COURSE DESCRIPTION CARD - SYLLABUS

Course name
Fundamentals of mechanics

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 studies

Course offered in
English

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes

Other (e.g. online)

Tutorials
30

Projects/seminars
30

Number of credit points

6

Lecturers

Responsible for the course/lecturer:
dr inż. Magdalena Łasecka-Plura

Responsible for the course/lecturer:

Prerequisites

Student knows the basics of vector calculus and mathematical analysis.

Course objective

Preparing student to solve two- and three-dimensional static problems and simple problems of dynamics for particles system and rigid bodies.

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)

4. Student knows the basic concepts related to kinematics and dynamics of a particle and rigid body (lecture)

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)

4. Student is capable to apply the concepts of kinematics and dynamics to describe the motion of a point and a rigid body (lecture)

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:

Lecture: Written examination checking knowledge of lectures.

Tutorials: Two tests checking knowledge of tutorials.

Project: Five unique exercises for solving and tests checking the knowledge of projects.

Mark - lecture:

Student gets a positive mark after obtaining at least 50% of the maximum amount of examination points:

0%-49% - unsatisfactory

50%-59% - satisfactory

60%-69% - satisfactory plus

70%-79% - good

80%-89% - good plus

90%-100% - very good

Mark - tutorials:

Student gets a positive mark after obtaining at least 50% of the maximum amount of points from two tests:

0%-49% - unsatisfactory

50%-59% - satisfactory

60%-69% - satisfactory plus

70%-79% - good

80%-89% - good plus

90%-100% - very good

Mark - project:

Student gets a positive mark after completing unique exercises and obtaining at least 50% of the maximum amount of points from five tests:

0%-49% - unsatisfactory

50%-59% - satisfactory

60%-69% - satisfactory plus

70%-79% - good

80%-89% - good plus

90%-100% - very good

Programme content

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 - Internal forces in frames.

Lecture 8 - Planar trusses. Methods for determining internal forces in truss members.

Lecture 9 - Reduction of spatial forces system. Equilibrium conditions of spatial concurrent and non-cncurrent forces system.

Lecture 10 - Three dimensional forces systems.

Lecture 11 - Friction and laws of dry frictions. Rolling resistance.

Lecture 12 - Principle of virtual work.

Lecture 13 - Application of the principle of virtual work to determine the supports reactions and internal forces in beams.

Lecture 14 - Kinematics of a particle. Kinematics of a rigid body.

Lecture 15 - Dynamics of a particle.

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 1-2 - Exercise 1: Resultant of non-concurrent forces system.

Project 3 - Test 1

Project 4-5 - Exercise 2: Analysis of rigid bodies in two dimensions.

Project 6 - Test 2

Project 7-8 - Exercise 3: Internal forces in beams.

Project 9 - Test 3

Project 10-11 - Exercise 4: Internal forces in frames.

Project 12 - Test 4

Project 13-14 - Exercise 5: Internal forces in truss members.

Project 15 - Test 5

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	6,0
Classes requiring direct contact with the teacher	90	3,5
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	65	2,5

[1] delete or add other activities as appropriate