Fundusze Europejskie
Wiedza Edukacja Rozwój

Politechnika Warszawska

Unia Europejska
Europejski Fundusz Społeczny

Warsaw University of Technology

Faculty of Automotive and Construction Machinery Engineering

WARSAW UNIVERSITY OF TECHNOLOGY

Curriculum

for

Mechanical Engineering
(conducted in English)

specialisation

Advanced Machinery and Vehicles Engineering

Field of Study

Full-time study

II degree study

Warsaw 2022

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1. BASIC INFORMATION ABOUT THE STUDY

1.1. Faculty: Faculty of Automotive and Construction Machinery Engineering

1.2. Field of study: Mechanical Engineering

1.3. Level of study: Second-cycle study

1.4. Profile of study: General academic

1.5. Form of study: Full-time study

1.6. Language of study: English

1.7. Academic discipline to which the field of study is assigned: Mechanical Engineering

1.8. Number of semesters of study: 4 semesters

1.9. Professional title awarded to graduates: Master of Science

1.10. General educational objectives (description of the profile of graduates of the field of study, graduates of the specialisation):

Graduates of the Mechanical Engineering field of study, conducted in English at the Faculty of Automotive and Construction Machinery Engineering of the Warsaw University of Technology, are characterised by: extensive knowledge of basic subjects and an interdisciplinary and systemic approach to solving technical problems. They are able to work in international English-speaking teams. Graduates have knowledge and skills related to the design, manufacture and operation of machinery and vehicles. They also have skills related to the use of modern design and manufacturing techniques used in the vehicle and machinery industry. They also have knowledge of modern diagnostic methods, as well as are prepared for work related to the operation of machinery and vehicles.

Graduates of the Mechanical Engineering field of study conducted in English are prepared for creative activities in design, research and development or operation-related departments in multinational corporations, as well as in small and medium-sized enterprises dealing with the production and operation of vehicles and machines.

We offer the following specialisation: **Advanced Machinery and Vehicles Engineering.**

As part of the specialisation, graduates acquire knowledge and skills in the following areas:

- Mechanics of vehicle and machine movement,
- Modelling and computer simulation of phenomena occurring in vehicle and machine movement,
- Structure and design of vehicles: powertrain, chassis and body systems with the use of engineering software,

- Advanced computational methods for numerical simulation of the behaviour of engineering structures,
- Use of modern computer tools and methods used in CAD/CAM/CAE integrated design systems,
- Development of new methods used in computer-aided design and manufacturing,
- Issues related to the structure, design, operation of piston combustion engines and their components,
- Conducting empirical and simulation research on combustion engines,
- Issues concerning the use of alternative fuels used to supply internal combustion engines.

Graduates will find employment in design companies and in research and development centres related to the vehicle and machinery industry in Poland and abroad. Also in production and service firms related to road transport, including public transport companies (buses, trams, and underground). All these companies and institutions are potential workplaces for masters of engineering – graduates of the offered specialisation.

1.11. Prerequisites and expected competence of applicants for the second-cycle study

Applicants for admission to the second-cycle Mechanical Engineering field of study in English must have a first-cycle qualification and the competence necessary to continue their education in the second-cycle Mechanical Engineering field of study. Applicants should have competence including in particular:

1) Knowledge and skills in mathematics and physics to understand the physical fundamentals of mechanics and machine construction and to formulate and solve simple machine construction tasks,
2) Knowledge and skills in mechanics, thermodynamics, fluid mechanics, and electricity necessary to understand the fundamental physical phenomena that occur in the power transmission systems of machines and vehicles,
3) Knowledge of mechanics of materials, including stress and strain states in elements of mechanical structures, necessary to conduct strength analyses,
4) Ability to use analytical, simulation and experimental methods to formulate and solve engineering tasks in construction of machines and vehicles,
5) Knowledge and skills in the design of power transmission systems and structural components of machinery, including selection of materials, technological process, preparation of technical documentation and preliminary economic evaluation of actions taken,

6) Skills to interpret, present and document the results of an experiment and to present and document the results of a design task,
7) Abilities to communicate in English in the field of study according to the requirements of at least B2+ according to the Common European Framework of Reference for Languages.

2. DESCRIPTION OF THE EFFECTS OF EDUCATION IN THIS FIELD

Intended learning outcomes

Reference to learning outcomes in the learning area of study program	Learning outcomes for Mechanical Engineering	Reference – symbol I/III	Reference – symbol
Knowledge			
K_W01	has extensive and in-depth knowledge in the field of chosen areas of mathematics, mechanics, numerical methods, optimization methods including genetic and neural network algorithms indispensable for: 1. modelling and analyzing advanced design problems in machine and vehicle construction, 2. modelling and synthesizing advanced mechanical systems, 3. modelling and analyzing, as well as synthesizing advanced, complex production processes.	I.P7S_WG.o	P7U_W
K_W02	has basic knowledge in the field of solid-state physics, quantum physics, relativistic physics and nuclear physics.	I.P7S_WG.o	P7U_W
K_W03	has extensive and in-depth knowledge in the field of physics (especially mechanics and thermodynamics),	I.P7S_WG.o	P7U_W
K_W04	has well-ordered and theoretically-based knowledge in the field of materials mechanics, indispensable to perform strength analysis of construction elements, including the use of computer systems	I.P7S_WG.o	P7U_W
K_W05	has extensive and in-depth knowledge in the field of advanced modelling and analysis problems applied in fluid mechanics and	I.P7S_WG.o	P7U_W

	thermodynamics		
K_W06	has well-ordered knowledge in the field of modern materials, main development trends and the most important achievements used in machine construction, and ways of determining their mechanical properties, as well as knows economic aspects of their application	I.P7S_WG.o I.P7S_WK	P7U_W
K_W07	has well-ordered and in-depth knowledge in the field of modern integrated production systems	I.P7S_WG.o	P7U_W
K_W08	has well-ordered and in-depth knowledge in the field of solution applied in machine and vehicle automated systems, and development trends which are related to them	I.P7S_WG.o	P7U_W
K_W09	has basic knowledge in the field of contemporary applications of computer tools in solving problems of vehicle and construction machinery design	I.P7S_WG.o	P7U_W
K_W10	has extensive knowledge in the field of integrating new solutions and developments into design and production processes in reference to vehicles and construction machinery	I.P7S_WG.o	P7U_W
K_W11	has in-depth knowledge in the field of computer modeling of machine and vehicle design issues	I.P7S_WG.o	P7U_W
K_W12	has extensive knowledge in the field of machine systems testing and modelling	I.P7S_WG.o	P7U_W
K_W13	knows and understands basic approaches applied in modeling and testing processes of contemporary machines and vehicles	I.P7S_WG.o	P7U_W
K_W14	has well-ordered and in-depth knowledge in the field of diagnosis of technically advanced machines and vehicles	I.P7S_WG.o	P7U_W
K_W15	knows and understands basic methods applied in modeling of technical systems	I.P7S_WG.o	P7U_W
K_W16	has basic knowledge in the field of intellectual property management and patent law, and forms of individual entrepreneurship	I.P7S_WG.o	P7U_W
K_W17	has a basic knowledge of the life cycle and maintenance of construction machinery and vehicles	I.P7S_WG.o III.P7S_WG	P7U_W
K_W18	has elementary knowledge of management, including quality management and conducting business	I.P7S_WK	P7U_W
K_W19	knows the basic rules for the creation and development of forms of individual enterprise	I.P7S_WK III.P7S_WK	P7U_W

Skills			
K_U01	knows how to use learnt mathematical and physical methods and models to support implementation of engineering processes, by means of assessments and critical analysis	I.P7S_UW.o III.P7S_UW.o	P7U_U
K_U02	can apply learnt modelling and analyzing methods and tools in the processes of solving advanced design issues in machine and vehicle construction	I.P7S_UW.o III.P7S_UW.o	P7U_U
K_U03	knows how to successfully perform modelling and synthesizing process of advanced mechanical systems, and to critically assess the obtained solutions	I.P7S_UW.o III.P7S_UW.o	P7U_U
K_U04	knows how to choose proper construction materials to design elements of machines and vehicles, based on the knowledge of their mechanical properties, and considering the economic assessment of performed engineering actions	I.P7S_UW.o III.P7S_UW.o	P7U_U
K_U05	can analyze advanced, complex processes using contemporary and modern production systems, and can use contemporary, integrated production systems,	I.P7S_UW.o III.P7S_UW.o	P7U_U
K_U06	can apply knowledge using contemporary techniques and tools referring to advanced solutions in machine and vehicle automated systems,	I.P7S_UW.o III.P7S_UW.o	P7U_U
K_U07	can design optimal elements and systems of machines and vehicles, considering economic and functional criteria, using the right methods and tools and considering their production technological process	I.P7S_UW.o III.P7S_UW.o	P7U_U
K_U08	can practically implement knowledge in the field of computer, advanced modelling in order to analyze and technically simulate issues of machine and vehicle construction	I.P7S_UW.o III.P7S_UW.o	P7U_U
K_U09	knows how to plan and perform a study of construction machinery and vehicle mechanical systems and can interpret the results as well as draw proper conclusions,	I.P7S_UW.o III.P7S_UW.o	P7U_U
K_U10	can apply knowledge in the field of contemporary numerical solutions in construction machinery and vehicle design,	I.P7S_UW.o III.P7S_UW.o	P7U_U
K_U11	can use knowledge in the field of diagnostics while solving technically advanced diagnostic problems in machines and vehicles, using analytical simulation and experimental methods	I.P7S_UW.o III.P7S_UW.o	P7U_U
K_U12	while performing project and research assignments, is able to recognize the	I.P7S_UW.o III.P7S_UW.o	P7U_U

	components requiring unconventional solutions; while performing project and research assignments, is able to recognize and appreciate innovative and non-technical elements,		
K_U13	can use methods of technical system modelling in the design of construction machinery and vehicles, within the scope of analyzing the obtained solutions	I.P7S_UW.o III.P7S_UW.o	P7U_U
K_U14	in order to solve engineering problems, can integrate knowledge coming from different sources, both in terms of interdisciplinary and multidisciplinary engineering processes in machine and vehicle construction,	I.P7S_UW.o III.P7S_UW.o	P7U_U
K_U15	can obtain information from literature, data bases and other sources; can integrate obtained information, interpret it, critically evaluate it, draw conclusions and formulate factual opinions,	I.P7S_UW.o	P7U_U
K_U16	knows how to develop and present a study on a performed experiment or project assignment; can prepare a comprehensive report on obtained results,	I.P7S_UW.o III.P7S_UW.o	P7U_U
K_U17	can prepare and give a presentation on an existing solution and perform a design task in order to improve an existing solution	I.P7S_UK III.P7S_UW.o	P7U_U
K_U18	has such command of English or other foreign language recognized as medium of international communication in the area of machines and vehicles, which allows proper communication on professional matters, comprehension of specialized literature, or giving a short presentation on a performed project or research assignment,	I.P7S_UK	P7U_U
K_U19	can specify fields of further education in order to improve professional competences,	I.P7S_UU	P7U_U
K_U20	can supervise the work of a team in an industrial environment, related to project and research tasks within the field of machine and vehicle design,	I.P7S_UW.o	P7U_U
K_U21	can work individually and in group; can estimate the time needed to complete a given task; can develop and implement a work schedule to ensure deadlines are met.	I.P7S_UO	P7U_U
Social Competences			
K_K01	understands the need to formulate and convey to a society in a commonly understandable manner information and opinions relating to achievements in the field of machine and vehicle construction, as well as other aspects	I.P7S_KO I.P7S_KR	P7U_K

	of a mechanical engineer's activity		
K_K02	understands the need of a life-long learning, can inspire and organize other people's learning process in the field of advanced issues in the field of mechanics and construction machinery	I.P7S_KK I.P7S_KO	P7U_K

3. STUDY PLAN

First year/Semester 1

No	Subject	Type of course				ECTS point	Symbol credits
		L	E	Lab	Pro		
1	Complex analysis	30	15	0	0	4	E/Z
2	Probability and statistics	30	15	0	0	4	E/Z
3	Mechanics	30	30	0	0	5	E/Z
4	Integrated production systems	30	0	15	0	3	Z
5	Applied physics	45	0	0	0	4	Z
6	Computer programing	15	0	0	45	8	Z
7	Elective course HES 1	30	0	0	0	2	Z
	Total	210	60	15	45	30	

First year/Semester 2

No	Subject	Type of course				ECTS point	Symbol credits
		L	E	Lab	Pro		
1	Computer aided manufacturing	15	0	15	0	3	E/Z
2	Thermodynamics of heat engines	30	15	0	0	3	E/Z
3	Fluid flow computer modelling	15	0	0	15	3	Z
4	Elective course B1	15	0	0	15	3	Z
5	Elective course B2	15	0	0	15	3	Z
6	Elective course B3	15	0	0	15	3	Z
7	Elective course B4	15	0	0	15	3	Z
8	Elective course B5	15	0	0	15	3	Z
9	Interim project I	0	0	0	75	6	P
	Total	135	15	15	165	30	

Second year/Semester 3

No	Subject	Type of course				ECTS point	Symbol credits
		L	E	Lab	Pro		
1	Design theory	30	0	0	0	2	E/Z
2	Modelling machines and vehicles	30	0	15	15	6	E/Z
3	Machine diagnostics	15	0	15	0	2	Z
4	Elective course A1	30	0	0	0	2	Z
5	Elective course B6	15	0	0	15	3	Z
6	Elective course B7	15	0	0	15	3	Z
7	Elective course B8	15	0	0	15	3	Z

8	Elective course B9	15	0	0	15	3	Z
9	Interim project II	0	0	0	75	6	P
	Total	165	0	30	150	30	

Second year/Semester 4

No	**Subject**	**Type of course**				**ECTS point**	**Symbol credits**
		L	**E**	**Lab**	**Pro**		
1	Diploma seminar	0	30	0	0	2	Z
2	Elective course A2	30	0	0	0	2	Z
3	Elective course B10	15	0	0	15	3	Z
4	Elective course HES 2 *	30	0	0	0	3	Z
5	Master of science thesis	0	0	0	270	20	P
	Total	75	30	0	285	30	

***** the subject must include outcome KW_19

4. STRUCTURE OF THE EDUCATIONAL PROGRAM

4.1. SUBJECTS FROM THE GROUP OF MATHEMATICS AND PHYSICS

Table of subjects in mathematics

No	**Subject**	**Type of course**				**Sum**	**ECTS point**
		L	**E**	**Lab**	**Pro**		
1	Complex analysis	30	15	0	0	45	4
2	Probability and statistics	30	15	0	0	45	4
	Total	**60**	**30**	**0**	**0**	**90**	**8**

Table of subjects in physics

No	**Subject**	**Type of course**				**Sum**	**ECTS point**
		L	**E**	**Lab**	**Pro**		
1	Mechanics	30	30	0	0	60	5
2	Applied physics	45	0	0	0	45	4
3	Thermodynamics of heat engines	30	15	0	0	45	3
	Total	**105**	**45**	**0**	**0**	**150**	**12**

4.2. Humanistic, economic and social subjects

Table of humanistic, economic and social subjects

No	**Subject**	**Type of course**				**Sum**	**ECTS point**
		L	**E**	**Lab**	**Pro**		
1	Elective course HES 1	30	0	0	0	30	2
2	Elective course HES 2	30	0	0	0	30	3
	Total	**60**	**0**	**0**	**0**	**60**	**5**

4.3. SUBJECTS RELATED TO THE SCIENTIFIC DISCIPLINE

Table of subjects in mechanical engineering

No	Subject	Type of course				Sum	ECTS point
		L	E	Lab	Pro		
1	Mechanics	30	30	0	0	60	5
2	Integrated production systems	30	0	15	0	45	3
3	Computer aided manufacturing	15	0	15	0	30	3
4	Fluid flow computer modelling	15	0	0	15	30	3
5	Thermodynamics of heat engines	30	15	0	0	45	3
6	Modelling machines and vehicles	30	0	15	15	60	6
7	Machine diagnostics	15	0	15	0	30	2
8	Computer programing	15	0	0	45	60	8
9	Elective course A1	30	0	0	0	30	2
10	Elective course A2	30	0	0	0	30	2
11	Elective course B1	15	0	0	15	30	3
12	Elective course B2	15	0	0	15	30	3
13	Elective course B3	15	0	0	15	30	3
14	Elective course B4	15	0	0	15	30	3
15	Elective course B5	15	0	0	15	30	3
16	Elective course B6	15	0	0	15	30	3
17	Elective course B7	15	0	0	15	30	3
18	Elective course B8	15	0	0	15	30	3
19	Elective course B9	15	0	0	15	30	3
20	Elective course B10	15	0	0	15	30	3
21	Interim project I	0	0	0	75	75	6
22	Interim project II	0	0	0	75	75	6
23	Master of science thesis	0	0	0	270	270	20
	Total	**390**	**15**	**60**	**645**	**1140**	**99**

4.4. ELECTIVE SUBJECTS

Table of elective subjects to be chosen by the student

No	Subject	Type of course				Sum	ECTS point
		L	E	Lab	Pro		
1	Elective course A1	30	0	0	0	30	2
2	Elective course A2	30	0	0	0	30	2
3	Elective course B1	30	0	0	0	30	2
4	Elective course B2	30	0	0	0	30	2
5	Elective course B3	15	0	0	15	30	3
6	Elective course B4	15	0	0	15	30	3
7	Elective course B5	15	0	0	15	30	3

No	Subject	Type of course				Sum	ECTS
8	Elective course B6	15	0	0	15	30	3
9	Elective course B7	15	0	0	15	30	3
10	Elective course B8	15	0	0	15	30	3
11	Elective course B9	15	0	0	15	30	3
12	Elective course B10	15	0	0	15	30	3
13	Interim project I	0	0	0	75	75	6
14	Interim project II	0	0	0	75	75	6
15	Elective course HES 1	30	0	0	0	30	2
16	Elective course HES 2	30	0	0	0	30	3
17	Master of science thesis	0	0	0	270	270	20
	Total	**300**	**0**	**0**	**540**	**840**	**69**

4.5. SPECIALISATION (DIPLOMA PROFILE)

The study specialisation (diploma profile) is determined by the student in consultation with the academic supervisor after the first semester of studies. The thesis supervisor may be a staff member (a research and teaching employee or a teaching employee) with a doctoral degree who is chosen by the student. The role of the supervisor is:

- To determine, together with the student, elective lectures from the list in the field of study related to the specialisation being pursued;

To determine the topic and scope of the diploma thesis.

