M141	**Introduction to mathematical physics**	L	P	S	ECTS
		2	1	0	4

Course objectives. To inform students about the basic concepts of mathematical modelling using models from analytical mechanics. Moreover, students will study basics concepts and methods of mathematical physics.

Prerequisites. Multivariable Calculus

Course content.

1. Introduction. Newtonian mechanics. Motion. Newton's equation. Moments. Energy and work. Motion in relative reference system
2. Lagrangian mechanics. Calculus of variations. Lagrange equations. Hamilton's equation. Smooth manifolds.
3. Rigid body. Basic notions. Euler's equations.
4. Linearization of nonlinear models. Modelling of linear system in control theory.

LEARNING OUTCOMES

No.	LEARNING OUTCOMES
1.	Describe basic notions of Newtonian and Lagrangian mechanics.
2.	Formulate axioms of analytical mechanics.
3.	Derive main physical laws from Newtonian mechanics using axioms and based on basic concepts of mathematical logic.
4.	Clearly explain main similarities and differences in approaches and methods of Newtonian and Lagrangian mechanics.
5.	Use basics of calculus of variations for derivation of results within Lagrangian mechanics.
6.	Model and solve different problems of analytical mechanics.
7.	Discuss which mathematical structures and concepts are needed for proofs and derivation of main considered results.
8.	Use linearization for derivation of linear systems.

RELATING THE LEARNING OUTCOMES, ORGANIZATION OF THE EDUCATIONAL PROCESS AND ASSESSMENT OF THE LEARNING OUTCOMES

TEACHING ACTIVITY	ECTS	LEARNING OUTCOME **	STUDENT ACTIVITY*	EVALUATION METHOD	POINTS	
					min	max
Attending lectures and exercises	1	1-8	Lecture attendance, discussion, team work and independent work on given tasks	Attendance lists, tracking activities	0	4
Written exam (Mid-terms)	1	1-8	Preparing for written exam	Evaluation	25	48
Final exam	2	1-8	Revision	Oral exam	25	48
TOTAL	4				50	100

Teaching methods and student assessment. Lectures and exercises are obligatory. The exam consists of a written and an oral part. Upon completion of the course, students can take the exam. Successful midterm exam scores replace the written exam.

Can the course be taught in English: Yes

Basic literature:

1. I. Aganović, K. Veselić, Uvod u analitičku mehaniku, Mat. Odjel PMF, Sveučilište u Zagrebu, 1990.
2. I. Aganović, K. Veselić, Matematički modeli i metode, Sveučilište J. J. Strossmayera u Osijeku – Odjel za matematiku, Osijek, 2014.

Recommended literature:

1. A. Fasano, S. Marmi, B. Pelloni, Analytical mechanics: an introduction, Oxford University Press, Oxford, 2006.
2. A. I. Lurie, Analytical Mechanics, Springer, 2002.
3. J. L. Troutman, Variational calculus and optimal control: optimization with elementary convexity, Springer-Verlag, New York, 1996.