Statics

Code: MK3STATG04GX17_EN

ECTS Credit Points: 4

Evaluation: exam

Year, Semester: 2nd year, 2nd semester

Its prerequisite(s): -

Further courses are built on it: Yes/No

Number of teaching hours/week (lecture + practice): 2+2

Topics:

Newton's laws of motion. Force, moment, and couples. Reduction of a force system. Resultant and classification of force systems. Equilibrium equations. Statics of material points. Statics of rigid bodies. Static problems in planar systems. Practical structures (friction, pin-friction, rolling resistance, rope friction). Internal force systems of rigid bodies. Loading of beams (cantilevers, freely supported beams, fraction lined beams). Determination of shear and moment functions, and diagrams of beams. Statically determined beam structures (hinged-bar systems, compound beams, truss systems).

Literature:

Compulsory:

- Russel C. Hibbeler (2006): Engineering Mechanics – Statics and Dynamics, Prentice Hall, 2006. ISBN-13 9780132215091
- Lakshmana C. Rao, J. Lakshminarasimhan, Raju Sethuraman, Srinivasan M. Sivakumar (2004): Engineering Mechanics: Statics and Dynamics, PHI Learning Pvt. Ltd., ISBN 8120321898, 9788120321892
- Lawrence E. Goodman, Susan Goodman, William H. Warner (2001): Statics, Courier Dover Publications, ISBN 0486420051, 9780486420059
- Ferdinand P. Beer, E. Russell Johnston, Jr., (1987): University of Connecticut, Mechanics for Engineers: Statics and Dynamics (Package), 4th Edition, ©1987, ISBN-139780070045842
- 5. Joseph F. Shelley (1990): 800 solved problems in vector mechanics for engineers, Volume I: Statics. (SCHAUM'S SOLVED PROBLEM SERIES), McGraw-Hill, 1990, ISBN 0-07-056835-9

Schedule

1st week Registration week

2nd week: Mathematical introduction – Vector algebra

Lecture: Concept of a vector, description of a vector with coordinates, vector operations and their applications in basic geometry, position vector

Practice: Solving problems in vector algebra

3rd week: Newton's laws, force formulas. Equilibrium state of a particle

Lecture: Newton's laws, force formulas (gravitational, spring and reaction forces), resultant of a force system acting on a particle and its determination with calculation and construction, equilibrium state of a particle, solution of equilibrium problems

Practice: Calculating the resultant of 2 and 3 dimensional force systems acting on particles. Solving equilibrium problems of particles.

4th week: Equivalence and resultant of a force system. Classification of force systems

Lecture: Moment of a force, resultant force and moment of a force system, connection between the resultant moments of a force system relative to different point of space, equivalence and resultant of force systems, classification of force systems

5th week: Analysis of coplanar force systems

Lecture: Resultant of a coplanar force system, determination of the resultant with calculation and construction in case of intersecting and parallel force systems

Practice: Calculating the resultant force and moment of 3 dimensional force systems.

Practice: Calculating the resultant force and moment of 2 dimensional force systems, and determining its resultant with calculation. Constructing the resultant of intersecting and parallel force systems.

6th week: Centre of mass and gravity. Continuously distributed force systems

Lecture: Concept of centre of mass and gravity and their calculation, continuously distributed force systems along a line, and over a surface area or volume.

Practice: Calculating and constructing the centre of gravity of plane figures and arrangements build up from them.

7th week: Equilibrium state of a rigid body. Equilibrium equations. Calculation of reaction forces in statically determinate structures

Lecture: Equilibrium state of a rigid body and its conditions, equilibrium equations for a 3 and 2 dimensional force system, statically determinate and indeterminate structure, support types: roller, simple, pinned and fixed support

Practice: Calculating the reaction forces acting on a mechanical structure in equilibrium.

8th week: 1st drawing week First midterm test

9th week: Construction of reaction forces in statically determinate structures

Lecture: Methods for the construction of reaction forces in an intersecting and a parallel force system.

Practice: Constructing the reaction forces acting on a mechanical structure in equilibrium.

10th week: Analysis of practical structures

Lecture: Friction, pin-friction, rolling resistance, rope friction

Practice: Determination of the possible values of reaction forces acting on a practical structure from the equilibrium conditions by calculation and construction.

11th week: Analysis of simple machines with friction

Lecture: Wedge, groove, screw with flat and sharp thread, first and second class levers, pulley.

Practice: Analysis of simple machines

12th week: Internal force system of a rigid body and its resultant.

Lecture: General concept of normal and shear force, bending and torsional moment, calculation of the normal force, shear force and bending moment functions of beams.

Practice: Calculation of the normal force, shear force and bending moment functions of supported beams and cantilevers.

13th week: Loading diagrams of beams.

Lecture: Simple method for the drawing of the normal force, shear force and bending moment diagrams of beams.

Practice: Drawing the loading diagrams of freely supported beams, cantilevers and fraction lined beams.

14th week: Determined beam structures

Lecture: Hinged-bar systems, compound beams and truss systems

Practice: Analysis of hinged-bar systems, compound beams and truss systems

15th week: 2nd drawing week, Second midterm test

Requirements

A, for a signature:

Participation at lectures is compulsory. Students must attend lectures and may not miss more than three of them during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Attendance at lectures will be recorded by the lecturer. Being late is equivalent with an absence. In case of further absences, a medical certification needs to be presented. Missed lectures must be made up for at a later date, being discussed with the tutor.

Students have to write two midterm tests during the semester. The first (40 points max) in the 8th, the second (40 points max) in the 14th week. At the end of the semester everybody will get a seminar grade on the basis of the table below:

Fail (1)	0-39
Close fail (2)	40-50
Improvement needed (3)	51-60
Very good (4)	61-70
Excellent (5)	71-80

If somebody fails then he has to write both tests in the 1st week of the exam period again. If the result is 40 points (50%) or better, then he can take an exam. If somebody has to repeat his midterm tests then his seminar grade can't be better than (2).

There will be homework from week to week. Only students who have handed in all their homework at the time of the midterm test will be allowed to write it. The problems in the midterm tests will be selected from the homework assignments.

B, for a grade:

For their exam everybody will get an exam grade. The final grade will be the average of the seminar and exam grade. If it is for example (3.5) then the lecturer decides if it is (3) or (4).