Program	Level of studies		**First cycle**	
	Program name		**Physics**	
Course name	**CLASSICAL MECHANICS I**			
Course ID	Semester	Course status	ECTS credits	L+E
PTH3711	**III**	**MANDATORY**	**7**	**3+3**
Lecturer	**Prof. dr. Azra Gazibegović - Busuladžić**			
Aims and intended learning outcomes	Aim of the course is to teach students the principles of Classical mechanics and apparatus for particle and general holonomic system motion. After successfully completed this course, student will know how to: - Describe and solve particle motion problems in different curvilinear coordinate systems. - Analyze particle central force motion, particularly for inverse square force, and knows how to interpret an effective potential graph. - Student is familiar with dynamic laws for system of particles and characteristic physical quantities, and methods for solving problems of dynamic of particle system with constrains. - Student is familiar with Lagrangian mechanics.			

Course content

Subject, basic concepts and limits of the applicability of Classical mechanics. Kinematics of a particle: mathematical description of the motion, basic kinematic quantities. Curvilinear coordinates. Principles of dynamics: Newton's laws, the principle of determinism, Galilean's principle of relativity. Dynamics of the material particles: differential equations of motion, integrals of motion. Basic dynamic quantities: momentum, angular momentum, kinetic energy, work. Potential Energy and Conservative Forces. Force as the Gradient of Potential Energy. Rectilinear motion, Energy diagrams. Central motion: solution of the equations of motion in polar coordinates, Effective potential, Energy diagrams. Binet's formula. Particle in gravitational or Coulomb field. Particle scattering by a central potential.

Particle system dynamics: differential equations of motion, internal and external forces. Momentum, Center of mass, Angular momentum, Mechanic energy of the system. König's formula - dynamic quantities in the center of mass reference frame. Closed systems, classical integrals of motion. The virial theorem. Variable mass systems: the rocket equation. Two-Body Central-Force Problems. Relative Coordinates, Reduced Mass.

Constrained systems: constraints and normal forces, classification. Possible and virtual displacements, ideal constraints, d'Alembert's principle, Lagrange's equations of the first kind. Motion of a particle on a smooth surface and a smooth line, determination of the Lagrange multipliers. Spherical and mathematical pendulum. Lagrange mechanics: generalized coordinates, Lagrange's equations of the second kind, Lagrange function. Integrals of motion: ignorable coordinates, general energy *H*. Velocity-dependent potentials, appropriate examples. Lagrange equations structure.

Student workload (hours)		Grading	
Lectures and Exercises	90	Assessment method	Points
Exam preparation	85	Midterm exams	55
Total	175	Final exam	45
		Total	100

Literature

1. K. Suruliz, Klasična mehanika, FLAMMULA,2013
2. Corresponding material from the web-site "e-nastava" and notes from the lectures

Additional readings:

1. H. Goldstein, C. Poole, J. Safko, Classical Mechanics, Third Edition, Pearson/Addison-Wesley, Upper Saddle River 2002
2. John R. Taylor, Classical Mechanics, University Science Book, 2005

Remarks

The final exam is oral when possible. Students must score a minimum of 55% of the tests in order to enter the final exam. In order to successfully pass at the final exam, the student must score at least 50% of the points, with the total score at least 55 points.