STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Internal Combustion Engines**		Code **1010624161010620244**
Field of study **Mechanical Engineering**	Profile of study (general academic, practical) **(brak)**	Year /Semester **3 / 6**
Elective path/specialty **Internal Combustion Engines**	Subject offered in: **Polish**	Course (compulsory, elective) **obligatory**
Cycle of study: **First-cycle studies**	Form of study (full-time,part-time) **part-time**	
No. of hours Lecture: **18** Classes: **-** Laboratory: **20** 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:

DSc. DEng. Ireneusz Pielecha
email: ireneusz.pielecha@put.poznan.pl
tel. 61 224 45 02
Faculty of Machines and Transport
Piotrowo 3 Street, 60-965 Poznań

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_W14]
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
Types of models and methods of modeling. The use of models in the study of technical processes and combustion engines. Types and kinds of simulation and objects. Mathematical and physical modeling. Modeling and simulation of fuel injection and injection sizing. Modeling and simulation of ignition in internal combustion engine. Modelling of temperature distribution in an internal combustion engine components. Stationary and non-stationary models. Dynamic simulation of temperature distribution in an internal combustion engine components. Modeling and simulation of toxic exhaust emissions from the internal combustion engine. Modeling using FIRE software by AVL.

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.
5. Kneba Z., Makowski S., Zasilanie i sterowanie silników. WKŁ, Warszawa 2004
6. Gajek A., Juda Z., Czujniki, WKŁ, Warszawa 2008

Additional bibliography:

1. Proceedings of the hybrid powertrain
2. Combustion Engines Magazine
3. Zimmermann W., Schmidgall R., Magistrale danych w pojazdach: protokoły i standardy. WKŁ, Warszawa 2008.

Result of average student's workload

Activity	Time (working hours)
1. Participation in the lecture	30
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