COURSE DESCRIPTION CARD - SYLLABUS

Course name
Computational analysis of mechanical systems

Course

Field of study
Mechatronics

Year/Semester
1/1

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	Laboratory classes	Other (e.g. online)
15	15	0
Tutorials	**Projects/seminars**	
0	0	

Number of credit points

3

Lecturers

Responsible for the course/lecturer:
dr inż. Paweł FRITZKOWSKI
e-mail: pawel.fritzkowski@put.poznan.pl
tel. 61 665 2387
Faculty of Mechanical Engineering
ul. Jana Pawła II 24, 60-965 Poznań

Responsible for the course/lecturer:

Prerequisites

1) Basic knowledge of mathematics, technical mechanics, fluid mechanics and heat transfer which corresponds to the programme for the first cycle studies.
2) The ability to solve elementary problems of mechanics based on the already possessed knowledge; the skill to search for specific information in certain sources.
3) Understanding the necessity to broaden own knowledge and to shape new skills; self-reliance and perseverance in completing tasks and problem solving.

Course objective

1) To enrich students' knowledge on mechanics with some elements of advanced modelling and numerical simulation, and computational methods.
2) To shape students' skills in computer aided modelling and analysis in the area of kinematics and dynamics of mechanisms, heat transfer, and fluid dynamics.

3) To develop more aware use of the standard models of phenomena and technical systems, resonable choice of computational tools, and to develop skills in critical analysis of the results of numerical simulations.

Course-related learning outcomes

Knowledge

1) The student has well-structured and theoretically-based knowledge on the methods of building computational models in mechanics, as well as applications of the most popular computational methods.
2) The student understands the complexity of modelling of mechanical systems, including simplifying assumptions, formulating physical and mathematical models, as well as the methods of solution and verification of models.
3) The student has knowledge about computer aided design with the use of FEM systems and CAD/CAE systems.

Skills

1) The student can use a CAD/CAE software in design and computational analysis of mechanical systems.
2) The student can effectively conduct modelling and simulation studies, verify the used model, interpret the results and draw conclusions.
3) The student can prepare brief scientific works and reports of conducted simulation studies.

Social competences

1) The student understands the need for lifelong learning, and can organize the learning process, cooperate and work in teams.
2) The student can properly determine the priorities necessary to complete a given task.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: a written exam consisting of 5 equally scored, theoretical open-response questions.

Computer laboratory classes: final test of knowledge and skills, i.e. solving a selected problem related to solid mechanics or fluid mechanics.

Assessment rules: a grade given on the basis of the obtained scores; linear grading scale; C grade for earning at least 50% of all points.

Programme content

The essence of modelling and computer simulation, and their place within the contemporary science and engineering.
Physical, mathematical and numerical models. The improvement cycle for models.
Classification of models and problems in mechanics.
Classical models in solid mechanics and fluid mechanics.
Computer methods in mechanics. Sources of errors in approximate solutions. Verification vs. validation of models/simulations.

Computational tools applied in mechanics.
Simulation and analysis of simple mechanical systems.
Kinematic and dynamic analysis of mechanisms.
Analysis of heat conduction problems.
CFD analysis.
Capabilities of the contemporary CAD/CAE systems: simulation and analysis in the abovementioned areas; parameterization and multiple variations of models; comparative analysis of several variants of the designed mechanical system and optimization.

Teaching methods

Lecture: informational lecture, multimedia presentation, problem-based lecture.

Computer laboratory classes: problem-based method, project-based method, case study.

Bibliography

Basic

1) Gronowicz A., Podstawy analizy układów kinematycznych. Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2003.

2) Arczewski K., Pietrucha J., Szuster J.T., Drgania układów fizycznych. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2008.

3) Jeżowiecka-Kabsch K., Szewczyk H., Mechanika płynów. Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2001.

Additional

1) Stanisic M.M., Mechanisms and Machines: Kinematics, Dynamics, and Synthesis. Cengage Learning, 2015.

2) White F.M., Fluid Mechanics. WCB/McGraw-Hill, New York 1999.

3) Rosłoniec S., Wybrane metody numeryczne z przykładami zastosowań w zadaniach inżynierskich. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2008.

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,0
Classes requiring direct contact with the teacher	50	2,0
Student's own work (literature studies, preparation for laboratory classes, preparation for the final test) [1]	25	1,0

[1] delete or add other activities as appropriate