COURSE DESCRIPTION CARD - SYLLABUS

Course name
Thermal Processes in Combustion Engines

Course

Field of study
Construction and exploitation of means of transport

Year/Semester
1/1

Area of study (specialization)
Combustion Engines

Profile of study
general academic

Level of study
Second-cycle studies

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
30	0	0
Tutorials	**Projects/seminars**	
15	0	

Number of credit points

3

Lecturers

Responsible for the course/lecturer:
Prof. Krzysztof Wislocki, DSc, DEng.

Responsible for the course/lecturer:
Filip Szwajca, ME, Doctoral Student

Prerequisites

Completion of basic courses in mechanics, physics, thermodynamics, combustion engines theory and design

Course objective

Teaching the students of foundamentals and definitions of the combustible mixture formation, external and selfignition processes. Description and explanation of chemical combustion process and flame front propagation in combustion chamber. The student should learn methods and systems of generation of the charge air movement in cylinder, charge turbulization and its influance on mixture generation process and mixture combustion. The student should learn the principles of the thermal analysis of the real engine cycle, calculating of heat release and heat release rate in the relation to the combustion process control for better fuel economy and ecology. The student will recognize thermal and mechanical loads in engine cylinder and piston-crank system. The student learn fuel injection systems its moelling and control. The combustion and toxic compounds creation modelling will be presented, as well. The energy balance in engine cylinder will be described and mathematicaly modelled.

Course-related learning outcomes

Knowledge

The student has overall knowledge concerning mechanics, physics, chemistry, technical drawing, matherial strength, suitable to I level of technical studies.

Skills

The student is able to integrade acquired informations, to interprate them, formulate conclusions and justify opinions, aspecially concerning processes and phenomena occuring in combustion engines; he demonstrate alsa technical type of thinking, associating of couse and effect relationships in mechanics, physics and chemistry.

Social competences

The student is aware of social and economic meaning and importance of energy and recources wearing; he demonstrates his own independece in solving technical problems, acquiring and improving of his knowledge and skills.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Written or oral egzamination, semestral work, computing and laboratory exercisses

Programme content

1. Cylinder charge exchange: basic definitions, balance of gases in the cylinder, charge exchange indicators, theoretical model of charge exchange, cylinder filling model, waves distribution phenomena, charge movement in the cylinder. 2. Combustible mixture creation, fuel injection, spray generation and development, Sauter Mean Droplet Diameter (SMD), fuel evaporation. 3. Ignition and selfignition, chemical processes in the ignition delay, selfignition modelling, multistage processes in the selfignition delay, ignition delay modelling, 3 stages of combustion, energy balace in the cylinder, heat exchange. 4. Modelling of combustion, various models of the chain reactions, Wibe-combustion model and other models. 5. Forming of toic compounds during combustion, PM forming model, the Khan's-chart. Forming of NOx during combustion.

Teaching methods

1. Lectures including multimedia presentations. 2. Computing exercises.

Bibliography

Basic

1. Rychter T., Teodorczyk A.: Teoria silników spalinowych. WKiŁ, Warszawa 2005.

2. Luft S.: Podstawy budowy silników. WKiŁ, Warszawa, 2000.

3. Andreas Wimmer, Josef Glaser. Indykowanie silnika. Warszawa 2004.

4.Kowalewicz A.: Tworzenie mieszanki i spalanie w silnikach o zapłonie iskrowym. WKiŁ. Warszawa, 1984.

Additional

1. Kowalewicz A.: Podstawy procesów spalania. WNT. Warszawa 2000.

2. Niewiarowski K.: Tłokowe silniki spalinowe. WKiŁ, Warszawa 1983.

3. Kowalewicz A.: Systemy spalania szybkoobrotowych tłokowych silników spalinowych. WKiŁ. W-wa, 1980.

Breakdown of average student's workload

	Hours	ECTS
Total workload	80	3,0
Classes requiring direct contact with the teacher	45	2,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	35	1,0

[1] delete or add other activities as appropriate