COURSE DESCRIPTION CARD - SYLLABUS

Course name
Hybrid drive systems [S2MiBP1-HSN>UNH]

Course

Field of study
Mechanical and Automotive Engineering

Year/Semester
1/1

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
30

Laboratory classes
15

Other
0

Tutorials
15

Projects/seminars
0

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

KNOWLEDGE: the student has basic general knowledge about the construction of the surrounding world and the laws that govern it 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 social and economic importance of internal combustion engines

Course objective

Providing basic information on the construction and design of internal combustion engines, taking into account the latest solutions.

Course-related learning outcomes

Knowledge:
Has extended knowledge of thermodynamics and fluid mechanics to the extent necessary to understand the principle of operation and calculations of thermodynamic and flow processes occurring in working machines such as heating, cooling, drying, thermal and pressure agglomeration, etc., pneumatic transport, energy conversion, etc.
Has extended knowledge of modern construction materials such as carbon plastics, composites,

ceramics, in terms of their construction, processing technology and applications.
He has in-depth knowledge of the construction, principles of operation and classification of machines from a selected group.

Skills:
Can write user manual and safety manual for designed work machine or vehicle.
He can estimate the potential threats to the environment and people from the designed working machine and vehicle from a selected group.
Can plan and carry out experimental research of specific processes taking place in machines and routine tests of a working machine or a vehicle from a selected group of machines.

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 case of difficulties in solving the problem on its own.
Is willing to think and act in an entrepreneurial manner.

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 reports on laboratory activities. Final credit for classes. Final credit of laboratory classes.

Programme content

Lecture:
Division and types of internal combustion engines. Modern engine cycles, also in hybrid drives: Atkinson and Miller cycles. Working conditions of drive systems in hybrid drives, cooperation of engines in a hybrid drive. Design of timing systems. Valve and valveless timing. Variable Compression Systems - VCR. Design and systems of inlet and outlet systems. Exhaust gas recirculation systems. Methods of controlling motors in hybrid drive systems. Liquid fuel supply for spark ignition engines. Overview of the design of injection systems of SI engines. Fuel supply for diesel engines. Construction, tasks and types of ignition systems. Design of various cooling systems and construction of lubrication systems in hybrid drive systems.
Exercises:
Determining the main dimensions. Strength calculations of selected engine parts. Calculation of the flow through the valves of the engine - diameters. Calculation of basic parameters of the intake system - adjustment of pressure pulsations to the resonant boost system. Selection of the cooling system for the selected internal combustion engine. Calculation of the diesel and diesel engine work indicators.
Laboratory:
Tests of selected internal combustion engine systems (ignition system, injection system), advanced methods of measuring exhaust emissions, testing alternative combustion systems.

Course topics

Lecture:
1. Division and types of internal combustion engines.
2. Modern engine cycles, also in hybrid drives: Atkinson and Miller cycles.
3. Working conditions of drive systems in hybrid drives, cooperation of engines in a hybrid drive.
4. Design of timing systems. Valve and valveless timing.
5. Variable Compression Systems - VCR.
6. Design and systems of inlet and outlet systems.
7. Exhaust gas recirculation systems. Methods of controlling motors in hybrid drive systems.
8. Liquid fuel supply for spark ignition engines.
9. Overview of the design of injection systems of SI engines. Fuel supply for diesel engines.
10. Construction, tasks and types of ignition systems.
11. Design of various cooling systems and construction of lubrication systems in hybrid drive systems.
Exercises:

Determining the main dimensions. Strength calculations of selected engine parts. Calculation of the flow through the valves of the engine - diameters. Calculation of basic parameters of the intake system - adjustment of pressure pulsations to the resonant boost system. Selection of the cooling system for the selected internal combustion engine. Calculation of the diesel and diesel engine work indicators.
Laboratory:
Tests of selected internal combustion engine systems (ignition system, injection system), advanced methods of measuring exhaust emissions, testing alternative combustion systems.

Teaching methods

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

Bibliography

Basic
1. Wajand J.A., Wajand J.T., Tłokowe silniki spalinowe średnio- i szybkoobrotowe. WNT, Warszawa 2000
2. Luft S., Podstawy budowy silników. WKŁ, Warszawa 2009
3. Kowalewicz A., Wybrane zagadnienia samochodowych silników spalinowych. Wydawnictwo WSI, Radom 1996.
4. Kneba Z., Makowski S., Zasilanie i sterowanie silników. WKŁ, Warszawa 2004
5. Gajek A., Juda Z., Czujniki, WKŁ, Warszawa 2008
Additional
1. Materiały konferencyjne dotyczące silników spalinowych
2. Kwartalnik Combustion Engines, www.combustion-engines.eu
3. Zimmermann W., Schmidgall R., Magistrale danych w pojazdach: protokoły i standardy. WKŁ, Warszawa 2008.

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	60	3,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	40	1,00