5. DESCRIPTION OF TEACHING MODULES (SUBJECTS)

Description of a subject	
Subject code	
Subject	**COMPLEX ANALYSIS**
Subject version	2022/23
A. Placing the subject within the study system	
Level of study	II degree
Form of study	Full-time study
Field of study	Mechanical Engineering
Profile of study	General academic
Degree program	Advanced Machinery and Vehicles Engineering
Supervising unit	Faculty of Automotive and Construction Machinery Engineering
Performing unit	Faculty of Automotive and Construction Machinery Engineering
Subject coordinator	
B. General characteristics of the subject	
Subject kind	Basic
Subject level	Intermediate
Subject group	Obligatory
Language of instruction	English
Nominal semester	1

Course delivery in the academic year	Winter
Pre-requisites	-
Limit of number of students	30

C. Learning outcomes and the manner of conducting classes

Aim of the subject	Learning methods of complex analysis necessary to study subjects related to the field of study.

Subject outcomes

Code	***Description of the outcomes***	***Reference to learning outcomes in the learning area***	***Learning outcomes for field of study***
Knowledge			
W01	Knowing basic theorems in the field of Complex Analysis the ability to use them.	I.P7S_WG.o	K_W01
Skills			
U01	A student knows methods of Complex Analysis and Laplace Transform and knows how to apply them.	I.P7S_UW.o III.P7S_UW.o	K_U01

Form of classes and their duration	Lecture	Exercises	Laboratory	Project	Computer classes
Timetables	2	1	0	0	0
Throughout the semester	30	15	0	0	0

Learning content	Complex numbers: construction, canonical and trigonometric form, Moivre's theorem, root extraction, roots of polynomian, plane areas. Convergence on the complex plane, number and exponential complex series, complex function of real variable, differentiation and integration, Complex functions, polynomials. Integration of complex functions. Holomorphic maps and Cauchy-Riemann formula. Complex integral (so called Cauchy's). Cauchy formula. Developing real functions into Mc Laurent series. Residue theorem. Calculating real integrals using residue theorem. Reverse Laplace transform. Applying Laplace transform to solving ordinary differentia equations.
Learning methods	lecture presentation exercises problem solving

Methods of examination of learning outcomes

Code	***Evaluation methods***
Knowledge	
W01	Exam, tests, students' involvement while solving problems during practicals.
Skills	
U01	Exam, tests, students' involvement while solving problems during practicals.

Evaluation methods	Exam, tests, students' involvement while solving problems during practicals.
Exam	Yes
References	Materials in English will be shared electronically.
Subject website	–

D. Student's contribution

Number of ECTS points	4
Number of hours of student's work connected with achieving learning outcomes:	1) Number of contact hours- 50, including: a) lecture – 30h; b) practicals - 15 h.; c) consultations - 2 h; d) exam – 3h. 2) Student's individual work 60 hours, including: a)40 h – student's current preparation for practicals and lectures, literature study, b) preparing for tests – 10 h c) preparing for exam – 10 h TOTAL – 110 h.
Number of ECTS points	2 ECTS points– number of contact hours- 50, including:

for classes requiring direct participation of members of academic staff:	a) lecture – 30h; b) practicals - 15 h.; c) consultations - 2 h; d) exam – 3h.
Number of ECTS points obtained by a student within practical	–
E. Additional information	
Comments	-
Update date	3.10.2022 r.

Description of a subject					
Subject code					
Subject	**PROBABILITY AND STATISTICS**				
Subject version	2022/23				
A. Placing the subject within the study system					
Level of study	II degree				
Form of study	Full-time study				
Field of study	Mechanical Engineering				
Profile of study	General academic				
Degree program	Advanced Machinery and Vehicles Engineering				
Supervising unit	Faculty of Automotive and Construction Machinery Engineering				
Performing unit	Faculty of Automotive and Construction Machinery Engineering				
Subject coordinator					
B. General characteristics of the subject					
Subject kind	Basic				
Subject level	Intermediate				
Subject group	Obligatory				
Language of instruction	English				
Nominal semester	1				
Course delivery in the academic year	Winter				
Pre-requisites	-				
Limit of number of students	30				
C. Learning outcomes and the manner of conducting classes					
Aim of the subject	Learning rules of Calculus of Probability and Statistics indispensable to study subjects related to the field of study.				
Subject outcomes					
Code	***Description of the outcomes***			***Reference to learning outcomes in the learning area***	***Learning outcomes for field of study***
Knowledge					
W01	Knowing basic methods of Calculus of Probability and Statistics and their application.			I.P7S_WG.o	K_W01
Skills					
U01	A student knows basic methods of Calculus of Probability and Statistics and their application.			I.P7S_UW.o III.P7S_UW.o	K_U01
Form of classes and their duration	Lecture	Exercises	Laboratory	Project	Computer classes
Timetables	2	1	0	0	0
Throughout the semester	30	15	0	0	0

Learning content	Mathematical model of random experiment: probabilistic measure. Classical probability. Elements of combinatorics. Geometric probability. Conditional probability, chain formula and formula for total probability. Bayes' theorem. Independence of occurrences. Bernoulli and Poisson scheme. Random one-dimensional variables – discrete and continuous. Probability density function. Bernoulli and Poisson distribution, geometric, uniform, exponential. Cumulative and its properties. Function distribution of random variable. Regular distribution. Parameters of random variable distributions. Value of expectation and variance. Regular and central moments. Limit theorem. Elements of descriptive statistics. Theory of estimation. Confidence intervals. Theory of non-parametric hypotheses.
Learning methods	lecture presentation exercises problem solving

Methods of examination of learning outcomes	
Code	***Evaluation methods***
Knowledge	
W01	Exam, tests, students' involvement while solving problems during practicals.
Skills	
U01	Exam, tests, students' involvement while solving problems during practicals.

Evaluation methods	Exam, tests, students' involvement while solving problems during practicals.
Exam	Yes
References	Materials in English will be shared electronically.
Subject website	–
D. Student's contribution	
Number of ECTS points	4
Number of hours of student's work connected with achieving learning outcomes:	1) Number of contact hours- 50, including: a) lecture – 30h; b) practicals - 15 h.; c) consultations - 2 h; d) exam – 3h. 2) Student's individual work 60 hours, including: a)40 h – student's current preparation for practicals and lectures, literature study, b) preparing for tests – 10 h c) preparing for exam – 10 h TOTAL – 110 h.
Number of ECTS points for classes requiring direct participation of members of academic staff:	2 ECTS points– number of contact hours- 50, including: a) lecture – 30h; b) practicals - 15 h.; c) consultations - 2 h; d) exam – 3h.
Number of ECTS points obtained by a student within practical	–
E. Additional information	
Comments	-
Update date	3.10.2022 r.

Description of a subject	
Subject code	
Subject	**MECHANICS**
Subject version	2022/23
A. Placing the subject within the study system	
Level of study	II degree
Form of study	Full-time study
Field of study	Mechanical Engineering
Profile of study	General academic

Degree program	Advanced Machinery and Vehicles Engineering
Supervising unit	Faculty of Automotive and Construction Machinery Engineering
Performing unit	Faculty of Automotive and Construction Machinery Engineering
Subject coordinator	
B. General characteristics of the subject	
Subject kind	Basic
Subject level	Intermediate
Subject group	Obligatory
Language of instruction	English
Nominal semester	1
Course delivery in the academic year	Winter
Pre-requisites	Basic knowledge in general mechanics, theory of vibrations and strength of materials (completing I-degree courses).
Limit of number of students	30
C. Learning outcomes and the manner of conducting classes	
Aim of the subject	Improving knowledge in the field of mechanics of discrete and continuous mediums, variance rules, analytical and calculation methods of theory of vibrations and of strength of materials for complex issues of machine and construction elements – resilient and viscoelastic.

Subject outcomes

Code	*Description of the outcomes*	*Reference to learning outcomes in the learning area*	*Learning outcomes for field of study*
Knowledge			
W01	Has basic knowledge in the field of application of laws of mechanics to balance and motion of discrete and continuous mechanical systems enabling description with equations of movement and their simulations.	I.P7S_WG.o	K_W01 K_W03
W02	Has basic knowledge in the field of applied methods for solving simple problems within determining state and motion of mechanical systems in the field of machine construction, and knowledge concerning various methods of describing machine elements.	I.P7S_WG.o	K_W01 K_W03
W03	Has basic knowledge concerning attenuating properties and ageing of materials applied in machine construction necessary for modelling dynamic phenomena.	I.P7S_WG.o I.P7S_WK	K_W01 K_W03 K_W04 K_W06
Skills			
U01	Can perform analysis and interpretation of obtained results connected with problems of machine element movement in micro and macro scale.	I.P7S_UW.o III.P7S_UW.o	K_U01 K_U16
U02	Can apply equations, analytical and numerical methods to solve problems and determine strength and dynamic parameters of machine elements.	I.P7S_UW.o III.P7S_UW.o	K_U01 K_U02 K_U15 K_U16
U03	Can identify dynamic systems in the field of discrete and continuous machine elements both in established and transition states.	I.P7S_UW.o III.P7S_UW.o	K_U01 K_U02 K_U14 K_U16

Form of classes and their duration	Lecture	Exercises	Laboratory	Project	Computer classes
Timetables	2	2	0	0	0
Throughout the semester	30	30	0	0	0

Learning content	**Lecture** I and II type Lagrange equations for holonomic and non-holonomic equations. Gauss principle of minimal constraint, Hamilton principle. Non-linear vibrations, approximate methods of determining frequency of vibrations and amplitude-frequency characteristics. Parametric vibrations. Introducing equations of dynamics and free vibrations of typical one-dimensional elements (string, rod, shaft, beam). Circular flat symmetric elasticity problem – heavy wall tubes, rotating discs. Strength of ring and circular

	slabs. Bending, buckling and vibrations of rectangular slabs and panels. Basics of rheology. Elastic and viscoelastic analogy. **Practicals** Forming equations of motion – Lagrange equations of II type - holonomic and non-holonomic. Determining generalized forces - of right sides of equations of motions using virtual work method. Determining reaction of constraints using I type Lagrange equations. Determining equations of motion out of Hamilton principle. Determining dependencies of vibration frequency on amplitude using approximate methods. Determining amplitude-frequency characteristics of non-linear systems. Determining frequency and form of vibrations for strings, rollers and beams with different boundary conditions. Determining state of stress and displacement in heavy wall tubes and rotating discs. Calculations of strength for circular and ring slabs. Determining critical strains and frequency of vibrations of rectangular slabs. Using elastic and viscoelastic analogy to determine the course of displacement and stress in basic machine elements.
Learning methods	lecture presentation exercises problem solving
Methods of examination of learning outcomes	
Code	***Evaluation methods***
Knowledge	
W01	Lecture – exam. Practicals – tests.
W02	Lecture – exam. Practicals – tests.
W03	Lecture – exam. Practicals – tests.
Skills	
U01	Lecture – exam. Practicals – tests.
U02	Lecture – exam. Practicals – tests.
U03	Lecture – exam. Practicals – tests.
Evaluation methods	Lecture – exam. Practicals – tests.
Exam	Yes
References	Materials in English will be shared electronically.
Subject website	–
D. Student's contribution	
Number of ECTS points	5
Number of hours of student's work connected with achieving learning outcomes:	1) Number of contact hours- 64, including: a) lecture – 30 h, b) practicals – 30h, c) consulations – 2 h d) exam - 2 h. 2) Student's individual work 76 hours, including: a) 15 h – student's current preparation for lectures, b) 25 h – literature study, c) 21 h – preparation for tests, d) 15 h – preparation for exam 3) TOTAL – 140h.
Number of ECTS points for classes requiring direct participation of members of academic staff:	2.5 ECTS points – number of contact hours- 64, including: a) lecture – 30 h, b) practicals – 30h, c) consulations – 2 h d) exam - 2 h.
Number of ECTS points obtained by a student within practical	–
E. Additional information	
Comments	-
Update date	3.10.2022 r.

Description of a subject	
Subject code	
Subject	**INTEGRATED PRODUCTION SYSTEMS**
Subject version	2022/23
A. Placing the subject within the study system	
Level of study	II degree
Form of study	Full-time study
Field of study	Mechanical Engineering
Profile of study	General academic
Degree program	Advanced Machinery and Vehicles Engineering
Supervising unit	Faculty of Automotive and Construction Machinery Engineering
Performing unit	Faculty of Automotive and Construction Machinery Engineering
Subject coordinator	
B. General characteristics of the subject	
Subject kind	Basic
Subject level	Intermediate
Subject group	Obligatory
Language of instruction	English
Nominal semester	1
Course delivery in the academic year	Winter
Pre-requisites	Basic knowledge in machine construction technology.
Limit of number of students	30
C. Learning outcomes and the manner of conducting classes	
Aim of the subject	The aim of the subject is to learn models of manufacturing and tasks performed in integrated manufacturing, components of integrated manufacturing, their role and application in CIM. Learning about planning material needs, planning manufacturing resources of an enterprise, control structures, manufacturing strategies and their conditionality.

Subject outcomes

Code	***Description of the outcomes***	***Reference to learning outcomes in the learning area***	***Learning outcomes for field of study***
Knowledge			
W01	Has knowledge in the field of integrated manufacturing, material needs planning, planning, scheduling and manufacturing control	I.P7S_WG.o I.P7S_WK	K_W06 K_W07 K_W10 K_W18
W02	Has well-ordered, theoretically based general knowledge in the field of integrated manufacturing (CIM).	I.P7S_WG.o I.P7S_WK	K_W06 K_W07 K_W10 K_W11
Skills			
U01	Can use analytical, simulation and experimental methods to formulate and solve engineering tasks related to manufacturing planning and control.	I.P7S_UW.o III.P7S_UW.o	K_U05 K_U06 K_U07 K_U08 K_U14 K_U15 K_U18

Form of classes and their duration	Lecture	Exercises	Laboratory	Project	Computer classes
Timetables	2	0	1	0	0
Throughout the semester	30	0	15	0	0

Learning content	**Lecture:** 1. Model of manufacturing. Tasks performed in computer integrated manufacturing. Definition of CIM. Typical CIM chain. 2. Integrated database. Conditions of database organization. Criteria for CIM base choice. 3. Components of computer integrated manufacturing. Marketing research. Planning and control of manufacturing. 4. Planning of MRP material needs. Planning of MRP production resources. 5. Just in time manufacturing. Aims of JIT. 6. Computer aided design using CAD Interfaces. 7. Computer aided process planning CAPP. 8. Quality assurance. Integration of planning and management. 9. KANBAN method, 10. Lean Manufacturing. 11. Group technology. 12. Design for Manufacture and Assembly. 13. Rapid prototyping. 14. Artificial intelligence in CIM. **Laboratory:** 1. Introduction. Theory of decisions. Normative and descriptive methods. Operational research. 2. Mathematical programming. Function extremes. Classification. Square programming. 3. Linear programming. 4. Dynamic programming. 5. Project management. 6. Network programming.
Learning methods	lecture presentation exercises problem solving Laboratory 2 projects (design process)

Methods of examination of learning outcomes	
Code	***Evaluation methods***
Knowledge	
W01	Written exam.
W02	Evaluation of individual projects.
Skills	
U01	Written exam, evaluation of individual projects.

