COURSE DESCRIPTION CARD - SYLLABUS

Course name
Engineering mechanics [S1Mech2>MT]

Course

Field of study
Mechatronics

Year/Semester
1/2

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
15

Other
0

Tutorials
30

Projects/seminars
0

Number of credit points

5,00

Coordinators

dr hab. inż. Jacek Buśkiewicz
jacek.buskiewicz@put.poznan.pl

Lecturers

Prerequisites

Basic knowledge of physics. Knowledge of mathematics includes linear algebra, vector calculus and the basics of differential and integral calculus.

Course objective

To provide students with basic knowledge of mechanics as defined by the prerequisites specific to the field of study. To acquire in students the skills of mechanical description of motion of material bodies and structures. To prepare students for mechanical modelling of mechanical systems of mechatronic devices.

Course-related learning outcomes

Knowledge:
1. A student defines basic mechanical concepts in the scope covered by the content specific to the field of study and gives simple examples of their applications in the real world.
2. Student has well-structured, theoretically based general knowledge, which allows to determine: equilibrium of planar and spatial systems, centres of gravity; and to describe: kinematics and dynamics of a material point and a rigid body.
3. Student is able to formulate and explain basic physical laws, theorems and mechanical concepts

within the scope of the content specific to the field of study, identify the basic limitations and scope of their applicability and give examples of their applications in modelling of phenomena in the real world.
4. Student is able to explain the purpose and significance of simplified mechanical models in the description of physical phenomena.

Skills:
The student is able to
1. find the necessary information in the literature, both from databases and other sources; they are able to reproduce the reasoning described in the literature, taking into account the assumptions and approximations made.
2. apply basic physical laws and simplified models in solving simple problems within the scope of the content specific to the field of study.
3. communicate effectively with both specialists and non-specialists in a given subject area.
4. identify directions for further improvement of knowledge and skills (including self-education) in the field of mechatronics.

Social competences:
1. Understanding of the need for lifelong learning; to inspire and organise the learning of others.
2. Awareness of the benefits of basic engineering knowledge in solving practical engineering problems.
3. Awareness of the need to popularise engineering knowledge.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Theoretical exam - theoretical questions: 3.0 50.1%-70.0%, 4.0 70.1%-90.0%, 5.0 from 90.1%.
Credit for exercise colloquium: practical tasks: 50.1%-70.0%, 4.0 70.1%-90.0%, 5.0 from 90.1%.
Credit for laboratory on the basis of tests and reports of exercises conducted to illustrate selected issues of mechanics.

Programme content

Knowledge of statics of planar and spatial force systems including reduction of force systems and formulation of equilibrium conditions. Knowledge of planar trusses including construction and applications of trusses and selected methods for determining forces in the rods. Knowledge of sliding friction and rolling resistance. Selected issues of point kinematics with respect to choice of a coordinate system and description of trajectory, velocity and acceleration. Elements of rigid body kinematics - translational, rotational and planar motion. Dynamics of a material point in systems introduced in kinematics. Differential and integral dynamics. Momentum and moment of momentum of a rigid body as necessary concept to derive dynamic equations of motion.

Course topics

1.Statics:
laws of statics,
three forces theorem,
the moment of a force, the couple of forces,
reduction of an arbitrary planar force system and equilibrium equations,
reduction of a spatial force system and equilibrium equations,
equilibrium equations of any spatial system of forces,
trusses - analytical method for balancing nodes and Ritter's method,
sliding friction and rolling resistance.
2. Kinematics:
kinematics of a point in the Cartesian system, description of velocity and acceleration,
motion of a point in natural coordinates, tangential and normal acceleration,
translational motion of a rigid body,
rotational motion of a rigid body,
planar motion of a rigid body,
introduction to absolute motion and spherical motion.
3. Dynamics:
geometry of masses - centres of gravity and mass moments of inertia,

the principles of dynamics,
dynamics of a material point in Cartesian and natural coodrinates,
mechanical work and mechanical power,
conservative forces,
mechanical energy, principle of conservation of mechanical energy,
work and kinetic energy equivalence theorem.
momentum and moment of momentum.
the dynamic equation of a rigid body in translational, rotational and planar motion.
Laboratory:
Exercise 1 - Determination of moments of inertia by the physical pendulum method
Exercise 2 - Determination of moments of inertia by the three-point suspension method
Exercise 3 - Precession in motion of a gyroscope
Exercise 4 - Determination of the coefficient of restitution
Exercise 5 - Determination of the coefficient of static and kinetic friction Exercise 6 - Determination of mechanical energy in planar motion
Exercise 7 - Determination of forces in planar systems

Teaching methods

1. lecture: presentation illustrated by examples given on the blackboard, solving of the problems.
2. auditory exercises illustrating the material presented during the lectures with problems solved on the blackboard by students or demonstrated by the academic teacher, discussion of the ideas proposed by students to solve the problems.
3 Laboratory: experimental determination of selected mechanical quantities.

Bibliography

Basic:
1. Mechanika ogólna, tom I i II (Mechanics, vol. I and II), J. Leyko, PWN, Warszawa, 1996.
2. Mechanika techniczna, tom I i II (Engineering mechanics, vol. I and II), J. Misiak, WNT, Warszawa, 1996.
3. Engineering Mechanics, D.J. McGill, PWS Publishers, Boston, 1985.
4. Instructions for laboratory exercises - author's manuals made available by a teacher.

Additional:
1. Zadania z mechaniki ogólnej tom I i II (General mechanics problems, vol. I and II), J. Misiak, WNT, Warszawa, 2009.
2. Metodyka rozwiązywania zadań z mechaniki (Methodology for solving problems in mechanics), J. Nizioł, WNT, Warszawa, 2007.
3. Zbiór zadań z mechaniki ogólnej (General mechanics problems book), M. T. Niezgodzińscy, Wydawnictwo Naukowe PWN, Warszawa, 2009.

Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,00
Classes requiring direct contact with the teacher	77	3,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	48	2,00