COURSE DESCRIPTION CARD - SYLLABUS

Course name
Modeling of the design machinery [S2MiBM2>MWPM]

Course

Field of study
Mechanical Engineering

Year/Semester
1/1

Area of study (specialization)
–

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

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 analytical and numerical approach to modeling, and selected aspects of numerical simulation along with 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, including the capabilities and limitations of the contemporary CAD/CAE systems.
4) Has structured, theoretical knowledge of the use of information systems in the design of machines and technological processes.

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 model used, 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 signle choice test consisting of about 10-15 equally scored, theoretical questions.
Computer laboratory classes: miniproject that consists in modeling and computational analysis of a selected problem, and in writing a report.
Assessment rules: a grade given on the basis of the obtained scores; linear grading scale; Grades: very good - if the ratio of sums of achieved and total points is bigger than 90,1%; good plus - if the ratio of sums of achieved and total points is between 80,1-90%; good - if the ratio of sums of achieved and total points is between 70,1-80%; satisfactory plus - if the ratio of sums of achieved and total points is between 60,1-70%; satisfactory - if the ratio of sums of achieved and total points is between 50,1-60%; if the sum is smaller than 50% - unsatisfactory.

Programme content

The essence of modelling and computer simulation, and their place within the contemporary science and engineering.
Physical, mathematical and numerical 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.
The improvement cycle for models. Verification vs. validation of models/simulations.
Computational tools applied in mechanics.
Dynamic simulation and analysis of simple mechanical systems.
Kinematic and dynamic analysis of mechanisms.
Analysis of heat transfer problems.
Analysis of fluid flow.
Capabilities of the contemporary CAD/CAE systems: simulation and analysis in the abovementioned areas; comparative analysis of several variants of the designed mechanical system and optimization.

Course topics

Lectures topics:
1) Modeling and computer simulations
2) Computational methods and tools
3) Dynamic simulation and analysis of simple mechanical systems
4) Kinematic and dynamic analysis of mechanisms
5) Heat transfer analysis

6) Fluid flow analysis

Topics of the computer laboratory classes:
1) Introduction to SolidWorks Motion
2) Kinematic and dynamic analysis of mechanisms
3) Thermal analysis
4) CFD analysis - external flow
5) CFD analysis - internal flow

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) Duda P., Taler J., Rozwiązywanie prostych i odwrotnych zagadnień przewodzenia ciepła. WNT, Warszawa 2003.
4) 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	50	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	20	1,00