Evaluation methods	Written exam, evaluation of individual projects.
Exam	No
References	1. Skołud B., Krenczyk D.: Computer Integrated Manufacturing, WNT, 2003, Warszawa. 2. Computer Integrated Manufacturing, Materials from Worldwide Congress on Materials and Manufacturing Engineering and Technology, Gliwice 2005. 3. Instruction for Gantt Project.
Subject website	–
D. Student's contribution	
Number of ECTS points	3
Number of hours of student's work connected with achieving learning outcomes:	1) Number of contact hours- 76, including: a) lecture – 30 h, b)laboratory – 15 h, c) consulations – 2 h d) test – 1 h 2) Student's individual work 28 hours, including: a) 6 h – student's current preparation for lectures, b) 10 h – work on 2 projects, c) 6 h – literature study, d) 6 h – preparation for test 3) TOTAL – 71 h.
Number of ECTS points for classes requiring direct participation of members of academic staff:	2 ECTS points – number of contact hours- 76, including: a) lecture – 30 h, b)laboratory – 15 h, c) consulations – 2 h d) test – 1 h
Number of ECTS points obtained by a student within practical	1 ECTS point – 25 h, including a) laboratory – 15 h. b) 10 h – work on 2 projects.
E. Additional information	
Comments	-
Update date	3.10.2022 r.

Description of a subject	
Subject code	
Subject	**APPLIED PHYSICS**
Subject version	2022/23
A. Placing the subject within the study system	
Level of study	II degree
Form of study	Full-time study
Field of study	Mechanical Engineering
Profile of study	General academic
Degree program	Advanced Machinery and Vehicles Engineering
Supervising unit	Faculty of Automotive and Construction Machinery Engineering
Performing unit	Faculty of Automotive and Construction Machinery Engineering
Subject coordinator	
B. General characteristics of the subject	
Subject kind	Basic
Subject level	Intermediate
Subject group	Obligatory
Language of instruction	English
Nominal semester	1
Course delivery in the academic year	Winter
Pre-requisites	Basic knowledge of fundamental physics laws, mathematics. Basics of programing.
Limit of number of students	30
C. Learning outcomes and the manner of conducting classes	
Aim of the subject	Physics with computer techniques. Algorithms for modelling physics laws.

Subject outcomes

Code	*Description of the outcomes*	*Reference to learning outcomes in the learning area*	*Learning outcomes for field of study*
Knowledge			
W01	Has extensive and in-depth knowledge in the field of advanced modelling and analysis problems	I.P7S_WG.o	K_W05
W02	Has well-ordered and in-depth knowledge in the field of solution applied in machine and vehicle automated systems, and development trends which are related to them	I.P7S_WG.o	K_W02 K_W08
W03	Has basic knowledge in the field of contemporary applications of computer tools in solving problems.	I.P7S_WG.o	K_W09
W04	Has extensive knowledge in the field of integrating new solutions and developments into design and production processes.	I.P7S_WG.o	K_W10
Skills			
U01	Knows how to use learnt mathematical and physical methods and models to support implementation of engineering processes.	I.P7S_UW.o III.P7S_UW.o	K_U01 K_U06
U02	Knows how to make a written and oral presentation within the scope of application.	I.P7S_UW.o III.P7S_UW.o	K_U02
U03	Knows how to obtain knowledge on their own, within the scope of issues related to programming and can establish directions for self-study.	I.P7S_UW.o III.P7S_UW.o	K_U03
Social Competences			
K01	Can think and act in an entrepreneurial manner.	I.P7S_KO I.P7S_KR	K_K01
K02	Understands the influence of application of smart materials in vehicles and other technical devices and knows how to convey this information to society.	I.P7S_KK I.P7S_KO	K_K02

Form of classes and	Lecture	Exercises	Laboratory	Project	Computer classes

their duration					
Timetables	3	0	0	0	0
Throughout the semester	45	0	0	0	0
Learning content	1. Derivative equation in physics algorithms and modeling 2. Mid-point methods 3. Runge–Kutta methods 4. Newton Law and vectors in physics algorithms and modeling 5. Wave equation, algorithms and modeling				
Learning methods	lecture presentation Project - laboratory class will result in a score. At the end of projects students will prepare computer programs in groups.				
Methods of examination of learning outcomes					
Code	***Evaluation methods***				
Knowledge					
W01	Written test, presentation, discussion				
W02	Written test, presentation, discussion				
W03	Written test, presentation, discussion				
W04	Written test, presentation, discussion				
Skills					
U01	Written test. Presentation, discussion. Evaluation a project				
U02	Written test. Presentation, discussion. Evaluation a project				
U03	Written test. Presentation, discussion.				
Social Competences					
K01	Presentation, discussion. Evaluation a project				
K02	Presentation, discussion. Evaluation a project				
Evaluation methods	Written test. Presentation, discussion. Evaluation a project				
Exam	No				
References	Material in English				
Subject website	–				
D. Student's contribution					
Number of ECTS points	4				
Number of hours of student's work connected with achieving learning outcomes:	1) Number of contact hours - 45, including: a) lecture - 15 h.; b) project – 30 h; 2) Student's own work: a) 20 h – literature studies, b) 15 h – preparing for test from lectures/presentations, c) 40 h – preparing project, 3) TOTAL – 120 h				
Number of ECTS points for classes requiring direct participation of members of academic staff:	4 ECTS point – number of contact hours - 45, including: a) lecture - 15 h; b) project – 30 h;				
Number of ECTS points obtained by a student within practical	2 ECTS point - 55 h, including: 1) 40 h – preparing project, 2) 15 h – preparing for a test/presentation				
E. Additional information					
Comments	-				
Update date	3.10.2022 r.				

Description of a subject	
Subject code	
Subject	**COMPUTER PROGRAMMING**
Subject version	2022/23
A. Placing the subject within the study system	
Level of study	II degree
Form of study	Full-time study
Field of study	Mechanical Engineering
Profile of study	General academic
Degree program	Advanced Machinery and Vehicles Engineering
Supervising unit	Faculty of Automotive and Construction Machinery Engineering
Performing unit	Faculty of Automotive and Construction Machinery Engineering
Subject coordinator	
B. General characteristics of the subject	
Subject kind	Basic
Subject level	Intermediate
Subject group	Obligatory
Language of instruction	English
Nominal semester	1
Course delivery in the academic year	Winter
Pre-requisites	Basic knowledge of fundamental features of algorithms, knowledge of basics programing language.
Limit of number of students	30
C. Learning outcomes and the manner of conducting classes	
Aim of the subject	Computer techniques in mechanical engineering with use of programing languages and group work.

Subject outcomes

Code	*Description of the outcomes*	*Reference to learning outcomes in the learning area*	*Learning outcomes for field of study*
Knowledge			
W01	Has extensive and in-depth knowledge in the field of advanced modelling and analysis problems	I.P7S_WG.o	K_W05
W02	Has well-ordered and in-depth knowledge in the field of solution applied in machine and vehicle automated systems, and development trends which are related to them	I.P7S_WG.o	K_W08
W03	Has basic knowledge in the field of contemporary applications of computer tools in solving problems.	I.P7S_WG.o	K_W09
W04	Has extensive knowledge in the field of integrating new solutions and developments into design and production processes.	I.P7S_WG.o	K_W10
Skills			
U01	Knows how to use learnt mathematical and physical methods and models to support implementation of engineering processes.	I.P7S_UW.o III.P7S_UW.o	K_U01
U02	Knows how to make a written and oral presentation within the scope of application.	I.P7S_UW.o III.P7S_UW.o	K_U02
U03	Knows how to obtain knowledge on their own, within the scope of issues related to programming and can establish directions for self-study.	I.P7S_UW.o III.P7S_UW.o	K_U03
Social Competences			
K01	Can think and act in an entrepreneurial manner.	I.P7S_KO I.P7S_KR	K_K01

Form of classes and their duration	Lecture	Exercises	Laboratory	Project	Computer classes
Timetables	1	0	0	3	0

Throughout the semester	15	0	0	45	0

Learning content	1. Basics of version control software, 2. Introduction to Java SDK, 3. Overview of the environment, the construction of the elementary program, 4. Overview of the environment GIT/GITHUB 5. Using GIT/GIYHUB in group work. 6. Basics of Java programing, 7. Use of special libraries to create own programs 8. Creating own libraries.
Learning methods	lecture presentation Project - laboratory class will result in a score.. At the end of each projects (individual or groups) will prepare computer programs..

Methods of examination of learning outcomes	
Code	***Evaluation methods***
Knowledge	
W01	Written test. Presentation, discussion
W02	Written test. Presentation, discussion
W03	Written test. Presentation, discussion
W04	Written test. Presentation, discussion
Skills	
U01	Written test. Presentation, discussion. Evaluation a project
U02	Written test. Presentation, discussion. Evaluation a project
U03	Written test. Presentation, discussion. Evaluation a project
Social Competences	
K01	Presentation, discussion. Evaluation a project

Evaluation methods	Written test. Presentation, discussion. Evaluation a project
Exam	No
References	Materials in English will be shared electronically.
Subject website	–

D. Student's contribution	
Number of ECTS points	8
Number of hours of student's work connected with achieving learning outcomes:	1) Number of contact hours - 60, including: a) lecture - 15 h.; b) project – 45 h; 2) Student's own work: a) 30 h – literature studies, 1) 50 h – preparing individual project, 2) 60 h – preparing group project, 3) TOTAL – 200 h
Number of ECTS points for classes requiring direct participation of members of academic staff:	2 ECTS point – number of contact hours - 60, including: a) lecture - 15 h; b) project – 45 h;
Number of ECTS points obtained by a student within practical	6 ECTS point - 150 h, including: 1) 60 h – preparing individual project, 2) 60 h – preparing group project, 3) 30 h – preparing for a test/presentation

E. Additional information	
Comments	-
Update date	3.10.2022 r.

Description of a subject	
Subject code	
Subject	**COMPUTER AIDED MANUFACTURING**
Subject version	2022/23
A. Placing the subject within the study system	
Level of study	II degree
Form of study	Full-time study
Field of study	Mechanical Engineering
Profile of study	General academic
Degree program	Advanced Machinery and Vehicles Engineering
Supervising unit	Faculty of Automotive and Construction Machinery Engineering
Performing unit	Faculty of Automotive and Construction Machinery Engineering
Subject coordinator	
B. General characteristics of the subject	
Subject kind	Basic
Subject level	Intermediate
Subject group	Obligatory
Language of instruction	English
Nominal semester	2
Course delivery in the academic year	Summer
Pre-requisites	Technology of Machine Building; Computer Aided Manufacturing (learning of programming CNC machine); 3D CAD systems (learning of 3D modeling).
Limit of number of students	30
C. Learning outcomes and the manner of conducting classes	
Aim of the subject	Programming milling and turning in 3D CAM systems for CNC machines (from 2 to 5 axes). Parameters of generating toolpaths for roughing machining and surface finishing. Visualization of tool path and virtual simulation of machining (with or without kinematic of machinery).

Subject outcomes

Code	***Description of the outcomes***	***Reference to learning outcomes in the learning area***	***Learning outcomes for field of study***
Knowledge			
W01	Has knowledge of programming CNC machine tools.	I.P7S_WG.o	K_W01
W02	Has detailed knowledge of the construction of CNC machine tools, coordinate system of vertical and horizontal 3-, 4- and 5-axis milling centers, standard cutting tools for the CNC vertical milling, reference points for the milling.	I.P7S_WG.o	K_W11
W03	Has knowledge of roughing and surface milling in 3D CAD systems, their parameters and limitations.	I.P7S_WG.o	K_W01
Skills			
U01	Is prepared to obtain information from literature and other properly chosen sources within the scope of the subject; can integrate the obtained information, interpret it and draw conclusions and formulate and justify opinions within the scope of the application of smart materials in vehicles.	I.P7S_UW.o	K_U15
U02	Knows how to make a written and oral presentation within the scope of programs for CNC machine tools.	I.P7S_UW.o	K_U15
U03	Knows how to obtain knowledge on their own, within the scope of milling parameters with end-tool.	I.P7S_UW.o	K_U15
Social Competences			
K01	He understands the shape's influence on its technology.	I.P7S_KO I.P7S_KR	K_K01

K02	Can think and act in an entrepreneurial manner.			I.P7S_KO I.P7S_KR	K_K01

Form of classes and their duration	Lecture	Exercises	Laboratory	Project	Computer classes
Timetables	1	0	1	0	0
Throughout the semester	15	0	15	0	0

Learning content	1. Introduction to 3D CAD/CAM systems; type of export/import files (2D drawings and 3D models); type of CNC milling and turning machines; coordinate system of vertical and horizontal 3-, 4- and 5-axis milling centers; coordinate system of lathes and turning centers; standard cutting tools for the CNC vertical milling; reference points for the milling; 2. Modeling of a detail in CAD/CAM systems; import files from 2D and 3D CAD systems; selection or definition of blank geometry and fixing; selection or definition of cutting tools; selection of CNC machines; application of the right machining strategy; type of cycles and milling operation; 3. Roughing (on edges or text geomatry); parameters of visualization tool paths and simulations of machining; rest roughing; 4. Roughing (solids geomatry); 5. Hole cycles (drilling, reaming, boring); 6. Surface milling (profiling, flat land); selection or definition of safety surfaces, borders and levels; cusp high; 7. Surface milling (parallel lace, pencil mill cycle, rest finishing); 8. Surface milling (project toolpath); 9. Surface milling (parameters of HSM milling); 10. 5-axes milling (part 1); 11. 5-axes milling (part 2); 12. Simulation of machining with visualization of the worked surface; collision detection; 13. Generating and analysis the NC code; definition of CNC machines 14. Real tests NC code on the CNC machine (4-axes VMC). 15. Test. Student presentations.
Learning methods	lecture presentation presentation: preparing a project of a controlled suspension system of a vehicle

Methods of examination of learning outcomes	
Code	***Evaluation methods***
Knowledge	
W01	Written test. Presentation, discussion
W02	Written test. Presentation, discussion
W03	Written test. Presentation, discussion
Skills	
U01	Written test. Presentation, discussion. Evaluation a project
U02	Written test. Presentation, discussion. Evaluation a project
U03	Written test. Presentation, discussion.
Social Competences	
K01	Written test. Presentation, discussion. Evaluation a project
K02	Written test. Presentation, discussion. Evaluation a project

Evaluation methods	Written test. Presentation, discussion. Evaluation a project
Exam	Yes
References	1. Gandarias E.: Manufacturing Technologies CNC. Italy 2017: https://www.slideshare.net/endika55/cnc-milling-71884758 2. Siemens NX 12 Help: https://docs.plm.automation.siemens.com/tdoc/nx/12/nx_help 3. Edgecam Documentation, Vero, 2018: http://help.edgecam.com 4. CATIA V5R20 Documentation, Dassault Systeme 2009: http://catiadoc.free.fr/online/CATIA_P3_default.htm 5. Rao M.: Computer Aided Design and Manufacturing. India, 2009: https://nptel.ac.in/courses/112102103/
Subject website	–
D. Student's contribution	
Number of ECTS points	3
Number of hours of	1) Number of contact hours – 30 h, including lecture.

student's work connected with achieving learning outcomes:	2) Student's own work: a) 15 h – literature studies, b) 15 h – preparing for test from lectures/presentations. TOTAL – 60 h
Number of ECTS points for classes requiring direct participation of members of academic staff:	1 ECTS point – number of contact hours – 30 h, including lecture;
Number of ECTS points obtained by a student within practical	1 ECTS point - 30 h, including: 1) 15 h – preparing a project of a controlled suspension system, 2) 15 h – preparing for a test/presentation
E. Additional information	
Comments	-
Update date	3.10.2022 r.

