Course code: MBM PS **Course item:** D.3.2

1. INFORMATION ABOUT THE COURSE

A. Basic information

Course title	Internal combustion engines
Field of study	Mechanical engineering
Cycle	First cycle
Study profile	Academic
Study mode	Full-time
Specialisation	Cars and tractors
Unit responsible for the field of study	Faculty of Mechanical Engineering
Lecturer	PhD. Marcin Łukasiewicz, PhD. Tomasz Kałaczyński
Introductory courses	thermodynamics, mechanics
Prerequisites	no prerequisites

B. Semester/ weekly timetable

Semester	Lectures	Classes	Laboratories	Project classes	Seminars	Fieldwork	ECTS credits
winter /summer	30	-	30	-	-	-	4

C. Assumed outcomes and aims - aims bind the course programme with the study programme and are referred to in learning outcomes point 2

2. LEARNING OUTCOMES (acc. to National Qualifications Framework)

No.	Description of learning outcomes	Reference to learning outcomes for the field of study	Reference to learning outcomes for the area of study
KNOWLEDGE			
K1	has knowledge of machine exploitation	K_W08	P6S_WG
K2	has basic knowledge of development trends in the field of science and scientific disciplines relevant to the studied field of study	K_W14	P6S_WK
SKILLS			
S1	can obtain information from literature, databases, catalogues, standards and patents; is able to integrate the obtained information, interpret it, draw conclusions and formulate and justify opinions	K_U01	P6S_UW

S2	can design simple systems for the operation of machines and devices	K_U07	P6S_UW
SOCIAL COMPETENCES			
SC1	understands the need and knows the possibilities of continuous training (second and third degree studies, postgraduate studies, courses) - improving professional, personal and social competences	K_K01	P6S_KK
SC2	is aware of the importance and understands the non-technical aspects and effects of the activities of a mechanical engineer, including its impact on the environment, and the related responsibility for decisions made	K_K04	P6S_KO

3. TEACHING METHODS

multimedia lecture, laboratory classes, discussion.

4. METHODS OF EXAMINATION

Oral/written exam, colloquium, short raport – every laboratory classes

5. COURSE CONTENT

Specify the content separately for each type of classes in accordance with point I.B.	**Lecture** Introduction: division of heat and combustion engines and their use, basic names and definitions. Motor fuels and their properties. Comparative cycles and their properties, real cycles in 4 and 2 stroke engines. The course and parameters of individual phases of the real cycle. Indicator chart. Engine operation indicators. Engine characteristics. Self-ignition and spark ignition engines - principle of operation, description of working processes, combustion chambers. Flushing and charging in 2-stroke engines, top-up. General principles of engine design. Crank system - kinematics and dynamics of the system. Purpose, construction and basics of calculations of crank system elements. Timing system - mechanics and tasks, construction and calculations of timing system components. Cooling systems - construction and principle of operation. Lubrication system - purpose, lubrication systems, construction. Fuel supply systems for SI and CI engines. Ecological aspects of the operation of internal combustion engines. Information technology in engine design. **Laboratories** Introduction, health and safety rules. Practical acquaintance with the construction and principle of operation of selected assemblies of car engines: power supply system, timing system, crank-piston system, oiling system, cooling system, determination of engine characteristics, measurement and analysis of toxic exhaust components of SI and CI engines.

6. VALIDATION OF LEARNING OUTCOMES

(Each learning outcome from the list requires validation methods to ensure that it was achieved by a student.)

Learning outcome	Form of assessment (for example:)					
	Oral examination	Written examination	Colloquium	Project	Report	……
K1	x	x				
K2	x	x				
S1			x		x	

S2			x		x	
SC1			x		x	
SC2			x		x	

7. LITERATURE

Basic literature	1. Wajand J., Wajand J.: *Tłokowe silniki spalinowe średnio i szybkoobrotowe*. WNT, Warszawa 2005. 2. Jankowski M., Żółtowski B.: *Badania silników spalinowych*. Skrypt ATR, Bydgoszcz 1995. 3. Rychter T., Teodorczyk A.: Teoria silników tłokowych. WKŁ, Warszawa 2006.
Supplementary literature	1. Niewiarowski K.: *Tłokowe silniki spalinowe.* WNT, Warszawa 1983 2. Luft S.: *Podstawy budowy silników*. WKŁ, Warszawa 2003. 3. Janiszewski T, Spiros M.: *Elektroniczne układy wtryskowe silników wysokoprężnych*. WKŁ, Warszawa 2009. 4. J. Jędrzejowski - *Obliczanie tłokowego silnika spalinowego.* WNT Warszawa 1998.

8. TOTAL STUDENT WORKLOAD REQUIRED TO ACHIEVE EXPECTED LEARNING OUTCOMES EXPRESSED IN TIME AND ECTS CREDITS

Student's activity		Student workload– number of hours (for example:)
Classes conducted under a direct supervision of an academic teacher or other persons responsible for classes	Participation in classes indicated in point 1B	60
	Supervision hours	2
Student's own work	Preparation for classes	5
	Reading assignments	15
	Other (preparation for exams, tests, carrying out a project etc)	10
Total student workload		92
	Final number of ECTS credits	4