Course: Symplectic geometry and analytic mechanics

Course instructors: Vladimir Dragović, Borislav Gajić, Božidar Jovanović, Milena Radnović

Course type: elective

Credit points: 10 ECTS

Prerequisites: -

Course objectives:

The course is devoted to the symplectic and Poisson geometry with emphasis on its connections with theoretical mechanics.

Learning outcomes:

Students will learn symplectic geometry through the perspective of theoretical mechanics. They will be able to apply modern geometric techniques in the study of concrete mechanical systems.

Course description (outline):

Theory

1. Smooth manifolds. Vector fields and differential forms.

- 2. Principles of mechanics. Lagrange systems. Legendre transformation.
- 3. Symplectic manifolds. Poisson manifolds. Hamiltonian systems.
- 4. Completely integrable systems, Liouville-Arnold theorem.
- 5. Canonical formalism. Hamilton-Jacobi equations. Method of separation of variables.
- 6. Hamiltonian actions of Lie groups. Symplectic reduction. Poisson reduction.
- 7. Rigid body dynamics.
- 8. Elliptic curves and elliptic functions in mechanics.
- Practice

Homework, Seminars talks

References:

1. V.I. Arnold: Mathematical methods of classical mechanics, Graduate Texts in Mathematics, 60 Springer 1989.

2. В. Драговић, Д. Милинковић, Анализа на многострукостима, примене у геометрији, механици, топологији, Математички факултет, Београд 2003.

3. P. Liberman, C.-M. Marle, Symplectic geometry and analytical mechanics, Kluwer, 1987.

4. J. Marsden, T. Ratiu, Introduction to Mechanics and Symmetry, Springer-Verlag New York, 1999.

5. A. C. da Silva, Lectures on Symplectic Geometry, LNM 1764, Springer 2008.

6. Болотин С.В., Карапетян А.В., Кугушев Е.И., Трещев Д.В., Теоретическая механика, 2010.

 Active teaching hours: 5
 Theoretical classes: 5
 Practice classes:

 Methods of teaching:
 Lectures and practice, with active participation of the students, discussion, seminars, etc.

 Grading structure (100 points)

Grading stracture (100 points)	
Pre-exam obligations	Homework (30 points), Seminar talk (30 points)
Exam	Oral Exam (40 points)