LUNDS UNIVERSITET
Lunds Tekniska Högskola

Course syllabus

Mekanik
Engineering Mechanics

FMEA30, 15 credits, G1 (First Cycle)

Valid for: 2023/24
Faculty: Faculty of Engineering, LTH
Decided by: PLED M
Date of Decision: 2023-04-11

General Information

Main field: Technology.
Compulsory for: M2, MD2
Language of instruction: The course will be given in Swedish

Aim

- give knowledge about the basic concepts in mechanics for material systems at rest
- give knowledge about the basic concepts in mechanics for material systems in motion, mainly for particles, systems of particles and rigid bodies
- give knowledge and skills in engineering modelling
- develop ability to solve problems by using the computer softwares MATLAB and ADAMS

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- be able to define and apply fundamental concepts such as force and moment of force, linear and angula momentum, impulse and moment of impulse, and be able to express them both in scalar and vectorform
- be able to draw a free body diagram of a material body and to set up the equations of equilibrium and motion

- be ably to describe velocities and accelerations in Cartesian, polar and natural coordinates systems and use the the force and moment equationsfor a particle
- be able to use the velocity and acceleration fields in rigid body motionl
- be able to define and use the basic concepts linear momentum, angular momentum, impulse and moment of impulse, moment of inertia, power, energy and work for a rigid body
- be able to use the force and moment equations to describe plane rigid body motion
- be able to analyze practical problems in mechanics
- be able to use MATLAB in the solution of problems in mechanics

Competences and skills
For a passing grade the student must

- starting with a real situation be able to delimit a problem and perform an equilibrium analysis
- be able to apply systematic methods in an analysis of mechanical systems in equilibrium and particles in motion
- starting with a real situation be able to delimit a problem and treat material bodies as particles or rigid bodies
- be able to apply systematical methods to mechanical systems in motion
- be able to present written solutions to mechanical problems with suitable drawing and free body diagrams
- given a project specification be able to delimit a problem and create a model which may be analyzed using in a simulation sofware.

Judgement and approach
For a passing grade the student must

- evaluate the physical consistency of the obtained results

Contents

Statics: Moment and force systems in 2 and 3 dimensions. Free-body diagrams and equilibrium of material bodies. Equilibrium in frames. Distributed forces, centre of mass, flexible cables. Friction. Potential energy and stability.

Dynamics: Newton's laws. Kinematics and kinetics of particles in straight and curved motion, natural and polar co-ordinates. Energy and work. Momentum and impulse, moments of momentum and impulse moments. Impact. Kinematics of system of particles (general) and rigid bodies (plane). Energy, work, linear and angular impulse and momentun. Impact. Newtons laws. Kinetic for particles in 2D and 3D and kinetic for rigid bodies in plane motion. Rotating coordinate systems. Vibrations of damped and undamped mechanical systems. Free and forced vibrations. Natural frequencies and

vibration analysis.

MATLAB: Numerical calculations, writing scripts, defining functions, graphics, symbolic calculations differentiation and integration, solving equations, differential equations, linear algebra

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: Written examinations. Approved project report. Approved assignments.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Parts
Code: 0113. **Name:** Statics and Particle Dynamics.
Credits: 7. **Grading scale:** TH. **Assessment:** Written exam. (part)
Code: 0213. **Name:** Dynamics.
Credits: 5. **Grading scale:** TH. **Assessment:** Written exam.
Code: 0313. **Name:** Project.
Credits: 0. **Grading scale:** UG. **Assessment:** Approved project report.
Code: 0413. **Name:** Assignment 1.
Credits: 1,5. **Grading scale:** UG. **Assessment:** Approved hand-in.
Code: 0513. **Name:** Assignment 2.
Credits: 1,5. **Grading scale:** UG. **Assessment:** Approved hand-in.

Admission

Assumed prior knowledge: FMA420 Linear algebra, FMAA01/05 Calculus in One Variable.
The number of participants is limited to: No
The course overlaps following course/s: FMEA01, FMEA25, FMEA05, FMEA20, FMEA10, FMEA15

Reading list

- C.Nyberg: Mekanik : statik. Liber, 2014, ISBN: 9789147114429.
- C. Nyberg: Mekanik - Partikeldynamik. Liber, 2014, ISBN: 9789147114436.
- C. Nyberg: Mekanik - Stelkroppsdynamik. Liber, 2014, ISBN: 9789147114443.
- William J. Palm III: A Concise Introduction to MATLAB, International Edition. McGraw Hill, 2008.

Contact and other information

Course coordinator: Per Hansson, per.hansson@mek.lth.se
Course homepage: http://www.mek.lth.se/Education
Further information: Parts of the course may be in English.