STUDY MODULE DESCRIPTION FORM

Name of the module/subject	Code
Supercharging of Internal Combustion Engines	**1010622221010620477**

Field of study	Profile of study (general academic, practical)	Year /Semester
Mechanical Engineering	**(brak)**	**1 / 2**
Elective path/specialty	**Subject offered in:**	**Course (compulsory, elective)**
Internal Combustion Engines	**Polish**	**obligatory**

Cycle of study:	Form of study (full-time,part-time)
Second-cycle studies	**full-time**

No. of hours	No. of credits
Lecture: **2** Classes: **1** Laboratory: **-** Project/seminars: **-**	**3**

Status of the course in the study program (Basic, major, other)	(university-wide, from another field)
(brak)	**(brak)**

Education areas and fields of science and art	ECTS distribution (number and %)
technical sciences	**3 100%**

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 and working principles of combustion engines as well as of the rules on mechanics, physics, chemistry, materials strength.
2	**Skills**	student is able to interpret basics of processes and phenomenon occurring in piston engines, grate the information, make their interpretation, draw conclusions, formulate and justify opinions mainly on cause and effect relationships.
3	**Social competencies**	student is aware of the important means non-technical aspects and impacts of operation of combustion engines; students is able to define priorities in solving predefined technical tasks.

Assumptions and objectives of the course:

To teach the student definitions and main principles of application of supercharging systems in internal combustion engines; to learn boundaries and limitations in super- and turbocharging; get to know the rules of shaping of full-load engine characteristics; basic principles and model of mathematical modeling of turbocharging and turbocharger matching to the engine .

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

Knowledge:

1. Student has a broader and deeper knowledge of the application of supercharging as the method of improvement of operational indexes of IC engines - [W14]
2. Student has a theoretical underpinnings detailed knowledge related to the solving of problems combustion engine and turbocharger cooperation - [W18]
3. Student has a detailed knowledge about super- and turbocharging systems applied in combustion engines and knowledge about trends in its development - [W21]

Skills:

1. The student knows how to use analytical and experimental methods to formulate and solve problems associated with the supercharging in IC Engines - [U02]
2. Students can obtain information from the literature to make their identification and draw conclusions specific to design and operating of supercharging systems in combustion engines - [U01]
3. Student is able to plan and carry out experiments on the supercharging systems - [U07]
4. Student is able to analyze and evaluate the functioning of the existing technology by identification of cause and effect relationships in super- and turbocharged internal combustion engines - [U10]

Social competencies:

1. The student understands the necessity of lifelong learning - raising professional and personal - [K01]
2. The student is able to think and act in a creative and enterprising - - [K07]
3. The student is aware of their responsibility for collaborative tasks related to teamwork - [K04]

Assessment methods of study outcomes

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

Course description

Definition and purposefulness of application of supercharging systems in IC engines. Systematization of supercharging systems. Historical sketch of super- and turbocharging. Supercharging degree and its restrictions. Theoretical and real thermodynamic cycles of supercharged engines. Charger-less supercharging, mechanical supercharging and turbocharging. Constant pressure and pulse turbocharging. One-stage and multistage turbocharging, sequential turbocharging. Matching turbocharger to the engine. Problems of turbocharger control and control systems. Combined and differential turbocharging. Intercooling and aftercooling. Design problems in turbocharged engines. Unconventional supercharging systems.

Basic bibliography:

1. Wisłocki K.: Systemy doładowania szybkoobrotowych silników spalinowych. WKiŁ, Warszawa 1992, ss. 356;
2. Kowalewicz A.: Doładowanie silników spalinowych. Politechnika Radomska 1998 r.
3. Mysłowski J.: Doładowanie silników spalinowych. WKiŁ, Warszawa 2002 r.
4. Rychter T., Teodorczyk A.: Teoria silników tłokowych. WKiŁ, Warszawa 2006, ss. 270;

Additional bibliography:

1. Zinner K.: Aufladung von Verbrennungsmotoren, Springer-Verlag, I-IV Auflage, -1985;
2. Watson N., Janota M.: Turbocharging the internal combustion engines, The MacMillan Press Ltd.,London 1982;
3. Pucher H.: Aufladung von Verbrennungsmotoren. Kontakt und Studium, B. 133, Expert Verlag 1985
4. Hiereth H., Prenninger P.: Aufladung von Verbrennungskraftmaschinen. Springer Verlag,2003.

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	74	3
Contact hours	56	2
Practical activities	0	0