Study programme(s): Mathematics (M), Applied Mathematics (MAP)

Course title: MECHANICS (M139)

Lecturer(s): Srboljub S. Simić

Course status: elective (M), compulsory on module: Techno-mathematics (MAP)

ECTS points: 7

Requirements: Analysis 1 (on M), Differential and Integral Calculus (on MAP)

Learning Objectives

Introducing students to the basic problems of classical mechanics and the mathematical apparatus used in their description and analysis.

Learning Outcomes

Minimal: Students should understand the basic concepts and laws of mechanics and the role of the mathematical apparatus in their formulation.

Desirable: Students should develop a sense of mathematical modeling of mechanical problems and gain experience in formulating and solving them.

Syllabus

Theoretical instructions

Units of measure, physical quantities and vectors. Rectilinear motion of a material point, the notion of velocity and acceleration. Curvilinear motion of a material point, analysis of motion in different coordinate systems, natural components of velocity and acceleration. Newton's laws of motion. Application of Newton's laws. Work and kinetic energy, theorem on change of kinetic energy. Potential energy and energy conservation. Impulse, momentum and collision; the impulse-momentum change theorem, fundamental theorems on the dynamics of a system of material points. Rotational motion of a rigid body. Dynamics of rotational motion, dynamics of plane motion, basic equations of gyroscope theory. Equilibrium and elasticity, Hooke's law. Fluid mechanics, basic properties of fluids, fluids at rest and in motion, Bernoulli's equation. Gravity, Kepler's laws, analysis of motion in a central force field. Oscillatory motion, free, damped and forced oscillations, mathematical and physical pendulum.

Practical instructions:

The exercises follow the exposition materials from the theoretical lectures. Problem solving sessions, examples, exercises.

Literature

1. S .M . Targ: **Teorijska mehanika – kratak kurs**, Građevinska knjiga, Beograd, 1983.
2. V . Vučić, D. Ivanović: **Fizika I**, Naučna knjiga, Beograd, 1989.
3. H.D. Young, R.A. Freedman: **University Physics** (13th Edition), Addison-Wesley, San Francisco, 2012.
4. D. Halliday, R. Resnick, J. Walker: **Fundamentals of Physics** (10th Edition), John Wiley & Sons, New York, 2014.

Number of active classes	**Lectures: 3**	**Exercises: 3**

Teaching methods

Classic plenary lectures accompanied by presentations and numerical simulations on the computer and videos of experiments. Discussion with the students. Exercises focus onto typical problems and training their solutions.			
Grading (maximum number of points 100)			
Pre-exam obligations	Points	**Final exam**	Points
colloquia	**60**	oral exam	**40**