Description of a subject			
Subject code			
Subject	**THERMODYNAMICS OF HEAT ENGINES**		
Subject version	2022/23		
A. Placing the subject within the study system			
Level of study	II degree		
Form of study	Full-time study		
Field of study	Mechanical Engineering		
Profile of study	General academic		
Degree program	Advanced Machinery and Vehicles Engineering		
Supervising unit	Faculty of Automotive and Construction Machinery Engineering		
Performing unit	Faculty of Automotive and Construction Machinery Engineering		
Subject coordinator			
B. General characteristics of the subject			
Subject kind	Basic		
Subject level	Intermediate		
Subject group	Obligatory		
Language of instruction	English		
Nominal semester	2		
Course delivery in the academic year	Summer		
Pre-requisites	Basic knowledge of thermodynamics, fluid dynamics and chemistry (at a bachelor's level)		
Limit of number of students	30		
C. Learning outcomes and the manner of conducting classes			
Aim of the subject	The aim of this course is to provide the students with knowledge and understanding of the general processes of combustion, heat transfer and fluid dynamics in the scope necessary to describe and discuss phenomena occurring in heat engines, especially piston combustion engines, as well as apply theoretical knowledge into relevant practical cases.		
Subject outcomes			
Code	***Description of the outcomes***	***Reference to learning outcomes in the learning area***	***Learning outcomes for field of study***
Knowledge			
W01	Can identify thermodynamic processes in the field of combustion, heat transfer and gas flow.	I.P7S_WG.o	K_W03 K_W05
W02	Has theoretical knowledge concerning kinds of combustions and their definitions. Knows basic terms related to combustion and can calculate	I.P7S_WG.o	K_W03 K_W05

	fuel composition, the demand for oxidizer and air and the amount and composition of exhaust gases. Can recognize phenomena of heat transfer, select appropriate theoretical descriptions and use them to perform calculations concerning heat and temperature. Has theoretical knowledge on the gas flow and can describe this process by determining the stagnation and critical parameters of the gas as well as balancing energy. Knows the applicability of the above-mentioned theory for description of processes occurring in heat engines.		
W03	Has the knowledge and understanding of the mechanisms behind the processes of combustion, heat transfer and fluid dynamics in the scope necessary to describe phenomena occurring in piston combustion engines.	I.P7S_WG.o	K_W03 K_W05
Skills			
U01	Can conduct basic calculations indispensable to consider combustion processes, heat transfer and gas flow in description of processes occurring in heat engines.	I.P7S_UW.o	K_U01 K_U14

Form of classes and their duration	Lecture	Exercises	Laboratory	Project	Computer classes
Timetables	2	1	0	0	0
Throughout the semester	30	15	0	0	0

Learning content	Lecture: 1) Introduction; 2) Thermodynamics of combustion: quantity balance of the substances in the combustion process, the demand for oxidizer and air in combustion, the amount and composition of exhaust gases, the basics of chemical thermodynamics of combustion, energy balance of the combustion process; 3) Heat transfer: types and basic laws of heat transfer, thermal conduction, thermal convection, thermal radiation, complex heat transfer, heat exchangers; 4) Thermodynamics of flow processes: basic equations of steady flow, the parameters of stagnation, the critical parameters, convergent nozzle, de Laval nozzle, rotary flow machines; 5. Selected aspects of thermodynamic calculations for piston engines. Class exercises: 1) Thermodynamics of combustion: calculating fuel composition, the demand for oxidizer and air, the amount and composition of exhaust gases, balancing the amount of substances and energy in the combustion process; 2) Heat transfer: calculating heat transfer through conduction, convection and radiation, in simple and complex cases; 3) Thermodynamics of flow processes: calculating gas flow, determining the stagnation and critical parameters of the gas, balancing energy of the gas flow.
Learning methods	lecture presentation exercises problem solving

Methods of examination of learning outcomes	
Code	***Evaluation methods***
Knowledge	
W01	Lecture – exam, class exercises – 3 tests
W02	Lecture – exam, class exercises – 3 tests
W03	Lecture – exam, class exercises – 3 tests
Skills	
U01	Lecture – exam, class exercises – 3 tests

Evaluation methods	Lecture – exam, class exercises – 3 tests
Exam	Yes
References	1) Michael J. Moran, Howard N. Shapiro: Fundamentals of engineering thermodynamics, John Wiley & Sons, 2010; 2) Glassman I., Yetter R. A.: Combustion, Academic Press, 2014; 3) Serth R. W., Lestina T. G.: Process heat transfer: principles, applications and rules of thumb, Academic Press, 2014; 4) Munson B. R., Okiishi T. H., Huebsch W. W., Rothmayer A. P.: Fundamentals of fluid mechanics, John Wiley & Sons, 2013.
Subject website	–
D. Student's contribution	
Number of ECTS points	3
Number of hours of student's work connected with achieving learning	1) Number of contact hours – 55, including: a) lecture – 30 h b) class exercises – 15 h c) consultations – 1 h

outcomes:	d) exam – 9 h 2) Student's individual work – 30 hours, including: a) preparing for lectures and class exercises – 10 h b) preparing for 3 tests – 10 h c) preparing for exam – 10 h 3) TOTAL – 85 h
Number of ECTS points for classes requiring direct participation of members of academic staff:	2,6 ECTS points – number of contact hours – 55, including: a) lecture – 30 h b) class exercises – 15 h c) consultations – 1 h d) exam – 9 h
Number of ECTS points obtained by a student within practical	
E. Additional information	
Comments	-
Update date	3.10.2022 r.

Description of a subject			
Subject code			
Subject	**FLUID FLOW COMPUTER MODELLING**		
Subject version	2022/23		
A. Placing the subject within the study system			
Level of study	II degree		
Form of study	Full-time study		
Field of study	Mechanical Engineering		
Profile of study	General academic		
Degree program	Advanced Machinery and Vehicles Engineering		
Supervising unit	Faculty of Automotive and Construction Machinery Engineering		
Performing unit	Faculty of Automotive and Construction Machinery Engineering		
Subject coordinator			
B. General characteristics of the subject			
Subject kind	Basic		
Subject level	Intermediate		
Subject group	Obligatory		
Language of instruction	English		
Nominal semester	2		
Course delivery in the academic year	Summer		
Pre-requisites	Fluid Mechanics, Thermodynamics, Hydraulic and Pneumatic Drives, Heat Transfer		
Limit of number of students	30		
C. Learning outcomes and the manner of conducting classes			
Aim of the subject	Acquiring basic knowledge in the field of numerical modelling of fluid flow (Computational Fluid Dynamics) and the operation of the ANSYS Fluent program, including: creating a numerical mesh, setting the solver, assigning boundary conditions, methods for verifying the correctness of the solution, presentation of results.		
Subject outcomes			
Code	***Description of the outcomes***	***Reference to learning outcomes in the learning area***	***Learning outcomes for field of study***
Knowledge			
W01	Acquisition of knowledge in the field of computer modelling of fluid flow. Acquisition of knowledge in the field of comparative analysis of results obtained by various methods.	I.P7S_WG.o	K_W16

Skills			
U01	Preparation for performing an independent simulation analysis. Building numerical model, carrying out calculations, verifying the correctness of obtained results, interpreting results and draw conclusions..	I.P7S_UW.o III.P7S_UW.o	K_U08
U02	Acquisition of knowledge for performing an independent simulation for liquid and gas flow, and heat transfer.	I.P7S_UW.o III.P7S_UW.o	K_U09
U03	Acquisition of knowledge for presenting the obtained results in the form of technical report.	I.P7S_UW.o III.P7S_UW.o	K_U10
Social Competences			
K01	Understanding the use of modern computer methods and the possibility of using them in various branches of industry. The ability to transfer knowledge to the public.	I.P7S_KO I.P7S_KR	K_K01

Form of classes and their duration	Lecture	Exercises	Laboratory	Project	Computer classes
Timetables	1	0	0	1	0
Throughout the semester	15	0	0	15	0

Learning content	1. Organizational matters. Benefits and examples of applications of the CFD numerical modelling in industry. 2. Presentation of the basic numerical equations of fluid mechanics. 3. Presentation of the basic principles of creating a numerical mesh. 4. Overview of possible boundary conditions. 5. Overview of methods to validate the solution and present the results. 6. Simulation analysis of liquid flow in a orifice (a venturi model from a laboratory exercise to study cavitation). 7. Aerodynamic simulation analysis of the object. Determination of object drag and object drag coefficient Cx. Comparison of simulation results with measurement data. 8. Simulation analysis of liquid pressure losses in the pipeline. Determination of the local loss factor for the elbow. Comparison of simulation results with measurement data. 9. Simulation analysis of forced convection. Determination of heat flux and heat transfer coefficient α [W / m2K]. 10. Simulation analysis of natural convection. Visualization of air movement caused by temperature difference. Determination of heat flux and heat transfer coefficient α [W / m2K].
Learning methods	Execution of two simulation projects and presentation of results in the form of a report containing the specification of the simulation, results and conclusions.

Methods of examination of learning outcomes	
Code	***Evaluation methods***
Knowledge	
W01	Execution of two independent simulation projects
Skills	
U01	Presentation, discussion, project
U02	Presentation, discussion, project
U03	Presentation, discussion, project
Social Competences	
K01	Presentation, discussion, project

Evaluation methods	Execution of two independent simulation projects. Presentation, discussion, project
Exam	No
References	1. ANSYS Fluent - User's Guide 2. Blazek J. Computational Fluid Dynamics: Principles and Applications. Elsevier, 2001
Subject website	–
D. Student's contribution	
Number of ECTS points	3
Number of hours of student's work connected with achieving learning outcomes:	1) Number of contact hours - 30 hours of a practicals. 2) Student's own work – 30 hours, including: a) literature study: 15 hours. b) Work on preparing the project: 15 hours. 3) TOTAL – 60 hours.
Number of ECTS points	1 ECTS points – number of contact hours - 30 hours of a practicals.

for classes requiring direct participation of members of academic staff:	
Number of ECTS points obtained by a student within practical	1 ECTS points - 30 hours of student's work, including: a) work on preparing the project – 15 hours; b) literature study: 15 hours
E. Additional information	
Comments	-
Update date	3.10.2022 r.

Description of a subject			
Subject code			
Subject	**INTERIM PROJECT I**		
Subject version	2022/23		
A. Placing the subject within the study system			
Level of study	II degree		
Form of study	Full-time study		
Field of study	Mechanical Engineering		
Profile of study	General academic		
Degree program	Advanced Machinery and Vehicles Engineering		
Supervising unit	Faculty of Automotive and Construction Machinery Engineering		
Performing unit	Faculty of Automotive and Construction Machinery Engineering		
Subject coordinator			
B. General characteristics of the subject			
Subject kind	Specialised		
Subject level	Intermediate		
Subject group	Elective		
Language of instruction	English		
Nominal semester	2		
Course delivery in the academic year	Summer		
Pre-requisites	-		
Limit of number of students	30		
C. Learning outcomes and the manner of conducting classes			
Aim of the subject	The aim of the subject is student's completion of the interim thesis.		
Subject outcomes			
Code	***Description of the outcomes***	***Reference to learning outcomes in the learning area***	***Learning outcomes for field of study***
Knowledge			
W01	Knows how to obtain data from literature; can evaluate the operation of rules and laws concerning intellectual property protection.	I.P7S_WG.o III.P7S_WG.o	K_W16 K_W17
Skills			
U01	Can design a simple device, system or process, using proper methods, techniques and tools, considering the use of proper materials and technologies necessary in the production process.	I.P7S_UW.o III.P7S_UW.o	K_U01 K_U03 K_U05 K_U08
U02	Can perform an initial economic analysis of designed construction solutions or processes.	I.P7S_UW.o III.P7S_UW.o	K_U07
U03	Can obtain data from literature and data bases, can evaluate the operation of rules and laws of intellectual property protection and can	I.P7S_UW.o III.P7S_UW.o	K_U14 K_U15

	prepare a clear report or presentation discussing advantages and disadvantages of different solutions.	I.P7S_UK	K_U17 K_U18 K_U20
Social Competences			
K01	Is aware of the role of a graduate in conveying the achievements in mechatronics of vehicle and construction machinery to the society.	I.P7S_KO I.P7S_KR	K_K01

Form of classes and their duration	Lecture	Exercises	Laboratory	Project	Computer classes
Timetables	0	0	0	5	0
Throughout the semester	0	0	0	75	0

Learning content	The subject includes student's own work in the scope necessary to complete the interim thesis, in agreement with the Thesis Supervisor. Topic of the thesis ought to be connected with student's field of study. It should refer to general-engineering issues and should enable the use of technical knowledge gained by a student up to this moment.
Learning methods	Lecture presentation project problem solving

Methods of examination of learning outcomes	
Code	***Evaluation methods***
Knowledge	
W01	Interim thesis
Skills	
U01	Evaluation of the interim thesis
U02	Evaluation of the interim thesis
U03	Evaluation of the interim thesis
Social Competences	
K01	Evaluation of the interim thesis

Evaluation methods	Evaluation of the interim thesis. Interim thesis
Exam	No
References	References chosen by a student in agreement with the Thesis Supervisor within the scope connected with the topic of the thesis.
Subject website	–

D. Student's contribution	
Number of ECTS points	6
Number of hours of student's work connected with achieving learning outcomes:	1) Number of contact hours - 75 hours of a project. 2) Student's own work – 35 hours, including: a) literature study: 10 hours. b) Work on preparing the project: 25 hours. 3) TOTAL – 110 hours.
Number of ECTS points for classes requiring direct participation of members of academic staff:	3 ECTS points – number of contact hours - 75 hours of a project.
Number of ECTS points obtained by a student within practical	3 ECTS points - 110 hours of student's work, including: a) participation in project practicals - 75 hours; b) work on preparing the project – 25 hours; c) literature study: 10 hours

E. Additional information	
Comments	-
Update date	3.10.2022 r.

Description of a subject	
Subject code	
Subject	**DESIGN THEORY**
Subject version	2022/23
A. Placing the subject within the study system	
Level of study	II degree
Form of study	Full-time study
Field of study	Mechanical Engineering
Profile of study	General academic
Degree program	Advanced Machinery and Vehicles Engineering
Supervising unit	Faculty of Automotive and Construction Machinery Engineering
Performing unit	Faculty of Automotive and Construction Machinery Engineering
Subject coordinator	
B. General characteristics of the subject	
Subject kind	Basic
Subject level	Intermediate
Subject group	Obligatory
Language of instruction	English
Nominal semester	3
Course delivery in the academic year	Winter
Pre-requisites	Basic knowledge on mechanical engineering design.
Limit of number of students	30
C. Learning outcomes and the manner of conducting classes	
Aim of the subject	Obtaining knowledge on elements of different design methodologies and their methods and tools.

Subject outcomes

Code	*Description of the outcomes*	*Reference to learning outcomes in the learning area*	*Learning outcomes for field of study*
Knowledge			
W01	Has knowledge in the field of the design methodologies.	I.P7S_WG.o	K_W01
W02	Has detailed knowledge in the field of the design methodologies.	I.P7S_WG.o	K_W11
W03	Has knowledge within the scope of methods and tools in the field of the design methodologies.	I.P7S_WG.o	K_W01
Skills			
U01	Is prepared to obtain information from literature and other properly chosen sources within the scope of the subject; can integrate the obtained information, interpret it and draw conclusions and formulate and justify opinions within the scope of the application of design methodologies.	I.P7S_UW.o	K_U15
U02	Knows how to make a written and oral presentation within the scope of design methodologies	I.P7S_UW.o	K_U15
U03	Knows how to obtain knowledge on their own, within the scope of issues related to application of design methods and can establish directions for self-study.	I.P7S_UW.o	K_U15
Social Competences			
K01	Understands the influence of application of design methods and knows how to convey this information to society.	I.P7S_KO I.P7S_KR	K_K01
K01	Can think and act in an entrepreneurial manner.	I.P7S_KO I.P7S_KR	K_K01

Form of classes and their duration	Lecture	Exercises	Laboratory	Project	Computer classes

Timetables	2	0	0	0	0
Throughout the semester	30	0	0	0	0

Learning content	1. Engineering design and information processes. 2. Computer Aided Engineering. Scope of CAD/CAE. 3. Engineering design – historical perspective. Elements of engineering design methodologies. Stages of engineering design. 4. Sequential and concurrent engineering. Design environment. Requirements in machine design. 5. Product Lifecycle Management - basic concepts. 6. Engineering design methodology by Osiński/Wróbel. 7. Knowledge in mechanical engineering. Repositories of engineering knowledge. 8. Collaborative product development. 9. Mathematical models in mechanical engineering. 10. Typology of optimization problems. 11. Survey of optimization methods. 12. Multi-disciplinary optimization. 13. Computer simulation. Optimal synthesis of mechanisms. 14. Engineering data bases. 15. Trends in CAD/CAE systems development.
Learning methods	lecture presentation

Methods of examination of learning outcomes	
Code	***Evaluation methods***
Knowledge	
W01	Written tests
W02	Written tests
W03	Written tests
Skills	
U01	Written tests
U02	Written tests
U03	
Social Competences	
K01	Written tests
K02	Discussion

Evaluation methods	Lecture - 2 tests (written)
Exam	Yes
References	Materials in English (for each lecture, based on different knowledge sources)
Subject website	-
D. Student's contribution	
Number of ECTS points	2
Number of hours of student's work connected with achieving learning outcomes:	1) Number of contact hours - 30, including: a) lecture - 30 h.; 2) Student's own work: a) 15 h – literature studies, b) 15 h – preparing for tests from lectures/presentations, 3) TOTAL – 60 h
Number of ECTS points for classes requiring direct participation of members of academic staff:	1 ECTS point – number of contact hours - 30, including: a) lecture - 30 h;
Number of ECTS points obtained by a student within practical	1 ECTS point - 30 h, including: 1) 15 h – preparing a project of a controlled suspension system, 2) 15 h – preparing for tests
E. Additional information	
Comments	-
Update date	3.10.2022 r.

