SG1131 Mechanics I 11.0 credits

Mekanik I

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 valid from Fall 2022

Grading scale

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

Education cycle

First cycle

Main field of study

Technology

Specific prerequisites

First year KTH course.

Language of instruction

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

Intended learning outcomes

The students should be able to, starting with a concrete mechanical problem, make idealizations, motivate and create a mathematical model, solve it using mathematical or numerical methods and finally critically scrutinize the result. Further the students should be able to differentiate between reality and theoretical model and understand the interaction between basic observations, model building, and axioms, postulates, laws and their consequences.

Measurable aims: After passing the course the students should be able to: Define the basic concepts and quantities in mechanics and explain how they are related, e.g. velocity, acceleration, mass, time, force, and moment of force. Formulate the laws of motion and derive the connections between them, e.g. Newton’s laws for particles, inertial systems, laws about equilibrium of rigid bodies. Identify and define typical systems of forces and a manifold of more abstract mechanical quantities (center of mass, momentum, angular momentum, resultant force, impulse, angular impulse, work, kinetic and potential energy, conservative and non-conservative forces). Discuss central mechanical phenomena (such as free fall, free damped and undamped harmonic oscillation, forced oscillation, resonance, Kepler motion, elastic and completely inelastic impact, etc). Prove abstract energy and momentum laws starting from Newton’s laws. Analyze given systems of forces, and simplify them as far as possible. Analyze given motions with suitable choice of coordinate systems (inertial systems). Calculate forces and positions of equilibrium. Starting from Newton’s laws and kinematic and geometric relationships put down mathematical models for different types of particle motions and make calculations of this motion.

Course contents

Statics: Quantities, units, and dimension, vector algebra and vector geometry, geometry of force systems including resultant force, couples etc. Necessary conditions for equilibrium, force and torque in a beam, centre of mass.

Particle dynamics: Kinematics of a particle in Cartesian coordinates, cylindrical (polar) coordinates, natural components. Inertial systems, forces, and Newton’s laws. Work, power, energy, conservative forces, kinetic and potential energy. Motion in central force fields. Linear oscillations, harmonic, damped, and forced.

Systems of particles: The basic principles of linear and angular momentum.

During the course the student must practice formulation of problems, modelling, idealization and quantitative as well as qualitative estimates. Group interaction is also practiced since the hand in assignments normally are done as collaborations. The ability to communicate in writing is practiced since the students get feedback on their assignments, as well as on their variuos exams. English is trained in various ways. The relevant english vocabulary is made available to the student in the form of lists with translations. Giving some assignments in English provides examination and training of this vocabulary.

Examination

- INL1 - Assignments, 1.0 credits, grading scale: P, F
- PROJ - Project, 2.0 credits, grading scale: P, F
- TEN1 - Examination, 4.0 credits, grading scale: A, B, C, D, E, FX, F
- TEN2 - Examination, 4.0 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.