Faculty of Health, Science and Technology
Physics

Syllabus

Course Approval
The syllabus was approved by the Faculty Board of Health, Science and Technology on 12 February 2014 , and is valid from the Autumn semester of 2014 at Karlstad University.

Course Code: FYGB08
Analytic mechanics I, 7.5 ECTS Credits
(Analytisk mekanik I, 7.5 Swedish credit points)
Degree Level: Bachelor
Progressive Specialisation: G1F (First cycle, has less than 60 credits in first-cycle course/s as entry requirements)

Language of Instruction
Swedish or English

Prerequisites
Completed courses in Mathematics totalling 22.5 ECTS cr and Physics 30 ECTS cr.

Major Field of Study
FYA (Physics), TKA (Engineering Physics)

Learning Outcomes

The aim of the course is that the students acquire thorough knowledge -- both conceptual and applied -- in classical mechanics and the ability to analyze mechanical systems with the help of the Lagrange and Hamilton formalisms.

Upon completion of the course, students should be able to:
- apply the Lagrange and Hamilton formalisms, including variational calculus and the method of Lagrange multipliers, to mechanical systems with a small number of degrees of freedom and with holonomic constraints;
- give an account of the connection between symmetries and conservation laws;
- derive the equations of motion for the Kepler problem, for the rigid body and for oscillation phenomena with the help of the Lagrange or Hamilton formalism, as well as describe the solution of these equations of motion;
-find normal coordinates for solving the equations of motion for small oscillations;
-give an account of basic concepts in the area of special relativity;
-demonstrate an improved ability to interpret scientific texts.

Content and Form of Instruction

The mathematical structure of mechanics:
-Recapitulation of Newton's description of mechanics
-generalized coordinates, Lagrange and Hamilton equations, variational calculus, Hamilton's principle, holonomic and nonholonomic constraints
-symmetries and conservation laws
-canonical transformations, Poisson brackets

-inertial systems, Galilei och Lorentz transformations, the special theory of relativity

Mathematical tools
-Calculus of variations, Legendre transformation, tensor calculus, separation of variables.

Applications
-two-body problem, Kepler problem
-kinematics of rigid bodies, dynamics of rigid bodies
- small oscillations.

Reading List

See separate document.

Examination

Assessment is based on hand-in assignments, written and oral presentation of individual in-depth assignments and an oral exam.

Grades

One of the grades Fail (U), Pass (G), or Distinction (VG) is awarded in the examination of the course.

Quality Assurance

Follow-up relating to learning conditions and goal-fulfilment takes place both during and upon completion of the course in order to ensure continuous improvement. Course evaluation is partly based on student views and experiences obtained in accordance with current regulations and partly on other data and documentation. Students will be informed of the result of the evaluation and of any measures to be taken.

Course Certificate

A course certificate will be provided upon request.

Additional Information

Students who enrolled before 1 July 2007 will complete their studies in accordance with the requirements of the earlier admission. Upon completion students may request degree and course certificates to be issued under the current ordinance if they meet its requirements.

The local regulations for studies at the Bachelor's and Master's levels at Karlstad University stipulate the obligations and rights of students and staff.

Karlstads universitet 651 88 Karlstad, Sweden
Tel +46-54-700 10 00 Fax +46-54-700 14 60
information@kau.se www.kau.se