and non-homogeneous). Method of the constants variations. Equations of free and forced oscillations, equation of electric chain and others.	4			4			**8**	**6**	
The systems of differential equations and their general properties Caushy problem. Systems of the linear equations with constant coefficients. Integration of these systems.	4			4			**8**	**6**	
Mechanical interpretation of the systems of normal differential equations. Phase trajectories. Balance points.	4			4			**8**	**6**	
Conception of the stability (in the Liapunov sense). Classification of the balance points and the phase trajectories in their neighborhood.	4			4			**8**	**6**	
Tests (written)				4			**4**	**6**	
Exam (written)		2					**4**	**12**	2 hours for tutorial, 12 hours for preparation, 2 hours for exam
Iš viso	**32**	**2**		**32**			**68**	**62**	

Assessment strategy	Weight %	Deadline	Assessment criteria
Tests (written)	40	During the semester	Two tests are written: in the middle and at the end of the semester. The results of each test are valued in the decimal system . The final mark P_1 is given by formulae $$P_1=(K_1+K_2)\times 0{,}2;$$ here K_1 and K_2 are the ratings of the first test and of the second test.
Exam (written)	60	During exam session	The exam tasks include theoretical questions and some practical problems of ODE's. The mark P_2 of exam is given by the formulae $$P_2=E\times 0{,}6;$$ here E is the exam rating in the decimal system.

Author	Publishing year	Title	Number or volume	Publisher or URL
Required reading				
P. Golokvosčius	2000	Differential Equations (in Lithuanian)		Vilnius: TEV
S. Rutkauskas	2008	Introduction to Theory Differential Equations (in Lithuanian)		Vilnius: VPU press
Recommended reading				
D.K. Arrowsmith, C.M. Place	1982	Ordinary Differential Equations. A qualitative approach with applications		London New York: Chapman and Hall
S.Rutkauskas	2008	Asymptotic Methods for Ordinary Differential Equations (in Lithuanian)		Vilnius, Mokslo aidai
J. D. Meiss	2007	Differential Dynamical Systems		Philadelphia: SIAM, Mathematical Modeling and Computation
А.Ф. Филиппов	2002	Problems of Differential Equations (in Russian)		Москва-Ижевск: НИЦ «Регулярная и хаотическая динамика»