STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Thermal Processes of IC Engines**		Code **1010622211010620305**
Field of study **Mechanical Engineering**	Profile of study (general academic, practical) **(brak)**	Year /Semester **1 / 1**
Elective path/specialty **Internal Combustion Engines**	Subject offered in: **Polish**	Course (compulsory, elective) **obligatory**
Cycle of study: **Second-cycle studies**	Form of study (full-time,part-time) **full-time**	
No. of hours Lecture: **2** Classes: **1** Laboratory: **-** Project/seminars: **-**		No. of credits **3**
Status of the course in the study program (Basic, major, other) **(brak)**	(university-wide, from another field) **(brak)**	
Education areas and fields of science and art **technical sciences**		ECTS distribution (number and %) **3 100%**

Responsible for subject / lecturer:

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Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	student has a basic knowledge of design of combustion engines
2	**Skills**	student is able to integrate the information, make their interpretation, draw conclusions, formulate and justify opinions
3	**Social competencies**	student is aware of the important means non-technical aspects and impacts of operation of combustion engines

Assumptions and objectives of the course:

Transfer of basic knowledge about the desing of combustion engines with the latest solutions.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Student has a broader and deeper knowledge of the design of combustion engines and solving complex engineering tasks - [K2A_K04]
2. Student has a theoretical underpinnings detailed knowledge related to the desing of parts of combustion engines - [K2A_W18]
3. Student has a detailed knowledge about desing of combustion engine and knowledgeable about trends in development of combustion engines - [K2A_W21]

Skills:

1. The student knows how to use analytical and experimental methods to formulate and solve problems associated with the combustion engines - [K2A_U02]
2. Students can obtain information from the literature to make their identification and draw conclusions specific to desing and oprerating of combustion engines - [K2A_U01]
3. Student is able to plan and carry out experiments on the parts of combustion engines - [K2A_U07]
4. Student is able to analyze and evaluate the functioning of the existing technology of internal combustion engines - [K2A_U10]

Social competencies:

1. The student understands the necessity of lifelong learning - raising professional and personal competences - [K2A_K01]
2. The student is able to think and act in a creative and enterprising - [K2A_K07]
3. The student is aware of their responsibility for collaborative tasks related to teamwork - [K2A_K04]

Assessment methods of study outcomes

Discussion with the use of visual materials related to combustion engines.
The written examination, completion exercises based on the work carried out.

Course description

Charge exchange processes. Charge motion in the cylinder. Combustion in SI engines: ignition from sparks, flame propagation, unique processes, abnormal combustion. Combustion in diesel engines: fuel systems, fuel injection process and its parameters, physical and chemical processes of ignition delay period, fuel burn/heat evolution, its main phase. The possibility of forming process heat discharge due to its physical and chemical effects. Combustion models. The formation of the cylinder: nitrogen oxides, hydrocarbons, carbon monoxide, soot, etc. The heat transfer in combustion engines: convection, gas radiation and flame propagation (empirical determination of the problems). An internal balance of energy in the cylinder. The main problems of the so-called. thermal load on internal combustion engines.

Basic bibliography:

1. Oppenheim A.K., Combustion in Piston Engines. Verlag: Berlin, Springer, 2004.
2. Wajand J.A., Wajand J.T., Tłokowe silniki spalinowe średnio- i szybkoobrotowe. WNT, Warszawa 2000
3. Luft S., Podstawy budowy silników. WKŁ, Warszawa 2009
4. Kowalewicz A., Wybrane zagadnienia samochodowych silników spalinowych. Wydawnictwo WSI, Radom 1996.

Additional bibliography:

1. Proceedings of the hybrid powertrain
2. Combustion Engines Magazine

Result of average student's workload

Activity	Time (working hours)
1. Participation in the lecture	76
2. Consulting (lecture)	3
3. Exam preparation	12
4. Participation in the exam	3
5. Prepare for training auditorium	5
6. Participation in exercises auditorium	15
7. Consulting (excersice)	3
8. Preparing to pass	3
9. Participation in passing the material	2

Student's workload

Source of workload	hours	ECTS
Total workload	76	3
Contact hours	56	2
Practical activities	20	1