Description of a subject	
Subject code	
Subject	**MODELLING MACHINES AND VEHICLES**
Subject version	2022/23
A. Placing the subject within the study system	
Level of study	II degree
Form of study	Full-time study
Field of study	Mechanical Engineering
Profile of study	General academic
Degree program	Advanced Machinery and Vehicles Engineering
Supervising unit	Faculty of Automotive and Construction Machinery Engineering
Performing unit	Faculty of Automotive and Construction Machinery Engineering
Subject coordinator	
B. General characteristics of the subject	
Subject kind	Basic
Subject level	Advanced
Subject group	Obligatory
Language of instruction	English
Nominal semester	3
Course delivery in the academic year	Winter
Pre-requisites	Knowledge and skills concerning: - basic algebra incl. matrices and linear equations, - differential and integral calculus, - differential equations, - complex numbers and complex calculus, - principles of mechanics – linear and angular momentum laws, kinetic energy law, - Lagrangian mechanics, - basic knowledge on strength of materials, - Fourier and Taylor series, - fundamentals of signal processing, - basic concepts of object and procedural programming.
Limit of number of students	30
C. Learning outcomes and the manner of conducting classes	
Aim of the subject	The main goal of that lecture is to present a comprehensive knowledge regarding the dynamics modelling of mechanical systems. During the classes students will be familiarized with basic concepts which are necessary to perform efficient analysis of physical systems behaviour. A very important and skills developing part of the lecture is an involvement of Python programming in order to enable conducting the analysis of a dynamics of the considered system motion. The three main topics will be considered: - governing equations obtaining with an application of Lagrangian mechanics, - numerical solving of differential equations with SciPy, - time-domain and spectral analysis by utilization of NumPy and matplotlib libraries. That approach allows for a comparison of the analytical methods and tools used for an approximate modelling of the physical phenomena with the more accurate numerical simulations results.

Subject outcomes

Code	***Description of the outcomes***	***Reference to learning outcomes in the learning area***	***Learning outcomes for field of study***
Knowledge			
W01	Knows kinds of models, methods and techniques of modelling within the scope of physical and mathematical models.	I.P7S_WG.o	K_W11 K_W12
W02	Knows methods of parameter and structural identification of dynamic models.	I.P7S_WG.o	K_W11 K_W12 K_W13

Skills			
U01	Can plan and perform a research and development experiment.	I.P7S_UW.o III.P7S_UW.o	K_U01 K_U09
U02	Can analyze and evaluate modelling precision.	I.P7S_UW.o III.P7S_UW.o	K_U01 K_U02 K_U08 K_U14
Social Competences			
K01	Can think and act in an entrepreneurial manner.	I.P7S_KO I.P7S_KR	K_K01

Form of classes and their duration	Lecture	Exercises	Laboratory	Project	Computer classes
Timetables	2	0	1	1	0
Throughout the semester	30	0	15	15	0

Learning content	- Lagrangian and Newtonian mechanics - review, - basics of programming in Python with SageMath, - single and Multi DOF systems with linear elasticity, - continuous systems and nonlinear problems, - numerical simulations of mechanical systems, - Fourier series and transformation, - spectra of elementary functions, - sampling, windowing, filtering in time and frequency domain, - spectral analysis, sampling frequency, Nyquist frequency - identification problem formulation, - parametric identification.
Learning methods	lecture presentation laboratory experimental or numerical study preparing a project

Methods of examination of learning outcomes	
Code	***Evaluation methods***
Knowledge	
W01	Exam, test before admitting to exercises, evaluation of reports.
W02	Exam, test before admitting to exercises, evaluation of reports.
Skills	
U01	Written tests
U02	Written tests
Social Competences	
K01	Test before admitting to exercises, evaluation of task execution and report evaluation.
K02	Exam, test before admitting to exercises, evaluation of reports.

Evaluation methods	Projects: preparing project and homework which needs to utilize practical ability to solve simple problems as examples of theory presented within the lecture. Attestation of class exercises. Lecture: written examination on skills and knowledge concerning the scope of the course.
Exam	Yes
References	Materials in English will be shared electronically.
Subject website	-
D. Student's contribution	
Number of ECTS points	6
Number of hours of student's work connected with achieving learning outcomes:	1) Student work with tutor - 65 hours, including: a) lecture - 30 hours; b) project - 15 hours; c) laboratories - 15 hours; d) consultations - 2 hours; e) exam - 3 hours. 2) Independent student work - 85 hours, including: a) student preparing for lectures - 15 hours;;

	b) literature investigation - 15 hours; c) student preparing of project - 25 hours; d) student preparing for laboratories - 15 hours; e) student preparing for exam- 15 hours. 3) TOTAL – 150 hours
Number of ECTS points for classes requiring direct participation of members of academic staff:	2.6 ECTS point. Student work with tutor - 65 hours, including: a) lecture - 30 hours; b) project- 15 hours; c) laboratories - 15 hours; c) consultations - 2 hours; d) exam - 3 hours.
Number of ECTS points obtained by a student within practical	No separate credits for lecture and class.
E. Additional information	
Comments	-
Update date	3.10.2022 r.

Description of a subject			
Subject code			
Subject	**COMBUSTION AND CATALYSIS**		
Subject version	2022/23		
A. Placing the subject within the study system			
Level of study	II degree		
Form of study	Full-time study		
Field of study	Mechanical Engineering		
Profile of study	General academic		
Degree program	Advanced Machinery and Vehicles Engineering		
Supervising unit	Faculty of Automotive and Construction Machinery Engineering		
Performing unit	Faculty of Automotive and Construction Machinery Engineering		
Subject coordinator			
B. General characteristics of the subject			
Subject kind	Basic		
Subject level	Advanced		
Subject group	Elective A		
Language of instruction	English		
Nominal semester	3		
Course delivery in the academic year	Winter		
Pre-requisites	Basic knowledge of thermodynamics and heat engines theory (at a bachelor's level)		
Limit of number of students	30		
C. Learning outcomes and the manner of conducting classes			
Aim of the subject	Studying the basic chemical processes that are taking place during fuel's combustion in automotive spark ignition and diesel engines. The theory and operation of emission control systems.		
Subject outcomes			
Code	***Description of the outcomes***	***Reference to learning outcomes in the learning area***	***Learning outcomes for field of study***
Knowledge			
W01	Student who has passed the subject knows the combustion process in combustion engines and the methods of exhaust gases aftertreatment.	I.P7S_WG.o	K_W03 K_W05

W02	Has knowledge of controlling the combustion process in internal combustion engines, including the impact on the engine performance and its emission by adjustment fuel delivery system parameters	I.P7S_WG.o	K_W03 K_W12
Skills			
U01	Able to conduct an analysis of the engine's operating cycles taking into account combustion phenomena and pollutants formation.	I.P7S_UW.o III.P7S_UW.o	K_U01 K_U14
U02	Is able to analyze basic chemical processes occurring during fuel combustion in spark-ignition and self-ignition engines, as well as issues related to the theory and operation of exhaust gas aftertreatment systems.	I.P7S_UW.o III.P7S_UW.o	K_U14

Form of classes and their duration	Lecture	Exercises	Laboratory	Project	Computer classes
Timetables	1	0	0	1	0
Throughout the semester	15	0	0	15	0

Learning content	Lectures Lectures consist of two thematic packages: 1. Combustion – Combustion chemistry – Stochiometric combustion – Combustion temperature – Combustion thermochemistry – Harmful substances formation – Fuels – Combustion in SI engines – Combustion in Diesel engines – Visualization of combustion and films on combustion phenomena 2. Catalysis – Fundamentals of catalytic reactor design – Deactivation of catalytic reactors – Oxidizing reactors – Redox reactors – SCR reactors – Fundamentals of particulate filters design – PM filter regeneration
Learning methods	lecture presentation

Methods of examination of learning outcomes	
Code	***Evaluation methods***
Knowledge	
W01	Written test. Presentation, discussion
W02	Written test. Presentation, discussion
Skills	
U01	Written test. Presentation, discussion. Evaluation a project
U02	Written test. Presentation, discussion. Evaluation a project

Evaluation methods	Lectures: two written tests on skills and knowledge concerning the scope of the course. Positive marks from all written tests are needed to complete (pass) the course.
Exam	No
References	1. Heywood J.: Internal combustion engine fundamentals, McGrew Hill 1998. 2. Stone R.: Introduction to Internal Combustion Engines, Macmillan Press London 1992. 3. Merker G., Schwarz C., Teichmann R. : Combustion Engines Development: Mixture Formation, Combustion, Emissions and Simulation, Springer Wiesbaden 2009. 4. Arcoumanis C., Kamimoto T.: Flow and Combustion in Reciprocating Engines, Springer Berlin 2009.
Subject website	-
D. Student's contribution	
Number of ECTS points	2
Number of hours of student's work connected with	1) Number of contact hours – 31 hours, including: a) lectures – 30 hours.; b) consultations – 1 hour

achieving learning outcomes:	2) Student's own work – 15 hours, including: a) literature study – 10hours; b) student's preparation for tests – 5 hours 3) TOTAL – 46 hours
Number of ECTS points for classes requiring direct participation of members of academic staff:	1.2 ECTS points – number of contact hours – 31 hours, including: a) lectures – 30 hours; b) consultations – 1 hour
Number of ECTS points obtained by a student within practical	-
E. Additional information	
Comments	-
Update date	3.10.2022 r.

Description of a subject			
Subject code			
Subject	**MACHINE DIAGNOSTICS**		
Subject version	2022/23		
A. Placing the subject within the study system			
Level of study	II degree		
Form of study	Full-time study		
Field of study	Mechanical Engineering		
Profile of study	General academic		
Degree program	Advanced Machinery and Vehicles Engineering		
Supervising unit	Faculty of Automotive and Construction Machinery Engineering		
Performing unit	Faculty of Automotive and Construction Machinery Engineering		
Subject coordinator			
B. General characteristics of the subject			
Subject kind	Basic		
Subject level	Intermediate		
Subject group	Obligatory		
Language of instruction	English		
Nominal semester	3		
Course delivery in the academic year	Winter		
Pre-requisites	Measurements of dynamic variables and method of analyzing signals. Knowing vibrations of material mechanics and basics of vibroacoustic analysis.		
Limit of number of students	30		
C. Learning outcomes and the manner of conducting classes			
Aim of the subject	The aim of the subject is to learn advanced methods of modelling and simulation of diagnostic information generation, analysis of cause-effect relationship between diagnostic parameters and technical condition parameters, determining classes and classifiers of alert thresholds and preparing students to use and analyze diagnostic systems. The object of the subject is to apply information acquitted during lecture during practice in laboratory.		
Subject outcomes			
Code	***Description of the outcomes***	***Reference to learning outcomes in the learning area***	***Learning outcomes for field of study***
Knowledge			
W01	Has well-ordered, theoretically based knowledge detailed knowledge connected with chosen aspects of machine diagnostics.	I.P7S_WG.o	K_W14

W02	Knows development trends and the most important achievements connected with machine diagnostics.	I.P7S_WG.o	K_W14
W03	Has basic knowledge related to lifecycle of machines.	I.P7S_WG.o	K_W14
Skills			
U01	Can determine directions od further self-study and perform the process of self-study.	I.P7S_UW.o	K_U19
U02	Can solve engineering problems and problems connected with machine diagnostics using proper methods and means.	I.P7S_UW.o III.P7S_UW.o I.P7S_UK	K_U11 K_U12 K_U14 K_U15 K_U16 K_U17

Form of classes and their duration	Lecture	Exercises	Laboratory	Project	Computer classes
Timetables	1	0	1	0	0
Throughout the semester	15	0	15	0	0

Learning content	Lecture: General knowledge concerning diagnosing of typical faults of rotating machinery like: Diagnosing machinery faults, Diagnosing imbalance and eccentricity, Diagnosing misalignment, bent shaft and cocker bearing, Diagnosing looseness, Diagnosing rotor rub and journal bearing faults, Diagnosing resonant conditions, Diagnosing rolling element bearing faults, The nine stages of a bearing fault, Demodulation and bearing analysis, The Shock Pulse Method (SPM), Hydraulic and Aerodynamic faults, Diagnosing pumps, fans, compressors and reciprocating machines, Diagnosing electric motor faults, Diagnosing turbine faults, Diagnosing gearbox faults, Diagnosing coupling and belt drive faults Laboratory: Learning practical aspects of machine diagnostics. 1. Vibration measurements in machine diagnostics; 2. Acoustic measurements in machine diagnostics; 3. Diagnosis of gigacycle fatigue process; 4. Analysis of non-stationary processes in rotating machines; 5. Diagnostics of roller bearings using LabVIEW environment; 6. Fault detection in shaft bearings using database and simulation model.
Learning methods	lecture presentation laboratory experimental study

Methods of examination of learning outcomes	
Code	***Evaluation methods***
Knowledge	
W01	Exam, test before admitting to exercises, evaluation of reports.
W02	Exam, test before admitting to exercises, evaluation of reports.
Skills	
U01	Written tests
U02	Written tests
Social Competences	
K01	Test before admitting to exercises, evaluation of task execution and report evaluation.
K02	Exam, test before admitting to exercises, evaluation of reports.

Evaluation methods	Projects: preparing project and homework which needs to utilize practical ability to solve simple problems as examples of theory presented within the lecture. Attestation of class exercises. Lecture: written examination on skills and knowledge concerning the scope of the course.
Exam	No
References	Radkowski S.: Wibroakustyczna diagnostyka uszkodzeń niskoenergetycznych, ITE Warszawa-Radom 2002,
Subject website	http://www.mechatronika.simr.pw.edu.pl Materials available in intranet after logging in. Login and password will be given during the 1st class.
D. Student's contribution	
Number of ECTS points	2
Number of hours of student's work	1) Number of contact hours- 32, including: a) lecture - 15 h, b) laboratory - 15 h,

connected with achieving learning outcomes:	c) consultations – 2 h. 2) Student's individual work 25 hours, including: a) 5 h – student's current preparation for classes, b) 5 h - literature study, c) 5 h – preparing for test, d) 10 h - preparing reports. 3) TOTAL – 57 h.
Number of ECTS points for classes requiring direct participation of members of academic staff:	1.3 ECTS points – number of contact hours- 32, including: a) lecture - 15 h, b) laboratory - 15 h, c) consultations – 2 h.
Number of ECTS points obtained by a student within practical	1 ECTS point - student's individual work 25 hours, including a) participation in laboratory exercises - 15 h; b) preparing laboratory report - 10 h.
E. Additional information	
Comments	-
Update date	3.10.2022 r.

Description of a subject			
Subject code			
Subject	**INTERIM PROJECT II**		
Subject version	2022/23		
A. Placing the subject within the study system			
Level of study	II degree		
Form of study	Full-time study		
Field of study	Mechanical Engineering		
Profile of study	General academic		
Degree program	Advanced Machinery and Vehicles Engineering		
Supervising unit	Faculty of Automotive and Construction Machinery Engineering		
Performing unit	Faculty of Automotive and Construction Machinery Engineering		
Subject coordinator			
B. General characteristics of the subject			
Subject kind	Specialised		
Subject level	Intermediate		
Subject group	Elective		
Language of instruction	English		
Nominal semester	3		
Course delivery in the academic year	Winter		
Pre-requisites	-		
Limit of number of students	30		
C. Learning outcomes and the manner of conducting classes			
Aim of the subject	The aim of the subject is student's completion of the interim thesis.		
Subject outcomes			
Code	***Description of the outcomes***	***Reference to learning outcomes in the learning area***	***Learning outcomes for field of study***
Knowledge			
W01	Knows how to obtain data from literature; can evaluate the operation of rules and laws concerning intellectual property protection.	I.P7S_WG.o III.P7S_WG.o	K_W16 K_W17

Skills			
U01	Can design a simple device, system or process, using proper methods, techniques and tools, considering the use of proper materials and technologies necessary in the production process.	I.P7S_UW.o III.P7S_UW.o	K_U01 K_U03 K_U05 K_U08
U02	Can perform an initial economic analysis of designed construction solutions or processes.	I.P7S_UW.o III.P7S_UW.o	K_U07
U03	Can obtain data from literature and data bases, can evaluate the operation of rules and laws of intellectual property protection and can prepare a clear report or presentation discussing advantages and disadvantages of different solutions.	I.P7S_UW.o III.P7S_UW.o I.P7S_UK	K_U14 K_U15 K_U17 K_U18 K_U20
Social Competences			
K01	Is aware of the role of a graduate in conveying the achievements in mechatronics of vehicle and construction machinery to the society.	I.P7S_KO I.P7S_KR	K_K01

Form of classes and their duration	Lecture	Exercises	Laboratory	Project	Computer classes
Timetables	0	0	0	5	0
Throughout the semester	0	0	0	75	0

Learning content	The subject includes student's own work in the scope necessary to complete the interim thesis, in agreement with the Thesis Supervisor. Topic of the thesis ought to be connected with student's field of study. It should refer to general-engineering issues and should enable the use of technical knowledge gained by a student up to this moment.
Learning methods	preparing a project

Methods of examination of learning outcomes	
Code	***Evaluation methods***
Knowledge	
W01	Interim thesis
Skills	
U01	Evaluation of the interim thesis
U02	Evaluation of the interim thesis
U03	Evaluation of the interim thesis
Social Competences	
K01	Evaluation of the interim thesis

Evaluation methods	Evaluation of the interim thesis. Interim thesis
Exam	No
References	References chosen by a student in agreement with the Thesis Supervisor within the scope connected with the topic of the thesis.
Subject website	–

D. Student's contribution

Number of ECTS points	6
Number of hours of student's work connected with achieving learning outcomes:	1) Number of contact hours - 75 hours of a project. 2) Student's own work – 35 hours, including: a) literature study: 10 hours. b) Work on preparing the project: 25 hours. 3) TOTAL – 110 hours.
Number of ECTS points for classes requiring direct participation of members of academic staff:	3 ECTS points – number of contact hours - 75 hours of a project.
Number of ECTS points obtained by a student within practical	3 ECTS points - 110 hours of student's work, including: a) participation in project practicals - 75 hours; b) work on preparing the project – 25 hours; c) literature study: 10 hours

E. Additional information

Comments	-
Update date	3.10.2022 r.

