M090	Obligatory Semester 5	**Ordinary Differential Equations**	L	S	E	ECTS
			2	0	2	6

Course objectives. Introduce students with the concept and geometric meaning of ordinary differential equations as well as general theorems of existence and uniqueness of solutions. Demonstrate basic types and methods for finding a solution with particular emphasis on the theory of linear equations.

Course prerequisites. Differential Calculus, Integral Calculus, Basic knowledge of Multivariable Calculus.

Syllabus.

1. Introduction. Sources of ordinary differential equations (Problems of growth, radioactive decay, cooling problems, electrical networks, the predator / prey model, system of several masses and springs). Notion of solution, Cauchy problem. The slope field and geometric meaning. Classification of differential equations.
2. Ordinary differential equations of the first order. Existence and uniqueness theorems: Picard, Cauchy and Peano. Problem of sensibility on change of initial conditions. Introduction to numerical methods. Equation with separable variables, linear and exact equation. Solving some special types of equations (homogeneous, Bernoulli, Lagrange, Clairaut, Riccati, equations of higher order, which allow reduction of order). Applications.
3. Systems of ordinary differential equations and equations of higher order. Equivalence theorem. Existence and uniqueness result for Cauchy problem.
4. General results for linear equations and systems. Global solution. Fundamental system of solutions, matrix and determinant of Wronski. Evolution matrix of linear system. Lagrange's method of variation of constants.
5. Linear systems and equations with constant coefficients. Fundamental system of solutions and matrix exponential function. Method of undetermined coefficients. Laplace transform. Stability of the system. Applications.
6. Partial differential equation. Concept and examples from applications.

LEARNING OUTCOMES

Num.	**LEARNING OUTCOMES**
1.	Identify some real world problems that can be modelled by differential equations
2.	Identify and explain fundamental concepts, such as a solution of equation, Cauchy problem, slope field and sensitivity to initial conditions
3.	Classify differential equations by various criteria
4.	Express in their own words conditions that ensure the existence (and uniqueness) of a solution of the Cauchy problem
5.	Solve different types of equations of the first order as well as higher order equations that allow reduction of order
6.	Recognize and clarify characteristic properties of linear equations and systems
7.	Solve linear equations and systems
8.	Recognize basic examples of partial differential equations
9.	Clearly explain their conclusions to experts and laity, based on knowledge and arguments

CONNECTING LEARNING OUTCOMES, ORGANIZATION OF TEACHING PROCESS AND ASSESSMENT OF STUDENT LEARNING OUTCOMES

TEACHING PROCESS ORGANIZATION	ECTS	LEARNING OUTCOME **	STUDENT ACTIVITY*	EVALUATION METHOD	SCORE	
					min	max
Lecture attendance	1	1-9	Attending lectures, discussions, teamwork and individual work on tasks	Participant lists, monitoring activities on class	0	4
Mid-term exam (preliminary exam)	2	1, 5, 7, 9	Preparation for written exam	Checking the correctness of solutions	19	38
Final exam	2	1-9	Revision of subject matter	Oral exam	19	38
TOTAL	5				50	100

Teaching methods and student assessment. Lectures and exercises are mandatory. The exam consists of a written and oral part and is taken after the completion of lectures and exercises. Acceptable scores achieved in mid-term exams taken throughout the semester replace the written part of examination.

Can the course be taught in English: Yes.

Osnovna literatura:

1. M. Braun, Differential equations and their applications, Springer-Verlag, New York, 1993.

Dopunska literatura:

1. M. Alić, Obične diferencijalne jednadžbe, PMF - Matematički odjel, Zagreb, 2001.
2. I. Ivanšić, Fourierovi redovi. Diferencijalne jednadžbe, Odjel za matematiku, Osijek, 2000.
3. W. E. Boyce, R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 7th edition, John Wiley & Sons, 2000.
4. G. F. Simmons, J. S. Robertson, Differential Equations with Applications and Historical Notes, 2nd Ed., McGraw-Hill, Inc., New York, 1991.
5. I. I. Vrabie, Differential Equations, AnIntroduction to Basic Concepts, Results and Applications, World Scientific Publishing Co. Pte. Ltd., 2004.
6. B. P. Demidovič, Zadaci i riješeni primjeri iz više matematike s primjenom na tehničke nauke, Tehnička knjiga, Zagreb, 1986.