COURSE DESCRIPTION CARD - SYLLABUS

Course name

Modelling of mechanical systems

Course

Field of study

Construction and exploitation of means of transport

Year/Semester

1/2

Area of study (specialization)

Profile of study

general academic

Level of study

Second-cycle studies

Course offered in

polish

Form of study

full-time

Requirements

compulsory

Number of hours

Lecture

15

Laboratory classes

0

Other (e.g. online)

0

Tutorials

30

Projects/seminars

0

Number of credit points

3

Lecturers

Responsible for the course/lecturer:

Prof. Janusz Mielniczuk

email: janusz.mielniczuk@put.poznan.pl

tel. +48 61 665 2335

Faculty of Mechanical Engineering

Piotrowo 3 Street, 61-138 Poznań

Responsible for the course/lecturer:

MSc Eng. Krzysztof Wałęsa

email: krzysztof.walesa@put.poznan.pl

tel. +48 61 665 2318

Faculty of Mechanical Engineering

Piotrowo 3 Street, 61-138 Poznań

Prerequisites

Basic knowledge of mathematics, materials science, mechanics, basics of machine design, theory of machines and mechanisms and strength of materials. Basics of vector and tensor analysis, the ability to solve differential equations, the ability to solve simple problems of mechanics and strength of the materials, the ability to conduct the engineering calculations and components selection, the ability to design machines and devices. Students are creative and consistent in the implementation of the tasks has autonomy to solve problems, acquire and improve their knowledge and skills.

Course objective

The objective of the course is learning students a new mathematical apparatus necessary in the process of modeling materials and machines (mechanisms), learning the basics of physical and mathematical

modeling of construction materials, machinery and equipment, some physical and technological processes.

Course-related learning outcomes

Knowledge

1. Has basic knowledge in the field of solids mechanics and discrete systems with many degrees of freedom, mathematical modeling of physical and mechanical systems based on the d'Alembert principle and Lagrange equation, mathematical description of materials using constitutive equations.

2. Has extensive knowledge of the strength of materials in the field of nonlinear models, cracking and fatigue strength, calculations of statically indeterminate structures, structural stability.

3. Has extensive knowledge in the field of selected departments of technical mechanics related to the selected specialty (eg soil mechanics).

Skills

1. He is able to formulate and test hypotheses related to simple research problems.

2. He can use a popular system for numerical calculations to program a simple system simulation task with a small number of degrees of freedom.

3. He is able to communicate on specialist topics with diverse recipients.

Social competences

1. Is ready to critically evaluate received knowledge and content.

2. Is ready to recognize the importance of knowledge in solving cognitive and practical problems and to consult experts in the event of difficulties in solving the problem.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

An exam from the lectures on the last lecture in semester, which evaluates the knowledge of the theory and the ability to use it in practice. Passing the classes based on the passing test which covers accounting tasks related to material and machinery modelling. During the classes the current understanding of the previously presented material is verified by solving the tasks on the blackboard by students.

Programme content

Notes on modeling - a goal of modeling entities. The modeling process - stages of modeling scheme. Physical modelling - simplifying assumptions, the physical parameters, examples of physical models. Mathematical modelling - basics model, the size of tensor, coordinate systems, principles for the formulation of constitutive relationships, formulate and solve the equations of motion of mechanical systems. Mathematical models of construction materials - one-parameter models, complex models, some models nonclassical. Mechanical systems one and two-parameter - equations of motion, vibration, undamped and damped. Mathematical models of selected processes - electromechanical systems,

hydrodynamical systems. The analogies between the worlds of physical. Modelling stresses in the constructional elements, derivation of dynamic alternative parametres. Structure of the simulation models.

Teaching methods

Lecture: multimedia presentation and examples solved by the teacher. Tasks for individual or group solution.

Tutorials: multimedia presentation and examples solved by the teacher or by students on the board. Tasks to be solved during classes.

Bibliography

Basic

1. Derski W., Ziemba S., Analiza modeli reologicznych, Wyd. PWN, Warszawa 1968.

2. Ostwald M.: Podstawy optymalizacji konstrukcji. Wyd. Politechniki. Poznańskiej 2005.

3. Wrotny L.T., Zadania z kinematyki i dynamiki maszyn technologicznych i robotów przemysłowych, Wyd. PW, Warszawa 1998.

4. Czemplik A., Modele dynamiki układów fizycznych dla inżynierów

5. Heimann B., Gerth W., Popp K., Mechatronika. Komponenty, metody, przykłady. PWN, Warszawa 2001.

6. Jezierski E., Dynamika robotów, WNT, Warszawa 2006.

7. Ostrowska-Maciejewska; Podstawy mechaniki ośrodków ciągłych, PWN, Warszawa 1982

8. R. H. Cannon jr.; Dynamika układów fizycznych, WNT, Warszawa 1973

Additional

1. Z. Parszewski; Drgania i dynamika maszyn, WNT, Warszawa 1982

2. R. Scanlan, R. Rosenbaum; Drgania i flatter samolotów, PWN, Warszawa 1964

3. W. Tarnowski; Modelowanie systemów, Wyd. Politechniki Koszalińskiej, Koszalin 2004

4. W. Flügge; Tensor analysis and continuum mechanics, Springer-Verlag, Berlin 1972

5. Bąk R., Burczyński T., Wytrzymałość materiałów z elementami ujęcia komputerowego, wyd. WNT, Warszawa 2013

6. Spong M., Vidyasagar M., Dynamika i sterowanie robotów, WNT, Warszawa 1997

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,0
Classes requiring direct contact with the teacher	45	2,0
Student's own work (literature studies, preparation for tutorials, preparation for tests) [1]	30	1

[1] delete or add other activities as appropriate