Description of a subject					
Subject code					
Subject	**DIPLOMA SEMINAR**				
Subject version	2022/23				
A. Placing the subject within the study system					
Level of study	II degree				
Form of study	Full-time study				
Field of study	Mechanical Engineering				
Profile of study	General academic				
Degree program	Advanced Machinery and Vehicles Engineering				
Supervising unit	Faculty of Automotive and Construction Machinery Engineering				
Performing unit	Faculty of Automotive and Construction Machinery Engineering				
Subject coordinator					
B. General characteristics of the subject					
Subject kind	Specialised				
Subject level	Basic				
Subject group	Obligatory				
Language of instruction	English				
Nominal semester	4				
Course delivery in the academic year	Summer				
Pre-requisites	-				
Limit of number of students	30				
C. Learning outcomes and the manner of conducting classes					
Aim of the subject	Preparing students to execute diploma thesis and diploma presentation. Preparing students for diploma exam.				

Subject outcomes

Code	***Description of the outcomes***	***Reference to learning outcomes in the learning area***	***Learning outcomes for field of study***
Knowledge			
W01	Student who has passed the subject knows rules for M.Sc. thesis layout and presenting its results in a clear and understandable manner. He or she also has basic knowledge in the area of patent laws and intellectual property resources management.	I.P7S_WK	K_W16
Skills			
U01	Student can: •Analyze the state of knowledge of the scientific literature and other sources recommended for a given topic, •Critically evaluate the knowledge and formulate the results in the form of a short report.	I.P7S_UW.o	K_U15
U02	Can practically apply rules concerning intellectual property protection.	I.P7S_UW.o	K_U15
U03	Student can prepare and give presentation on a given topic and can defend the assumptions formulated in the presentation.	I.P7S_UW.o III.P7S_UW.o	K_U17 K_U20
U04	Student can participate in a factual discussion on a given subject.	I.P7S_UW.o III.P7S_UW.o	K_U15 K_U17 K_U20

Form of classes and their duration	Lecture	Exercises	Laboratory	Project	Computer classes

Timetables	0	2	0	0	0
Throughout the semester	0	30	0	0	0

Learning content	Practicals: Requirements for M.Sc. thesis. Student's own contribution. Rules for preparing Diploma Thesis Sheet. General structure and content of particular parts of diploma thesis. Rules for editing diploma thesis and for using proper terminology. Formulating tasks, aim and scope of diploma thesis. Preparing synopsis and references. Abiding by copyright laws. Diploma thesis aesthetics. Rules for conducting diploma exam. Ruled for conducting factual discussions. Rules for preparing diploma presentation: number and layout of slides, their content and coherence. Rules for giving a presentation.
Learning methods	multimedia presentation
Methods of examination of learning outcomes	
Code	***Evaluation methods***
Knowledge	
W01	Evaluation of presentation
Skills	
U01	Evaluation of presentation
U02	Evaluation of presentation
U03	Evaluation of presentation
U04	Evaluation of presentation
Evaluation methods	Evaluation of the presentation
Exam	No
References	Materials in English will be shared electronically.
Subject website	–
D. Student's contribution	
Number of ECTS points	2
Number of hours of student's work connected with achieving learning outcomes:	1) Number of contact hours – 31 h, including: a) practicals – 30 h.; b) consultations – 1 h 2) Student's own work – 20 h, including: a) literature study – 10 h; b) student's preparation for tutorials – 10 h 3) TOTAL – 51 h
Number of ECTS points for classes requiring direct participation of members of academic staff:	1.2 ECTS points – number of contact hours – 31 hours, including: a) practicals – 30 h; b) consultations – 1 h
Number of ECTS points obtained by a student within practical	1.6 ECTS points – 40 hours, including: a) practicals – 30 h; b) student's preparation for tutorials – 10 h
E. Additional information	
Comments	-
Update date	3.10.2022 r.

Description of a subject	
Subject code	
Subject	**MASTER OF SCIENCE THESIS**
Subject version	2022/23
A. Placing the subject within the study system	
Level of study	II degree
Form of study	Full-time study
Field of study	Mechanical Engineering

Profile of study	General academic
Degree program	Advanced Machinery and Vehicles Engineering
Supervising unit	Faculty of Automotive and Construction Machinery Engineering
Performing unit	Faculty of Automotive and Construction Machinery Engineering
Subject coordinator	
B. General characteristics of the subject	
Subject kind	Specialised
Subject level	Advanced
Subject group	Elective
Language of instruction	English
Nominal semester	4
Course delivery in the academic year	Summer
Pre-requisites	-
Limit of number of students	30
C. Learning outcomes and the manner of conducting classes	
Aim of the subject	The aim of the subject is student's execution of an M.Sc. thesis

Subject outcomes

Code	*Description of the outcomes*	*Reference to learning outcomes in the learning area*	*Learning outcomes for field of study*
Knowledge			
W01	Knows how to obtain data from literature and data bases; can evaluate the operation of rules and laws concerning intellectual property protection.	I.P7S_WK	K_W16
W02	Knows the safety methods in design.	I.P7S_WG.o	K_W15
Skills			
U01	Can design a simple device, system or process, using proper methods, techniques and tools, considering the use of proper materials and technologies necessary in the production process.	I.P7S_UW.o III.P7S_UW.o	K_U01 K_U03 K_U04 K_U05 K_U08 K_U10 K_U11 K_U12 K_U13
U02	Can perform an initial economic analysis of designed construction solutions or processes.	I.P7S_UW.o	K_U07
U03	Can obtain data from literature, data bases, and other sources within the scope of the field of study; can interpret and critically evaluate the obtained data as well as draw conclusions and justify opinions; can evaluate the operation of rules and laws of intellectual property protection; can prepare a synopsis of the M.Sc. thesis in English.	I.P7S_UW.o III.P7S_UW.o I.P7S_UK I.P7S_UO	K_U14 K_U15 K_U17 K_U18 K_U19 K_U21
Social Competences			
K01	Is aware of the role of a graduate in conveying the achievements in mechatronics of vehicle and construction machinery to the society.	I.P7S_KO I.P7S_KR I.P7S_KK	K_K01 K_K02

Form of classes and their duration	Lecture	Exercises	Laboratory	Project	Computer classes
Timetables	0	0	0	18	0
Throughout the semester	0	0	0	270	0

Learning content	The subject comprises student's own work in the scope indispensable to execute an M.Sc. thesis, established in agreement with the Thesis Supervisor. Topic of the thesis has to be connected with student's field of study. M.Sc. thesis ought to exhibit in-depth, basic theoretical and experimental knowledge in a given domain, and the ability to solve problems requiring the application of modern methods from the area of theoretical and empirical analyses. The object of the thesis may be especially: solving a computational, project or technological problem or solving a particular part of a bigger project, establishing or significantly improving an existing research, measurement or analytical method, performing a research task. M.Sc. thesis ought to contain new results of analyses, experimental or theoretical research, or theoretical inquiries, or a new solution to a chosen problem within student's field of study.
Learning methods	preparing the M.Sc. thesis
Methods of examination of learning outcomes	
Code	***Evaluation methods***
Knowledge	
W01	M.Sc. thesis
Skills	
U01	M.Sc. thesis
U02	M.Sc. thesis
U03	M.Sc. thesis
Social Competences	
K01	M.Sc. thesis
Evaluation methods	M.Sc. thesis
Exam	No
References	References chosen by a student in agreement with the Thesis Supervisor within the scope connected with the topic of the M.Sc. thesis.
Subject website	–
D. Student's contribution	
Number of ECTS points	20
Number of hours of student's work connected with achieving learning outcomes:	1) Number of contact hours - 270 h of the project. 2) student's own work – 250 h, including: a) literature study: 20 h b) work on preparing M.Sc. thesis: 230 h 3) TOTAL – 520 h
Number of ECTS points for classes requiring direct participation of members of academic staff:	10.8 ECTS points - 270 h of the project.
Number of ECTS points obtained by a student within practical	20 ECTS points - 500 h of student's own work, including: a) participation in project practicals - 270 h; b) work on preparing M.Sc. thesis – 230 h
E. Additional information	
Comments	-
Update date	3.10.2022 r.

Description of a subject	
Subject code	
Subject	**ADVANCED ALTERNATIVE FUELS FOR COMBUSTION ENGINES**
Subject version	2022/23
A. Placing the subject within the study system	
Level of study	II degree
Form of study	Full-time study
Field of study	Mechanical Engineering

Profile of study	General academic
Degree program	Advanced Machinery and Vehicles Engineering
Supervising unit	Faculty of Automotive and Construction Machinery Engineering
Performing unit	Faculty of Automotive and Construction Machinery Engineering
Subject coordinator	
B. General characteristics of the subject	
Subject kind	Specialised
Subject level	Basic
Subject group	Elective B
Language of instruction	English
Nominal semester	2
Course delivery in the academic year	Summer
Pre-requisites	Basic knowledge on general chemistry and combustion engines (at a bachelor's level).
Limit of number of students	30
C. Learning outcomes and the manner of conducting classes	
Aim of the subject	To provide the students with knowledge on alternative fuels (other than gasoline and diesel oil) currently being considered for supplying combustion engines, in vehicular and stationary applications. After completing the course, the students should be able to characterize the most significant physical and chemical properties of alternative fuels, discuss and compare fuels in terms of their impact on operating and ecological performance of combustion engines, as well as describe environmental impacts of various fuels from Well-to-Wheel perspective. Learning to obtain information from literature and other properly chosen sources within the scope of the subject; integrating the obtained information, interpreting it and drawing conclusions; formulating and justifying opinions within the scope of application of alternative fuels in combustion engines.

Subject outcomes

Code	***Description of the outcomes***	***Reference to learning outcomes in the learning area***	***Learning outcomes for field of study***
Knowledge			
W01	Has knowledge in the field of supplying combustion engines with alternative fuels.	I.P7S_WG.o	K_W01
W02	Has detailed knowledge of physical and chemical properties of alternative fuels.	I.P7S_WG.o	K_W11
W03	Has knowledge within the scope of physical and chemical properties of alternative fuels to evaluate their influence on operating and ecological performance of combustion engines.	I.P7S_WG.o	K_W01
Skills			
U01	Is prepared to obtain information from literature and other properly chosen sources within the scope of the subject; can integrate the obtained information, interpret it and draw conclusions and formulate and justify opinions within the scope of application of alternative fuels in combustion engines.	I.P7S_UW.o	K_U15
U02	Knows how to make a written and oral presentation within the scope of application of alternative fuels in combustion engines.	I.P7S_UW.o	K_U15
U03	Knows how to obtain knowledge on their own, within the scope of issues related to application of alternative fuels in combustion engines and can establish directions for self-study.	I.P7S_UW.o	K_U15
Social Competences			
K01	Understands the influence of application of alternative fuels in combustion engines on the environment and knows how to convey this information to society.	I.P7S_KO I.P7S_KR	K_K01
K02	Can think and act in an entrepreneurial manner.	I.P7S_KO I.P7S_KR	K_K01

Form of classes and	Lecture	Exercises	Laboratory	Project	Computer classes

their duration					
Timetables	1	0	0	1	0
Throughout the semester	15	0	0	15	0

Learning content	1. Organizational matters. Introduction to issues connected with engine fuels. 2. General characteristics and classification of alternative fuels. 3. Alcohol fuels (methanol, ethanol). 4. Eters. 5. Vegetable oils. 6. Vegetable oil esters (FAME, FAEE). 7. Liquefied petroleum gas (LPG). 8. Natural Gas (CNG, LNG). 9. Biogas. 10. Synthetic fuels (GTL, CTL, BTL). 11. Ammonia. 12. Hydrogen. 13. Well-to-Wheel analysis of alternative fuels. 14. Test. 15. Student presentations.
Learning methods	lecture presentation Project: preparing a construction of supplying combustion engines with alternative fuels.

Methods of examination of learning outcomes	
Code	***Evaluation methods***
Knowledge	
W01	Written test. Preparing a computer program
W02	Written test. Preparing a computer program
W03	Written test. Preparing a computer program
Skills	
U01	Written test. Preparing a computer program
U02	Written test. Preparing a computer program
U03	Written test. Preparing a computer program
Social Competences	
K01	Written test. Preparing a computer program
K02	Written test. Preparing a computer program

Evaluation methods	Written test. Preparing a project.
Exam	No
References	1. Richard Folkson, and Folkson. Alternative Fuels and Advanced Vehicle Technologies for Improved Environmental Performance: Towards Zero Carbon Transportation. Woodhead, 2014. 2. Srivastava, S. P., and Hancsók, Jenő. "Alternative Fuels." Fuels and Fuel-Additives. Hoboken, NJ: John Wiley & Sons, 2014. 121-76. 3. Abdul Karim, Zainal Ambri. Alternative Fuels for Compression Ignition Engines. Springer Singapore, 2018. 4. Lefebvre, Arthur Henry, and Dilip R. Ballal. Gas Turbine Combustion: Alternative Fuels and Emissions. 3rd ed. Boca Raton [etc.]: CRC/Taylor & Francis Group, 2010.
Subject website	–
D. Student's contribution	
Number of ECTS points	3
Number of hours of student's work connected with achieving learning outcomes:	1) Number of contact hours – 40 h, including: a) practicals – 30 h.; b) consultations – 10 2) Student's own work – 35 h, including: a) literature study – 10 h; b) student's preparation for tutorials – 10 h; c) preparation a project15 h; 3) TOTAL – 75 h
Number of ECTS points for classes requiring direct participation of members of academic	1.5 ECTS points – number of contact hours – 40 hours, including: a) practicals – 30 hours; b) consultations – 10 hour

staff:	
Number of ECTS points obtained by a student within practical	1.5 ECTS points – 35 h, including: a) student's preparation for tutorials – 10 h b) preparation a project 15 h;
E. Additional information	
Comments	-
Update date	3.10.2022 r.

Description of a subject			
Subject code			
Subject	**LOCAL MODELS OF LAYERED STRUCTURES**		
Subject version	2022/23		
A. Placing the subject within the study system			
Level of study	II degree		
Form of study	Full-time study		
Field of study	Mechanical Engineering		
Profile of study	General academic		
Degree program	Advanced Machinery and Vehicles Engineering		
Supervising unit	Faculty of Automotive and Construction Machinery Engineering		
Performing unit	Faculty of Automotive and Construction Machinery Engineering		
Subject coordinator			
B. General characteristics of the subject			
Subject kind	Basic		
Subject level	Intermediate		
Subject group	Elective B		
Language of instruction	English		
Nominal semester	2		
Course delivery in the academic year	Summer		
Pre-requisites	Strength of materials, theory of vibration, theory of ordinary differential equations		
Limit of number of students	30		
C. Learning outcomes and the manner of conducting classes			
Aim of the subject	Provide students with a local approach (several models) to describe the mechanical, static and dynamic behavior of planar multilayer structures such as plates, bands and beams, with layers free of limitations of geometric and physical parameters. Acquiring by the students the skills of error-free coding of the computational algorithms. Evaluation of the impact of selected parameters of the structures considered on deflections, eigenfrequencies, logarithmic decrement and coincidence frequencies. Evaluation of the impact of edge boundary conditions on the above mentioned computational characteristics.		
Subject outcomes			
Code	***Description of the outcomes***	***Reference to learning outcomes in the learning area***	***Learning outcomes for field of study***
Knowledge			
W01	He has a detailed knowledge about local models of layered structures and about limitations of their applications.	I.P7S_WG.o	K_W01
W02	Has knowledge about potential applications of the local models of layered structures.	I.P7S_WG.o	K_W11
W03	He has a detailed knowledge about transformations of the boundary problems for the layered plates to analogous problems for strips and beams.	I.P7S_WG.o	K_W01

Skills			
U01	Is prepared to obtain information from literature and other properly chosen sources within the scope of the subject; can integrate the obtained information, interpret it and draw conclusions and formulate and justify opinions within the scope of the application of local models of boundary problems of layered structures.	I.P7S_UW.o	K_U15
U02	Knows how to make a written and oral presentation within the scope of local models of static and vibration problems of layered structures.	I.P7S_UW.o	K_U15
U03	Knows how to obtain knowledge on their own, within the scope of local models of layered structures and can establish directions for self-study.	I.P7S_UW.o	K_U15
Social Competences			
K01	Understands the need for multi-layer structures in various technical fields and knows how to convey this information to society.	I.P7S_KO I.P7S_KR	K_K01
K02	Can think and act in an entrepreneurial manner.	I.P7S_KO I.P7S_KR	K_K01

