COURSE DESCRIPTION CARD - SYLLABUS

Course name
Selected Problems of Engine Element Systems Calculations [S2MiBP1-HSN>WMOUSSp]

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
0

Tutorials
30

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

Knowledge: Student has a basic knowledge of the construction, construction and operation of components and systems of internal combustion engines. Skills: Student is able to obtain information from literature, databases and other, properly selected sources, can integrate information, make their interpretation, as well as draw conclusions and formulate and justify opinions. Social competencies: Student understands the need for lifelong learning, can inspire and organize the learning process of other people, understands the need and ability to self-education, has the ability to work in a team.

Course objective

The aim of the course is to familiarize students with modern techniques allowing for multi-faceted work on selected systems of internal combustion engines.

Course-related learning outcomes

Knowledge:
1. Has advanced knowledge about modern technologies of machine manufacturing in the field of designing the production process of machine parts and their assembly using computer CAM tools
2. He has in-depth knowledge of the construction and operation principles and classification of

machines from a selected group
3. Has general knowledge about the principles and methods of constructing working machines, in particular the methods of functional and strength calculations, optimization of mathematical mechanical constructions and modeling of machine structures in 3D systems
4. Has extensive knowledge about the life cycle of machines, the principles of exploitation of working machines and destructive processes occurring during operation, such as tribological wear, corrosion, surface fatigue and volumetric aging of material

Skills:
1. Is able to develop a technical description and offer and construction documentation for a complex machine from a selected group of machines
2. Can use a popular system for numerical calculations to program a simple simulation task of a system with a small number of degrees of freedom
3. He can advise on the selection of machines for the production line within the machine group covered by the specialty
4. Is able to perform an average complex design of the construction of a work machine or its assembly using modern CAD tools, including tools for spatial modeling of machines and calculations using the finite element method

Social competences:
1. Is ready to critically evaluate your 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:

Learning outcomes presented above are verified as follows:
Written exam in the lecture part, credit based on the work done during the exercise.

Programme content

Lecture:
Fundamentals of engine design
Motor modelling and simulation
Characteristics of software environments for engine simulation
Discussion of selected engine systems

Exercises:
Execution of engine simulations in selected programs
Making a solid model of a component from a selected engine system

Course topics

Lecture:
Fundamentals of engine design:
- initial assumptions of engine design,
- internal combustion engine manufacturing process (AVL),
- calculation of main engine dimensions,
- number and arrangement of cylinders,
- main engine proportions,
- durability and reliability of the internal combustion engine,

Engine modelling and simulation:
- Modelling and simulation information,
- FEA in engine applications,

Characteristics of software environments for engine simulation
- Diesel-RK,
- Wave,

- AVL Boost,
- AVL Fire,
- GT-Suite, GT-Power,
- Lotus Engine Simulation

Discussion of selected engine systems in relation to their modelling:
- engine injection systems
- crank-piston systems (piston functions, details of piston components, technological clearances for engine systems).

Exercises:
Execution of engine simulations in selected programs
- Diesel-RK,
- Lotus Engine Simulation

Building a solid model of a component from the selected engine system
- 3D model of piston assembly including crank system in Autodesk Inventor software

Teaching methods

1. Lecture with multimedia presentation
2. Tutorials - solving tasks in simulation programs + creating a CAD project (e.g. in Inventor) of a selected engine element

Bibliography

Basic
1. Wajand J. A., Wajand J. T.: Tłokowe silniki spalinowe średnio- i szybkoobrotowe. Wydanie czwarte zmienione. Wydawnictwa Naukowo-Techniczne, Warszawa 2005.
2. Heywood, J.: Internal Combustion Engines Fundamentals, McGraw-Hill, USA, 1988
3. Pistons and engine testing, MAHLE GmbH, Stuttgart 2012
4. Luft S.: Podstawy budowy silników. Wydawnictwa Komunikacji i Łączności, Warszawa 2006.
5. Jędrzejowski J.: Obliczanie tłokowego silnika spalinowego, Wydawnictwa Naukowo-Techniczne, Warszawa 1988.
Additional
1. Stotsky Alexander A.: Automotive Engines; Control, Estimation, Statistical Detection, Springer-Verlag Berlin Heidelberg 2009
2. C. Arcoumanis, T. Kamimoto: Flow and Combustion in Reciprocating Engines, Springer-Verlag Berlin Heidelberg 2009
3. Mollenhauer K, Tschoeke H.: Handbook of Diesel Engines, Springer Heidelberg Dordrecht London New York 2010
4. Hoag Kevin L.: Vehicular Engine Design Powertrain, Springer-Verlag, Wien, 2006

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	45	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	30	1,00