Faculty of Science

FYTN09, Theoretical Physics: Classical Mechanics, 7.5 credits

Teoretisk fysik: Klassisk mekanik, 7,5 högskolepoäng

Second Cycle / Avancerad nivå

Details of approval

The syllabus was approved by Study programmes board, Faculty of Science on 2009-02-04 (N200999). The syllabus comes into effect 2009-02-04 and is valid from the autumn semester 2009.

General information

The course is an elective course for second-cycle studies for a Degree of Master of Science (120 credits) with a specialisation in physics.

Language of instruction: Swedish and English
If needed the course is given in English.

Main field of study	*Specialisation*
Physics	A1N, Second cycle, has only first-cycle course/s as entry requirements

Learning outcomes

The overall aim of the course is to give the student a solid knowledge of Lagrange and Hamilton formulations of classical mechanics with connections to field theory and relativity.
The aims of the course are that, upon completion of the course, the student should have acquired the following knowledge and skills:

- The variation principle and Lagrange's equations: The student can explain d'Alembert's principle and Lagrange's equations. The student can also explain Hamilton's principle with or without constraints and the advantages with a variation principle.
- The central force problem with two bodies: The student can describe the reduction to the equivalent one-body problem, the equations of motion and its solution as well as applying the formalism to the Kepler problem.

- Motion of rigid bodies: The student can explain the movement of a rigid body and how it leads to Euler's equations as well as apply these to a heavy symmetric top.
- Small oscillations: The student can explain the principle behind small oscillations around an equilibrium and describe and apply the principle axes transformation.
- Theory of special relativity: The student can describe the Lagrange formalism for a particle in a relativistic formulation.
- Hamilton formalism: The student can describe the derivation of the Hamilton formalism as well as the principle of least action.
- Canonical transformations, the Hamilton-Jacobi equation and Poisson brackets: The student can explain the principle behind canonical transformations and how it leads to the Hamilton-Jacobi equation and action angle variables.
- Perturbation theory: The student can explain the principle behind time-dependent and time-independent perturbation theory.
- Continuous systems and fields: The student can give a general description of the Lagrange/Hamilton formulation for continuous systems.

Examples of problems that the student should be able to solve upon completion of the course:

- Given a dynamical system derive normal coordinates, eigen frequencies and small oscillations around the equilibrium.
- Show how Euler's equations lead to precession of equinoxes.

Course content

The course consists of the elements described above for a total of 7.5 credits.

Course design

The teaching consists of lectures and exercise sessions, alternatively it consists of supervised literature studies.

Assessment

The examination consists of written hand-in assignments and an oral exam at the end of the course. Students who do not pass the regular exam are offered a new possibility shortly after the regular exam.

Grades

Grading scale includes the grades: Fail, Pass, Pass with distinction
To pass the entire course, it is required to pass both the oral exam as well as the written hand-in assignments.
The final grade is determined by combining the results of the different parts of the examination.

Entry requirements

For admission to the course, English B as well as knowledge equivalent to 60 credits in physics and 45 credits in mathematics is required.

Further information

The course cannot be counted towards a degree together with FYS239.