COURSE DESCRIPTION CARD - SYLLABUS

Course name
Heat engines [S1Energ2>SC]

Course

Field of study
Power Engineering

Year/Semester
3/6

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
15

Laboratory classes
15

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

Basic knowledge in the field of thermodynamics and fluid mechanics and knowledge about construction of energetic machines fired by gaseous fuels. Student should also have skills required for calculation of basic termodynamics parameters of energetic machines cycles.

Course objective

To acquaint students with the theoretical and practical problems related to the flow issues, construction and exploatation parameters of internal combustion gas engines.

Course-related learning outcomes

Knowledge:
They are familiar with and understand the rules and legal regulations regarding the construction, proper operation, assembly, and disassembly of machinery, equipment, installations, and power grids, as well as the processes occurring in the life cycle of energy devices. Therefore, they know how to plan necessary changes in the scope of applicable standards and legal acts.

Skills:

They are able to identify and formulate specifications for simple engineering tasks of a practical nature in the field of energy, including optimizing the consumption of energy generated from renewable and non-renewable energy sources, as well as designing energy recovery systems in industrial processes.

Social competences:
They are aware of the necessity to initiate changes both in the work environment and in the public interest, related to the implementation of new technologies as well as technical and organizational solutions in the field of energy.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: The knowledge acquired during the lecture will be assessed during the exam consisting of 5 open-ended questions, graded on a scale from 0 to 1. The passing threshold is 50% of the points. Topics for the exam, based on which questions will be developed, will be sent to students via email using the university's electronic mail system.
Laboratories: Continuous assessment of skills and competencies in every session through solving engineering tasks and analyzing specific cases, evaluating the knowledge and skills of the student based on a final written test consisting of 2 computational tasks related to the topics covered in the sessions, as well as submission of reports.

Programme content

Lecture: Gas engine construction, thermodynamic cycles of gas engines, operational parameters of reciprocating gas engines, global trends in reciprocating engine development, emission of toxic compounds, gas engine operation, engine failures, combustion of non-standard gas fuels in reciprocating engines, Stirling engines.
Laboratories: Measurement of parameters of reciprocating engine operation, measurement of emissions of harmful and toxic substances from gas engines, solving engineering tasks and problems related to the use of gas engines.

Course topics

Lecture:
1. Classification of heat engines
2. Theoretical cycles of piston engines
3. Operating parameters of piston engines
4. Operating characteristics of piston engines
5. Emission of toxic substances in piston engines
6. Directions of development of piston engines

Lab:
1. Measurement of basic operating parameters of a piston engine
2. Determining the indicated power of a gas engine
3. Measurement of emissions from a piston engine
4. Determination of the efficiency of a piston engine
5. Measurement of the acoustic load of a piston engine
6. Determining the degree of wear of piston engine component

Teaching methods

Lecture: multimedia presentation, illustrated with examples on the board
Laboratory: Performing measurements of parameters of gas engines on industrial facilities, calculating characteristic parameters of gas engines.

Bibliography

Basic:
Wajand J. A., Wajand J. T., Tłokowe Silniki Spalinowe Średnio- i Szybkoobrotowe
Serdecki W., Badania Silników Spalinowych. Laboratorium, Wydawnictwo Politechniki Poznańskiej
Skorek J. Kalina J.: Gazowe układy kogeneracyjne
K. Niewiarowski: Tłokowe silniki spalinowe, WKiŁ, 1983

Additional:
Heywood J.B., Internal Combustion Engine Fundamentals
C.R. Ferguson and A.T. Kirkpatrick, Internal Combustion Engines Applied Thermosciences, Second
Stone R., Introduction to Internal Combustion Engines
Ślefarski R., Gołębiewski M., Czyżewski P., Grzymisławski P., Wawrzyniak J.; Analysis of Combustion Process in Industrial Gas Engine with Prechamber-Based Ignition System; Energies - 2018, vol. 11, no. 2
Ślefarski R., Gołębiewski M., Wawrzyniak J.; Study on combustion process in large bore two-stroke gas engines GMVH-12; W: Engineering Mechanics 2018 : 24th International Conference, May 14-17,2018, Svratka, Czech Republic: Institute of Theoretical and Applied Mechanics of the Czech Academy of Sciences, 2018 - s. 773-776

Breakdown of average student's workload

	Hours	ECTS
Total workload	55	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)	25	1,00