COURSE DESCRIPTION CARD - SYLLABUS

Course name
Modeling and Simulation of Engine Processes [S2MiBP1-HSN>MiSPS]

Course

Field of study
Mechanical and Automotive Engineering

Year/Semester
2/3

Area of study (specialization)
Hybrid Powertrain Systems

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
0

Other (e.g. online)
0

Tutorials
30

Projects/seminars
0

Number of credit points

3,00

Coordinators

prof. dr hab. inż. Ireneusz Pielecha
ireneusz.pielecha@put.poznan.pl

Lecturers

Prerequisites

KNOWLEDGE: the student has basic knowledge of modeling and simulation of engine processes SKILLS: the student is able to integrate the obtained information, interpret it, draw conclusions, formulate and justify opinions SOCIAL COMPETENCES: the student is aware of the importance and understands the non-technical aspects and effects of modeling and simulating processes in internal combustion engines

Course objective

Basic knowledge about modeling and methods of simulating engine processes

Course-related learning outcomes

Knowledge:
Has extended knowledge of mathematics in the field of numerical methods used in optimization tasks, computer simulation, linear algebra, interpolation and approximation
Has a basic knowledge of the mechanics of solids and discrete systems with many degrees of freedom, mathematical modeling of physical and mechanical systems based on d"Alembert"s principle and Lagrange"s equations, mathematical description of materials using constitutive equations.
Has extended knowledge in the field of computer science, regarding computer programming and

engineering calculation programs in the field of computer simulation of physical systems

Skills:
Is able to plan and conduct experimental studies of specific processes occurring in machines and routine tests of a working machine or a vehicle from a selected group of machines
He can carry out basic measurements of mechanical quantities on the tested working machine with the use of modern measuring systems
Is able to use the acquired knowledge in the field of thermodynamics and fluid mechanics to simulate thermodynamic processes in the technological systems of machines, using specialized computer programs
He can design the technology of exploitation of a selected machine with a high degree of complexity

Social competences:
He is ready to critically assess his knowledge and received content
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 on its own
Is ready to fulfill professional roles responsibly, taking into account the changing social needs, including:
- developing the achievements of the profession,
- maintaining the ethos of the profession,
- observing and developing the principles of professional ethics and acting to comply with these principles

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
For discussion, ongoing preparation and activity in class. Written exam. Mandatory individual exercise reports.

Programme content

Types of models and methods of modeling. Application of models in research of technical and engine processes. Types and kinds of simulations and objects. Mathematical and physical modeling. Modeling and simulation of the fuel injection process and the selection of the injection size. Modeling and simulation of the ignition change angle in an IG engine. Modeling of the temperature distribution in the components of the internal combustion engine. Stationary and extramural models. Modeling the combustion process in SI and CI engines. Modeling and simulation of emissions of toxic exhaust gas components in an internal combustion engine.

Teaching methods

1. Lecture with multimedia presentation
2. Exercises - solving problems

Bibliography

Basic
1. Zeigler B.P., Teoria modelowania i symulacji. PWN Warszawa, 1984
2. Sobieszczański M.: Modelowanie procesów zasilania w silnikach spalinowych. WKŁ, Warszawa 2000
3. Rychter T., Teodorczyk A., Modelowanie matematyczne roboczego cyklu silnika tłokowego. PWN, Warszawa 1980.
4. Tarnowski W., Symulacja komputerowa procesów ciągłych. Wydawnictwo Uczelniane Wyższej Szkoły Inżynierskiej, Koszalin 1996
Additional
1. Instrukcja AVL FIRE
2. Instrukcja AVL BOOST, AVL Criuse

Breakdown of average student's workload

	Hours	ECTS
Total workload	45	3,00
Classes requiring direct contact with the teacher	27	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	18	1,00