COURSE DESCRIPTION CARD - SYLLABUS

Course name
Fundamentals of mechanics [S1BZ1E>PM]

Course

Field of study
Sustainable Building Engineering

Year/Semester
1/1

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
English

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
0

Other (e.g. online)
0

Tutorials
30

Projects/seminars
30

Number of credit points

6,00

Coordinators

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Lecturers

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Prerequisites

Student knows the basics of vector calculus and mathematical analysis.

Course objective

Preparing student to solve two- and three-dimensional static problems.

Course-related learning outcomes

Knowledge:
1. Student knows the equilibrium conditions of coplanar and spatial forces system (lecture, tutorials, project)
2. student knows the methods of determining internal forces in two-dimensional bar systems statically determinate (lecture, tutorials, project)
3. Student knows the principle of virtual work (lecture, tutorials)

Skills:
1. Student is capable to determine the support reactions in two- and three-dimensional systems (lecture, tutorials, project)

2. Student is capable to determine internal forces in two-dimensional bar systems statically determinate (lecture, tutorials, project)
3. Student is capable to apply the principle of virtual work to determine support reactions and internal forces (lecture, tutorials)

Social competences:
1. Student is responsible for the relability of the obtained results and their interpretation (tutorials, project).
2. Student can formulate conclusions and describe the results of her/his own work (tutorials, project)

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Lecture: Written examination checking knowledge of lectures.
Tutorials: Two tests checking knowledge of tutorials.
Project: Five unique exercises for solving.
Mark - lecture:
Student gets a positive mark after obtaining at least 50% of the maximum amount of examination points.
Mark - tutorials:
Student gets a positive mark after obtaining at least 50% of the maximum amount of points from the two tests.
Mark - project:
Student gets a positive mark after successfully submitting all five unique exercises with correct calculations.

Programme content

During the course, the following topics are discussed: basic knowledge of vector calculus; kinematic and static analysis of planar systems; determining reactions and internal forces in statically determinate systems; and the application of the principle of virtual work to determine reactions and internal forces in statically determinate systems.

Course topics

Lecture 1 - Fundamental concepts and principles. Basics of vector calculus. Moment of a vector about a point.
Lecture 2 - Moment of a vector about a given axis. Principles of mechanics. Forces system and its properties. Moment of a couple and its properties. Reduction of coplanar forces system. Equilibrium conditions of coplanar concurrent and non-concurrent forces system.
Lecture 3 - Degrees of freedom, constraints. Necessary and sufficient conditions of kinematical stability.
Lecture 4 - Static analysis of rigid bodies in two dimensions.
Lecture 5 - Internal forces in beams.
Lecture 6 - Differential equations for bending. Gerber beam.
Lecture 7-8 - Internal forces in frames.
Lecture 9-10 - Planar trusses. Methods for determining internal forces in truss members.
Lecture 11 - Reduction of spatial forces system. Equilibrium conditions of spatial concurrent and non-cncurrent forces system.
Lecture 12 - Three dimensional forces systems.
Lecture 13 - Friction and laws of dry frictions. Rolling resistance.
Lecture 14 - Principle of virtual work.
Lecture 15 - Application of the principle of virtual work to determine the supports reactions and internal forces in beams.
Tutorials 1 - Basics of vector calculus. Moment of a vector about a point. Resultant of concurrent forces system.
Tutorials 2 - Resultant of non-concurrent forces system. Equilibrium conditions of coplanar concurrent and non-concurrent forces system.
Tutorials 3 - Necessary and sufficient conditions of kinematical stability for rigid bodies system.
Tutorials 4-5 - Static analysis of rigid bodies in two-dimensions.
Tutorials 6-7 - Internal forces in beams.
Tutorials 8 - Test 1

Tutorials 9-10 - Internal forces in frames.
Tutorials 11-12 - Internal forces in truss members.
Tutorials 13-14 - Application of the principle of virtual work to determine the supports reactions and internal forces in beams.
Tutorials 15 - Test 2
Project 1-3 - Exercise 1: Resultant of non-concurrent forces system.
Project 4-6 - Exercise 2: Analysis of rigid bodies in two dimensions.
Project 7-9 - Exercise 3: Internal forces in beams.
Project 10-12 - Exercise 4: Internal forces in frames.
Project 13-15 - Exercise 5: Internal forces in truss members.

Teaching methods

Teaching methods: lecture - informative, monographic, tutorials - exercise and project method, project - exercise and project method

Bibliography

Basic
1. F.P. Beer, E. R. Johnston et al., Vector Mechanics for Engineers: Statics and Dynamics, McGraw-Hill Education-Europe, New York, USA 2015
2. R.C. Hibbeler, Engineering Mechanics: Statics, Pearson Education Limited, Harlow, United Kingdom 2016
3. R.C. Hibbeler, Engineering Mechanics: Dynamics, Pearson Education Limited, Harlow, United Kingdom 2016
4. Online teaching materials http://magdalena.lasecka-plura.pracownik.put.poznan.pl/node/21
Additional
1. J. Leyko, Mechanika ogólna. T. 1, Statyka i kinematyka, T. 2, Dynamika, PWN,Warszawa 2006
2. J. Misiak, Mechanika ogólna. T. 1, Statyka i kinematyka, T. 2, Dynamika, WNT Warszawa 1998
3. Z. Cywiński, Mechanika budowli w zadaniach. Układy statycznie wyznaczalne, PWN Warszawa 1999

Breakdown of average student's workload

	Hours	ECTS
Total workload	155	6,00
Classes requiring direct contact with the teacher	90	3,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	65	2,50