Form of classes and their duration	Lecture	Exercises	Laboratory	Project	Computer classes
Timetables	1	0	0	1	0
Throughout the semester	15	0	0	15	0

Learning content	Lecture. 1. Examples of applications of multilayer structures. 2. Kinematic models and fields of strains. 4. Local constitutive models of purely elastic layers. 5. Local constitutive models of viscoelastic layers. 6. Local, linear elasticity equilibrium equations and equations of motion. 7. Solutions to the local equilibrium equations. 8. Solutions to the local equations of motion. 9. Boundary problems of multilayer structures with edge boundary conditions of simple supports. 10. Boundary problems of multilayer structures with edge technical boundary conditions. 11. Transformations of the plate boundary problems to the problems of band and then to analogous problems of the beam. Project 1. Static deflection of a rectangular, two-layer panel subjected to a uniformly distributed load. 2. Eigenfrequencies of the two-layer purely elastic panel. 3. Eigenfrequencies and the logarithmic decrement of the two-layer viscoelastic panel. 4. Coincidence frequencies of the two-layer plate.
Learning methods	lecture presentation project: preparing 2 simulation projects and presentation of results

Methods of examination of learning outcomes	
Code	***Evaluation methods***
Knowledge	
W01	Written test. Presentation, discussion
W02	Written test. Presentation, discussion
W03	Written test. Presentation, discussion
Skills	
U01	Written test. Presentation, discussion. Evaluation a project
U02	Written test. Presentation, discussion. Evaluation a project
U03	Written test. Presentation, discussion. Evaluation a project
Social Competences	
K01	Written test. Presentation, discussion. Evaluation a project
K02	Written test. Presentation, discussion. Evaluation a project

Evaluation methods	Lecture - 1 test (written), Project – 1 report made by student
Exam	No
References	S. Karczmarzyk: An analytic model of flexural vibrations and the static bending of plane viscoelastic composite structures. OWPW, Warsaw, 1999.
Subject website	–
D. Student's contribution	
Number of ECTS	3

points	
Number of hours of student's work connected with achieving learning outcomes:	1) Number of contact hours - 30 hours of a practicals. 2) Student's own work – 30 hours, including: a) literature study: 5 hours. b) Work on preparing the project: 10 hours. 3) TOTAL – 75 hours.
Number of ECTS points for classes requiring direct participation of members of academic staff:	3 ECTS points – number of contact hours - 30 hours of a practicals.
Number of ECTS points obtained by a student within practical	3 ECTS points - 30 hours of student's work, including: a) work on preparing the project – 30 hours; b) literature study: 5 hours
E. Additional information	
Comments	-
Update date	3.10.2022 r.

Description of a subject			
Subject code			
Subject	**MODELLING HYBRID DRIVES**		
Subject version	2022/23		
A. Placing the subject within the study system			
Level of study	II degree		
Form of study	Full-time study		
Field of study	Mechanical Engineering		
Profile of study	General academic		
Degree program	Advanced Machinery and Vehicles Engineering		
Supervising unit	Faculty of Automotive and Construction Machinery Engineering		
Performing unit	Faculty of Automotive and Construction Machinery Engineering		
Subject coordinator			
B. General characteristics of the subject			
Subject kind	Basic		
Subject level	Intermediate		
Subject group	Elective B		
Language of instruction	English		
Nominal semester	2		
Course delivery in the academic year	Summer		
Pre-requisites	Mechanics, Hydraulic, Vehicles, Electric		
Limit of number of students	30		
C. Learning outcomes and the manner of conducting classes			
Aim of the subject	Obtaining theoretical bases concerning hybrid devices in vehicles, as well as gaining knowledge necessary to evaluate the influence energy distributions. Learning to obtain information from literature and other properly chosen sources within the scope of the subject; can integrate the obtained information, interpret it and draw conclusions, formulate and justify opinions within the scope of the hybrid (hydrostatic and electric) drive application in vehicles.		
Subject outcomes			
Code	***Description of the outcomes***	***Reference to learning outcomes in the learning area***	***Learning outcomes for field of study***

Knowledge			
W01	Has knowledge in the field of the construction of hybrid drive.	I.P7S_WG.o	K_W01
W02	Has detailed knowledge of hybrid drive in vehicles.	I.P7S_WG.o	K_W02
W03	Has knowledge within the scope of hybrid drive to evaluate the influence of energy distributions in a vehicle on its safety.	I.P7S_WG.o	K_W03
Skills			
U01	Is prepared to obtain information from literature and other properly chosen sources within the scope of the subject; can integrate the obtained information, interpret it and draw conclusions and formulate and justify opinions within the scope of the application of hybrid drive in vehicles.	I.P7S_UW.o	K_U15
U02	Knows how to make a written and oral presentation within the scope of application of hybrid drive in vehicles.	I.P7S_UW.o	K_U15
U03	Knows how to obtain knowledge on their own, within the scope of issues related to application of hybrid drive in vehicles and can establish directions for self-study.	I.P7S_UW.o	K_U15
Social Competences			
K01	Understands the influence of application of hybrid drive in vehicles, and other technical devices and knows how to convey this information to society.	I.P7S_KO I.P7S_KR	K_K01
K02	Can think and act in an entrepreneurial manner.	I.P7S_KO I.P7S_KR	K_K01

Form of classes and their duration	Lecture	Exercises	Laboratory	Project	Computer classes
Timetables	1	0	0	1	0
Throughout the semester	15	0	0	15	0

Learning content	1. Organizational matters. Introduction to issues connected with hybrid drive. 2. Discussing properties of vehicle drives. Advantages and disadvantages of classic and hybrid drive systems. 3. Hydrostatic drive systems of vehicles and machines. 4. Electric drive systems of vehicles and machines. 5. Overview of solutions of vehicles with hybrid drives. 6. Discussing issues of control of hybrid drives. 7. Modelling a hydrostatic drive of a vehicle. 8. Modelling an electric drive of a vehicle. 9. Modelling an electric-hydrostatic hybrid drive. 10. Preparing project works on a hybrid drive of a vehicle. 11. Analysis of power and energy flow in hybrid systems. 12. Test. Students' presentations.
Learning methods	lecture presentation project: preparing simulation project and presentation of results

Methods of examination of learning outcomes	
Code	***Evaluation methods***
Knowledge	
W01	Written test. Presentation, discussion
W02	Written test. Presentation, discussion
W03	Written test. Presentation, discussion
Skills	
U01	Written test. Presentation, discussion. Evaluation a project
U02	Written test. Presentation, discussion. Evaluation a project
U03	Written test. Presentation, discussion. Evaluation a project
Social Competences	
K01	Written test. Presentation, discussion. Evaluation a project
K02	Written test. Presentation, discussion. Evaluation a project

Evaluation methods	Lecture - 1 tests (written), Project – 2 report made by student
Exam	No

References	1. Szumanowski A. Hybrid-Electric Vehicle Drives Design; Institutefor Sustainable Technologies: Radom, Poland, 2006. 2. Khajepour A.; Fallach S.; Goodarrzi A. Electric and Hybrid Vehicles; Willey: Chichester, UK, 2014. 3. Wei L. Introductionto Hybrid Vehicle System Modeling and Control; John Wiley & Sons, Inc.: Hoboken, NJ, USA, 2013.
Subject website	–
D. Student's contribution	
Number of ECTS points	3
Number of hours of student's work connected with achieving learning outcomes:	1) Number of contact hours - 30 hours of a practicals. 2) Student's own work – 45 hours, including: a) literature study: 5 hours. b) work on preparing the project 1 - 20 hours. c) project 2 of drive system - 20 h 3) TOTAL – 75 hours.
Number of ECTS points for classes requiring direct participation of members of academic staff:	1,5 ECTS points – number of contact hours - 30 hours of a practicals.
Number of ECTS points obtained by a student within practical	1,5 ECTS points - 30 hours of student's work, including: a) work on preparing the project – 25 hours; b) literature study: 5 hours
E. Additional information	
Comments	-
Update date	3.10.2022 r.

Description of a subject	
Subject code	
Subject	**NUMERICAL METHODS IN MECHANICS**
Subject version	2022/23
A. Placing the subject within the study system	
Level of study	II degree
Form of study	Full-time study
Field of study	Mechanical Engineering
Profile of study	General academic
Degree program	Advanced Machinery and Vehicles Engineering
Supervising unit	Faculty of Automotive and Construction Machinery Engineering
Performing unit	Faculty of Automotive and Construction Machinery Engineering
Subject coordinator	
B. General characteristics of the subject	
Subject kind	Specialised
Subject level	Intermediate
Subject group	Elective B
Language of instruction	English
Nominal semester	2
Course delivery in the academic year	Summer
Pre-requisites	-
Limit of number of students	30
C. Learning outcomes and the manner of conducting classes	
Aim of the subject	Mathematical foundations regarding the issues under consideration (algebra, analysis), knowledge of mechanics and strength of materials, basic knowledge of programming,

Subject outcomes			
Code	***Description of the outcomes***	***Reference to learning outcomes in the learning area***	***Learning outcomes for field of study***
Knowledge			
W01	Has a knowledge in the field of mathematics and programming, necessary for formulating and solving numerically complex tasks related to problems of mechanics	I.P7S_WG.o	K_W03 K_W05
W02	He knows the basic methods and numerical techniques used to solve mathematical problems related to mechanics on a computer	I.P7S_WG.o	K_W03 K_W05
Skills			
U01	Can calculate on a computer (using the Scilab environment) solutions of exemplary problems from the field of mechanics, interpret obtained results and draw conclusions	I.P7S_UW.o III.P7S_UW.o	K_U01 K_U14
U02	He can apply numerical methods to solve engineering tasks	I.P7S_UW.o III.P7S_UW.o	K_U01 K_U14

Form of classes and their duration	Lecture	Exercises	Laboratory	Project	Computer classes
Timetables	1	0	0	1	0
Throughout the semester	15	0	0	15	0

Learning content	Lecture: 1) Introduction to numerical methods: number representation, algorithms, source of errors, modeling of typical problems in mechanics 2) Roots of nonlinear equations (Bisection, Newton-Raphson and False-Position methods), systems of nonlinear equations 3) Solution of linear algebraic equations (Gauss and Gauss-Jordan elimination, matrix inversion, iterative methods) 4) Interpolation (Lagrange and Newton polynomials) and approximation (Least-Squares and linear regression) 5) Numerical integration (Trapezoidal rule, Newton-Cotes formulas and Gauss quadrature) 6) Numerical solution of eigenvalue problem (Power method, main idea of QR method) 7) Ordinary differential equations (Euler's method, Runge-Kutta methods) and systems of equations Projects: 1) Introduction to programming in Scilab (or Matlab) 2) Algorithms for finding roots of a nonlinear equation, test of convergence (numerical example: equilibrium of a floating object) 3) Solution of a system of linear algebraic equations (numerical example: approximation of experimental data using the least squares approach) 4) Determination of eigenvalues and eigenvectors of a matrix (numerical example: eigenfrequencies and eigenmodes of a system of vibrating masses) 5) Numerical solution of a system of ordinary differential equations (numerical example: cantilever beam subjected to bending)
Learning methods	lecture presentation preparing a project

Methods of examination of learning outcomes	
Code	***Evaluation methods***
Knowledge	
W01	Lecture – test, 4 individual homeworks
W02	Lecture – test, 4 individual homeworks
Skills	
U01	Reports from calculations carried out on projects - 5 reports
U02	Reports from calculations carried out on projects - 5 reports

Evaluation methods	Evaluation of the homeworks and reports
Exam	No
References	S.S. Rao, Applied Numerical Methods for Engineers and Scientists, Prentice Hall Professional Technical Reference 2001
Subject website	–
D. Student's contribution	
Number of ECTS points	3
Number of hours of student's work connected with	1) Number of contact hours – 40, including: a) lecture – 15 h b) projects – 15 h c) consultations – 10 h

achieving learning outcomes:	2) Student's individual work – 30 hours, including: a) preparing for lectures and computer program – 20 h b) carrying out calculations and preparing reports - 10 h c) preparing for test – 5 h d) doing homework – 5 h 3) TOTAL – 80 h
Number of ECTS points for classes requiring direct participation of members of academic staff:	1,5 ECTS points – number of contact hours – 40, including: a) lecture – 15 h b) computer laboratories – 15 h c) consultations – 10 h
Number of ECTS points obtained by a student within practical	1,5 ECTS points – number of student's work – 40, including: a) preparing for lectures and computer program – 20 h b) carrying out calculations and preparing reports - 10 h c) preparing for test – 5 h d) doing homework – 5 h
E. Additional information	
Comments	-
Update date	3.10.2022 r.

Description of a subject			
Subject code			
Subject	**ACTIVE CONTROL OF VEHICLE VIBRATIONS**		
Subject version	2022/23		
A. Placing the subject within the study system			
Level of study	II degree		
Form of study	Full-time study		
Field of study	Mechanical Engineering		
Profile of study	General academic		
Degree program	Advanced Machinery and Vehicles Engineering		
Supervising unit	Faculty of Automotive and Construction Machinery Engineering		
Performing unit	Faculty of Automotive and Construction Machinery Engineering		
Subject coordinator			
B. General characteristics of the subject			
Subject kind	Basic		
Subject level	Basic		
Subject group	Elective B		
Language of instruction	English		
Nominal semester	2		
Course delivery in the academic year	Summer		
Pre-requisites	Mechanics, Theory of Vibrations, Theory of Vehicle Movement, Vehicles		
Limit of number of students	30		
C. Learning outcomes and the manner of conducting classes			
Aim of the subject	Obtaining theoretical bases concerning active and adaptive devices in vehicles, as well as gaining knowledge necessary to evaluate the influence of vibrations on vehicle structure and passengers. Learning to obtain information from literature and other properly chosen sources within the scope of the subject; can integrate the obtained information, interpret it and draw conclusions, formulate and justify opinions within the scope of the application of smart materials in vehicles.		
Subject outcomes			
Code	***Description of the outcomes***	***Reference to learning outcomes in the learning area***	***Learning outcomes for field of study***

Knowledge			
W01	Has knowledge in the field of the construction of active and adaptive devices.	I.P7S_WG.o	K_W01
W02	Has detailed knowledge of active and adaptive devices in vehicles.	I.P7S_WG.o	K_W11
W03	Has knowledge within the scope of active and adaptive devices to evaluate the influence on protection of a vehicle construction and passengers.	I.P7S_WG.o	K_W01
Skills			
U01	Is prepared to obtain information from literature and other properly chosen sources within the scope of the subject; can integrate the obtained information, interpret it and draw conclusions and formulate and justify opinions within the scope of the application of smart materials in vehicles.	I.P7S_UW.o	K_U15
U02	Knows how to make a written and oral presentation within the scope of application of smart materials in vehicles and in road traffic safety.	I.P7S_UW.o	K_U15
U03	Knows how to obtain knowledge on their own, within the scope of issues related to application of smart materials in technology and can establish directions for self-study.	I.P7S_UW.o	K_U15
Social Competences			
K01	Understands the influence of application of smart materials in vehicles and other technical devices and knows how to convey this information to society.	I.P7S_KO I.P7S_KR	K_K01
K02	Can think and act in an entrepreneurial manner.	I.P7S_KO I.P7S_KR	K_K01

Form of classes and their duration	Lecture	Exercises	Laboratory	Project	Computer classes
Timetables	1	0	0	1	0
Throughout the semester	15	0	0	15	0

Learning content	1. Organizational matters. Introduction to issues connected with smart materials. 2. Discussing properties. Advantages and disadvantages of smart materials in engineering solutions. 3. Review of application solutions of smart materials. Construction of energy-dissipating devices. 4. Application of smart materials in energy-dissipating systems. 5. Application of smart materials in control of construction vibrations. 6. Construction of mechanical systems with active and adaptive devices. 7. Basics of design of mechanical systems with active and adaptive devices. 8. Discussing issues of control of mechanical systems with active and adaptive devices. 9. Modelling of adaptive and active mechanical systems using Simulink software. 10. Adaptive and active vehicle suspensions. 11. Application of smart materials in road traffic safety. 12. Test. Student presentations.
Learning methods	lecture presentation project of a controlled suspension system of a vehicle

Methods of examination of learning outcomes	
Code	***Evaluation methods***
Knowledge	
W01	Written test. Presentation, discussion
W02	Written test. Presentation, discussion
W03	Written test. Presentation, discussion
Skills	
U01	Written test. Presentation, discussion. Evaluation a project
U02	Written test. Presentation, discussion. Evaluation a project
U03	Written test. Presentation, discussion. Evaluation a project
Social Competences	
K01	Written test. Presentation, discussion. Evaluation a project
K02	Written test. Presentation, discussion. Evaluation a project

Evaluation methods	Evaluation of the tests (written) and reports.

