SG1113 Mechanics, Continuation Course 6.0 credits

Mekanik, fortsättningskurs

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

Course syllabus for SG1113 valid from Autumn 2008

Grading scale

A, B, C, D, E, FX, F

Education cycle

First cycle

Main field of study

Mechanical Engineering,Technology

Specific prerequisites

The first year algebra and calculus courses, and the basic mechanics course (SG1130).

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

Overall aim
After passing this course the student should be able to

- Starting from a given problem, make idealizations, with motivations construct a mathematical model, and with mathematical and numerical methods, analyze the model for different values of given parameters, and interpret and critically analyze the result.
- Differentiate between reality and mathematical model and understand the connection between observations and model building which includes axioms, postulates, theorems, laws, and lemmas.

Measurable aims
After passing this course the student should be able to

- Define the basic concepts in mechanics for a system of particles and for a rigid body and to explain the connections between them. The concepts here are for example constraints, degrees of freedom, centre of mass, velocity, acceleration, angular velocity, angular acceleration, force, mass, moment of inertia, and moment of force.
- Identify a number of mechanical quantities such as momentum, angular momentum, impulse, moment of impulse, work, kinetic and potential energy for systems of particles and rigid bodies. Lagrange function, generalized momenta, and the Hamilton function for conservative systems.
- Analyze problems in an accelerated reference frame and explain the concepts needed for this.
- Describe the structure of the subject of mechanics and explain crucial mechanical phenomena such as coplanar motion, rotation about a fixed axis, impact phenomena.
- Formulate the laws of motion and deduce the connections between them
- Explain, calculate, and analyze central problems in rigid body mechanics as for example rotation about a fixed axis, rolling, and general coplanar motion.
- Analyze the state of motion of a rigid body and find out how the velocities and accelerations in different points are connected.
- Calculate forces and/or acceleration for a rigid body in motion.
- Starting from Euler's laws write down mathematical models for different types of rigid body motions and make calculations of these motions.
- Formulate a mathematical model for a given problem and analyze the model with relevant mathematical methods and make a simple numerical analysis of the model, using results from courses in these subjects.
- Analyse the mathematical model using numerical and symbolical computer tools in order to effectively investigate and visualize the properties of the system.
- Explain central concepts in analytical mechanics, analyze motion using Lagrange's method, Explain Hamilton's principle, variational principles, Derive Hamilton's canonical equations.

Course contents

The laws of mechanics for a system of particles. Rigid body two dimensional kinematics. Moments of inertia and products of inertia. Rigid body two dimensional dynamics. The laws of mechanics in accelerated reference frames.

Course literature

Rigid body and analytical mechanics by Nicholas Apazidis (Inst. för Mekanik).

Examination

- INL1 - Hand in Task, 1.5 credits, grading scale: P, F
- TENA - Examination, 1.5 credits, grading scale: A, B, C, D, E, FX, F
- TENB - Examination, 3.0 credits, grading scale: A, B, C, D, E, FX, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.