Óbuda University Bánki Donát Faculty of Mechanical and Safety Engineering	Institute for Natural Sciences and Basic Subjects

Course name and code: Mechanics I. (BTXMNE1BNF) **Credit: 5**

Full-time, 1. semester

Programs for which the course is available Mechatronic engineering BSc

Subject leader:	**Dr. habil Árpád Czifra**	Lecturer:	**Dr. habil Árpád Czifra**
Prerequisites:			

Lessons/week:	Lecture: 2	Practice.: 2	Lab: 0	Consultation:
Requirement:	exam			

Course description

This course provides a basic introduction to mechanics, especially to static and strength of material; to develop confidence and competence in solving statics problems

Topics: Force systems: resultant of coplanar force systems. Basic mechanical models: degree of freedom, cantilever, simple and overhanging beams. Reactions of statically determined beams and trusses. Internal effect of forces: tension and compression, bending, shearing and torsion. Centre of gravity. First and second moment of area. Stress state of tension and compression, bending, shearing and torsion. Combined loads. Sizing for strength. The maximum-shear-stress and the distortion-energy theory.

Week	Schedule:	Lec/Pr
1.	***Lecture:*** Introduction to static. Definition of force. ***Practice:*** Vector- and matrix algebra. Force and moment.	**2/2**
2.	***Lecture:*** Resultant of force systems. Coplanar force systems. ***Practice:*** Resultant of concurrent and parallel coplanar force systems.	**2/2**
3.	***Lecture:*** Ideal constrains, basic models of mechanics. Degree of freedom. ***Practice:*** Resultant of a non-concurrent, non-parallel coplanar force system.	**2/2**
4.	***Lecture:*** Reactions of cantilever- simple- and overhanging beams. ***Practice:*** Equilibrium of beams. Calculation of reactions	**2/2**
5.	***Lecture:*** Internal effect of forces: definitions, functions, diagrams. ***Practice:*** Internal effect of beams: functions and diagrams.	**2/2**
6.	***Lecture:*** Internal effect of forces of cantilever beams. ***Practice:*** Internal effects in cantilever beams: functions and diagrams.	**2/2**
7.	***Lecture:*** Internal effect of forces of simple- and overhanging beams. ***Practice:*** Internal effects in simple- and overhanging beams: functions and diagrams.	**2/2**
8.	***Lecture:*** Centre of gravity, first and second moment of area. ***Practice:*** Calculation of stresses in case of tension and compression.	**2/2**
9.	***Lecture:*** Introduction to strength of materials. Tension and compression. ***Practice:*** **1st Midterm test**	**2/2**
10.	***Lecture:*** Stress state of shearing and bending. ***Practice:*** Calculation of stresses in case of bended beams.	**2/2**
11.	***Lecture:*** Stress state of torsion. ***Practice:*** Calculation of stresses under torsion.	**2/2**
12.	***Lecture:*** Combined loads. Sizing for strength. ***Practice:*** Stress calculation in case of tension and bending combined load.	**2/2**
13.	***Lecture:*** The maximum-shear-stress and the distortion-energy theory. ***Practice:*** **2nd Midterm test**	**2/2**
14.	***Lecture:*** **Retake of 1st OR 2nd Midterm test** ***Practice:*** Combined load: bending and torsion.	**2/2**

Conditions for the signature
One must participate in at least 70% of all classes.
Two obligatory homework's must be solved and submitted until the deadline. Wrong and/or not accepted homework's should be submitted again. Completing homework assignments is mandatory during the academic period. Late submission is not possible during the exam season.
Homeworks:
1st HW: Internal effects; submission: week 7
2nd HW: Second moment of area; submission: week 11
Two midterm tests must be written on which 25+25=50 points can be collected. Only one midterm (1st OR 2nd) test can be retake. The sum points of midterm tests must be no less than 25 (50%).

Method of replacements: Only one midterm (1st OR 2nd) test can be retake during the semester. In case of failed tests, one replacement test can be written in the first 10 day of exam season. If the replacement test is not accepted, then the semester is invalid, and no signature will be given.

Examination: written (50 points).
Examination notes (based on the sum of the semester and exam points): 0-50 point: fail (1); 51-62 point: pass (2); 63-75 point: satisfactory (3); 76-88 point: good (4), 89-100 point: excellent (5).

Literature:

Mandatory:
1. Schaum's Outline Series; McNeel & Nelson: Engineering Mechanics, Statics and Dynamics, McGraw-Hill, 1988
2. Schaum's Outline Series; William A. Nash: Theory and Problems of strength of Materials, McGraw-Hill, 1998
3. R. Pratap and A. Ruina: Introduction to Statics and Dynamics, Oxford University Press, 2001

Offered:
4. Dietmar Gross, Werner Hauger, Jörg Schröder, Wolfgang A. Wall, Javier Bonet: Engineering Mechanics 2: Mechanics of Materials, Springer (2011)

Budapest, 2025. 06. 13.

Dr. habil Árpád Czifra