Exam	No
References	1. Sapiński B: Magnetorheological dampers in vibration control. Cracow AGH, 2006. 2. Goldasz J., Sapiński B.: Insight into Magnetorheological Shock Absorbers, Springer, 2015.
Subject website	-
D. Student's contribution	
Number of ECTS points	3
Number of hours of student's work connected with achieving learning outcomes:	1) Number of contact hours - 30, including: a) lecture - 15 h.; b) project – 15 h; 2) Student's own work: a) 15 h – literature studies, b) 15 h – preparing for test from lectures/presentations, c) 15 h – preparing project, 3) TOTAL – 75 h
Number of ECTS points for classes requiring direct participation of members of academic staff:	1 ECTS point – number of contact hours - 30, including: a) lecture - 15 h.; b) project – 15 h;
Number of ECTS points obtained by a student within practical	2 ECTS point - 45 h, including: 1) 15 h – preparing a project of a controlled suspension system, 2) 15 h – preparing for a test/presentation 3) 15 h – preparing a project,
E. Additional information	
Comments	-
Update date	3.10.2022 r.

Description of a subject	
Subject code	
Subject	**DESIGN OF AUTOMOTIVE SUSPENSIONS**
Subject version	2022/23
A. Placing the subject within the study system	
Level of study	II degree
Form of study	Full-time study
Field of study	Mechanical Engineering
Profile of study	General academic
Degree program	Advanced Machinery and Vehicles Engineering
Supervising unit	Faculty of Automotive and Construction Machinery Engineering
Performing unit	Faculty of Automotive and Construction Machinery Engineering
Subject coordinator	
B. General characteristics of the subject	
Subject kind	Basic
Subject level	Intermediate
Subject group	Elective B
Language of instruction	English
Nominal semester	2
Course delivery in the academic year	Summer
Pre-requisites	Knowledge of the issues of: general mechanics, machines dynamics and theory of vibrations of mechanical systems; construction of motor vehicles; basics of solid modelling of machines elements.
Limit of number of students	30
C. Learning outcomes and the manner of conducting classes	

Aim of the subject	Understanding the specifics of design calculations and geometric modeling of automotive suspension assemblies. Creating a mathematical model of vibrations of automobile and the geometric model of suspension construction. Awareness of the importance of the accuracy of building mathematical and geometric models in suspension design practice.

Subject outcomes

Code	***Description of the outcomes***	***Reference to learning outcomes in the learning area***	***Learning outcomes for field of study***
Knowledge			
W01	Knows how to obtain data from literature; can evaluate the operation of rules and laws concerning intellectual property protection.	I.P7S_WK	K_W16
W02	Has broadened and deep knowledge in the field of advanced construction of automotive suspensions and modern methods of their design.	I.P7S_WG.o	K_W05
W03	Has basic knowledge in the field of methods, techniques and tools used to solve complex problems related to creation of automotive suspension structure.	I.P7S_WK	K_W11
Skills			
U01	Student can apply in practice the knowledge in the field of computer-based, advanced modeling of suspension structures of motor vehicles.	I.P7S_UW.o III.P7S_UW.o	K_U08
U02	Is able to plan and carry out the strength analysis of automotive suspension component, interpret the results and draw proper conclusions.	I.P7S_UW.o III.P7S_UW.o	K_U09
Social Competences			
K01	Understands the need to formulate and communicate in a commonly understandable way the information and opinions on the achievements in the construction of suspensions.	I.P7S_KO I.P7S_KR	K_K01

Form of classes and their duration	Lecture	Exercises	Laboratory	Project	Computer classes
Timetables	1	0	0	1	0
Throughout the semester	15	0	0	15	0

Learning content	1. Overview of constructions of automobiles suspensions. 2. Description of vertical vibrations of automobile with the use of mathematical model. 3. The spectrum of road unevenness and its application in modeling of vibration. 4. Eigenvalue frequency of the body and the condition of conjugation of vibrations of front and rear axle. 5. Selection of stiffness coefficients of suspension spring elements based on the criterion of driving comfort. 6. Design calculations for elastic elements (coil spring, torsion bar). 7. Basics of solid modeling using CAD system. 8. Introduction to the principles of building geometric models including parameterization. 9. Presentation of the features of elements built using solid geometric models. 10. Execution of construction documentation for selected element of suspension. 11. Execution of the assembly drawing of suspension assembly. 12. Basics of strength calculations using CAE system. 13. Strength calculations of guiding elements in automotive suspension (reaction rods, rockers) - FEM method. 14. Analysis of forces acting on the body from the side of suspension elements. 15. Simulation studies of curvilinear motion of automobile depending on the geometry and suspension stiffness.
Learning methods	lecture presentation preparing a project

Methods of examination of learning outcomes

Code	***Evaluation methods***
Knowledge	
W01	Colloquium, project
W02	Colloquium, project
W03	Colloquium, project

Skills	
U01	Evaluation a project
U02	Evaluation a project
Social Competences	
K01	Evaluation a project

Evaluation methods	Evaluation of the 1 colloquium, 1 project. As part of the colloquium student must prove the knowledge of the issues mentioned in the content of education. As part of the project, student must prove that can prepare the construction documentation of the suspension element (eg. rocker) after checking its strength. It is necessary to pass at least a satisfactory grade both for the colloquium and the project. From these two partial grades (of the same weight), the arithmetic mean of the object is calculated.
Exam	No
References	1. Bastow D., Howard G., Whitehead J.P. Car Suspension and Handling, 4th Edition, Wiley, UK, 2004. 2. Halderman J.D. Automotive Steering, Suspension & Alignment (7th Edition) (Automotive Systems Books) 7th Edition, Pearson, 2016. 3. Mitschke M., Wallentowitz H. Dynamik der Kraftfahrzeuge. 3rd Edition. Springer, 2014. 4. Reimpell J., Stoll H., Betzler J. The Automotive Chassis: Engineering Principles 2nd Edition. Butterworth-Heinemann 2000.
Subject website	-
D. Student's contribution	
Number of ECTS points	3
Number of hours of student's work connected with achieving learning outcomes:	1) Number of contact hours - 31, including: a) lecture -15 hours; b) project -15 hours; c) consultations - 1 hours; 2) Student's own work – 19 hours, including: a) 10 hours – ongoing preparation for lectures (literature analysis), b) 9 hours - preparing for the colloquium and for carrying out the project. c) 15 h – preparing project, 3) OVERALL – 75 hours.
Number of ECTS points for classes requiring direct participation of members of academic staff:	1.2 ECTS point – number of contact hours - 31, including: a) lecture -18 hours; b) project - 12 hours; c) consultations - 1 hours;
Number of ECTS points obtained by a student within practical	1.8 ECTS point - 19 hours of student work, including: a) project implementation within contact hours - 10 hours; b) preparation of a report on the completed project - 24 hours.
E. Additional information	
Comments	-
Update date	3.10.2022 r.

Description of a subject	
Subject code	
Subject	**WEB DATABASES**
Subject version	2022/23
A. Placing the subject within the study system	
Level of study	II degree
Form of study	Full-time study
Field of study	Mechanical Engineering
Profile of study	General academic
Degree program	Advanced Machinery and Vehicles Engineering
Supervising unit	Faculty of Automotive and Construction Machinery Engineering

Performing unit	Faculty of Automotive and Construction Machinery Engineering
Subject coordinator	
B. General characteristics of the subject	
Subject kind	Specialised
Subject level	Intermediate
Subject group	Elective B
Language of instruction	English
Nominal semester	2
Course delivery in the academic year	Summer
Pre-requisites	Fundamentals of database language, web database programming.
Limit of number of students	30
C. Learning outcomes and the manner of conducting classes	
Aim of the subject	Fundamentals of Web databases systems, commands, software used in every day work.

Subject outcomes

Code	*Description of the outcomes*	*Reference to learning outcomes in the learning area*	*Learning outcomes for field of study*
Knowledge			
W01	Has basic knowledge about web databases systems.	I.P7S_WG.o	K_W01
W02	Has knowledge of Web databases systems.	I.P7S_WG.o	K_W11
W03	Has knowledge about Databases scripts, commands	I.P7S_WG.o	K_W01
Skills			
U01	Is prepared to obtain information from literature and other properly chosen sources within the scope of the subject; can integrate the obtained information, interpret it and draw conclusions and formulate and justify opinions within the scope of the application of web databases.	I.P7S_UW.o	K_U15
U02	Knows how to make a written and oral presentation within the scope of Web databases systems	I.P7S_UW.o	K_U15
U03	Knows how to obtain knowledge on their own, within the scope of issues related to databases systems and can establish directions for self-study.	I.P7S_UW.o	K_U15

Description of a subject	
Subject code	
Subject	**CONTROL OF DRIVE SYSTEMS**
Subject version	2022/23
A. Placing the subject within the study system	
Level of study	II degree
Form of study	Full-time study
Field of study	Mechanical Engineering
Profile of study	General academic
Degree program	Advanced Machinery and Vehicles Engineering
Supervising unit	Faculty of Automotive and Construction Machinery Engineering
Performing unit	Faculty of Automotive and Construction Machinery Engineering
Subject coordinator	
B. General characteristics of the subject	
Subject kind	Specialised
Subject level	Intermediate

Subject group	Elective B
Language of instruction	English
Nominal semester	3
Course delivery in the academic year	Winter
Pre-requisites	-
Limit of number of students	30

C. Learning outcomes and the manner of conducting classes

Aim of the subject	The course aims to familiarize students with the control of drive systems, requirements for drive systems, construction and analysis of drive systems, automation of drive systems. Learning to obtain information from literature and other properly chosen sources within the scope of the subject; can integrate the obtained information, interpret it and draw conclusions, formulate and justify opinions within the scope of the control of drive systems.

Subject outcomes

Code	*Description of the outcomes*	*Reference to learning outcomes in the learning area*	*Learning outcomes for field of study*
Knowledge			
W01	Has knowledge in the field of the control of drive systems.	I.P7S_WG.o	K_W01
W02	Has detailed knowledge of the control of drive systems.	I.P7S_WG.o	K_W11
W03	Has knowledge within the scope of the control of drive systems.	I.P7S_WG.o	K_W01
Skills			
U01	Is prepared to obtain information from literature and other properly chosen sources within the scope of the subject; can integrate the obtained information, interpret it and draw conclusions and formulate and justify opinions within the scope of the use of the control of drive systems.	I.P7S_UW.o	K_U15
U02	Knows how to make a written and oral presentation within the scope of the use of the control of drive systems.	I.P7S_UW.o	K_U15
U03	Knows how to obtain knowledge on their own, within the scope of issues related to the use of the control of drive systems and can establish directions for self-study.	I.P7S_UW.o	K_U15
Social Competences			
K01	Understands the need to critically analyze of a content and appreciation of knowledge while solving engineering problems within the field of the control of drive systems, and the importance of a proper attitude while formulating and covering to a society in a commonly understandable manner information and opinions relating to achievements in the field of the control of drive systems, as well as other aspects of a mechanical engineer's activity.	I.P7S_KO I.P7S_KR	K_K01
K02	Can think and act in an entrepreneurial manner.	I.P7S_KO I.P7S_KR	K_K01

Form of classes and their duration	Lecture	Exercises	Laboratory	Project	Computer classes
Timetables	1	0	0	1	0
Throughout the semester	15	0	0	15	0

Learning content	1. Organizational matters. Introduction to issues connected with the control of drive systems. 2. Basic concepts in drive systems. 3. Requirements for drive systems. 4. Construction and analysis of drive systems. 5. Problems of drive systems design. 6. Automation of drive systems. 7. Modulation of orders. 8. Program modulator.

	9. Program implementation of a system. 10. Computer tasks and processor cards. 11. Simulation of drive systems. 12. Test. Student presentations.
Learning methods	lecture presentation preparing a project
Methods of examination of learning outcomes	
Code	***Evaluation methods***
Knowledge	
W01	Written test. Presentation, discussion
W02	Written test. Presentation, discussion
W03	Written test. Presentation, discussion
Skills	
U01	Written test. Presentation, discussion. Evaluation a project
U02	Written test. Presentation, discussion. Evaluation a project
U03	Written test. Presentation, discussion. Evaluation a project
Social Competences	
K01	Written test. Presentation, discussion. Evaluation a project
K02	Written test. Presentation, discussion. Evaluation a project
Evaluation methods	Evaluation of the test and project.
Exam	No
References	1.S.K Sul, Control of Electric Machine Drive Systems, Wiley – IEEE Press, 2011. 2.W. Leonard, Control of electrical drives, Springer Verlag, 3rd ed., 2001. 3.M. Tondos, W. Mysinski, Microcomputer-based control system for drives with resilient couplings, Proc. of EPE'01, Graz, Austria, CD, 2001. 4.G. F. Franklin, J. D. Powell, Feedback Control of Dynamic Systems, 4-th edition, Prentice Hall, 2002. 5.K. T. Chau, Z. Wang, Chaos in electric drive systems: Analysis, Control and Application, Wiley-IEEE Press, 2011.
Subject website	–
D. Student's contribution	
Number of ECTS points	3
Number of hours of student's work connected with achieving learning outcomes:	1) Number of contact hours - 30, including: a) lecture - 15 h; b) project – 15 h; 2) Student's own work: a) 15 h – literature studies; b) 15 h – preparing for test from lectures/presentations; c) 15 h – preparing project, 3) TOTAL – 75 h
Number of ECTS points for classes requiring direct participation of members of academic staff:	1 ECTS point – number of contact hours - 30, including: a) lecture – 15 h; b) project – 15 h;
Number of ECTS points obtained by a student within practical	2 ECTS point - 45 h, including: 1) 15 h – preparing a project of the control of a drive system; 2) 15 h – preparing for a test/presentation; 3) 15 h – preparing project,
E. Additional information	
Comments	-
Update date	3.10.2022 r.

Description of a subject	
Subject code	
Subject	**FLUID FLOW COMPUTER MODELLING II**
Subject version	2022/23
A. Placing the subject within the study system	
Level of study	II degree
Form of study	Full-time study
Field of study	Mechanical Engineering
Profile of study	General academic
Degree program	Advanced Machinery and Vehicles Engineering
Supervising unit	Faculty of Automotive and Construction Machinery Engineering
Performing unit	Faculty of Automotive and Construction Machinery Engineering
Subject coordinator	
B. General characteristics of the subject	
Subject kind	Specialised
Subject level	Advanced
Subject group	Elective B
Language of instruction	English
Nominal semester	3
Course delivery in the academic year	Winter
Pre-requisites	Fluid Mechanics, Thermodynamics, Hydraulic and Pneumatic Drives, Heat Transfer
Limit of number of students	30
C. Learning outcomes and the manner of conducting classes	
Aim of the subject	Acquiring advanced knowledge in the field of numerical modelling of fluid flow (Computational Fluid Dynamics) and the operation of the ANSYS Fluent program, including: creating a numerical mesh, setting the solver, assigning boundary conditions, learning methods for verifying the correctness of the solution, presentation of results.

Subject outcomes

Code	*Description of the outcomes*	*Reference to learning outcomes in the learning area*	*Learning outcomes for field of study*
Knowledge			
W01	Acquisition of knowledge in the field of computer modelling of fluid flow. Acquisition of knowledge in the field of comparative analysis of results obtained by various methods.	I.P7S_WG.o	K_W16
Skills			
U01	Preparation for performing an individual simulation analysis. Building numerical model, carrying out calculations, verifying the correctness of obtained results, interpreting results and draw conclusions.	I.P7S_UW.o III.P7S_UW.o	K_U08
U02	Acquisition of knowledge for performing an individual simulation for compressible gas flow, cavitation, moving valves and combustion.	I.P7S_UW.o III.P7S_UW.o	K_U09
U03	Acquisition of knowledge for presenting the obtained results in the form of technical report.	I.P7S_UW.o III.P7S_UW.o	K_U10
Social Competences			
K01	Understanding the use of modern computer methods and the possibility of using them in various branches of industry. The ability to transfer knowledge to the public.	I.P7S_KO I.P7S_KR	K_K01

Form of classes and their duration	Lecture	Exercises	Laboratory	Project	Computer classes
Timetables	1	0	0	1	0
Throughout the semester	15	0	0	15	0

Learning content	1. Organizational matters. Benefits and examples of advanced applications of the CFD numerical modelling in industry. 2. Derivation of the compressible Navier-Stokes equations. 3. Derivation of the compressible energy equations. 4. Presentation of the basic principles of creating a numerical mesh. 5. Overview of possible boundary conditions. 6. Overview of methods to validate the solution and present the results. 7. Simulation analysis of gas expansion in de Laval nozzle and comparison with analytical solution. 8. Aerodynamic simulation analysis of the object for supersonic velocity. Analysis of shock wave. 9. Simulation analysis of cavitation – learning two phase fluid flow technics. 10. Simulation analysis of gas flow in the mobile valve system. Learning dynamic mesh technics. 11. Simulation analysis of isobaric combustion.
Learning methods	lecture presentation preparing a project
Methods of examination of learning outcomes	
Code	***Evaluation methods***
Knowledge	
W01	Execution of two different simulation projects
Skills	
U01	Presentation, discussion, project
U02	Presentation, discussion, project
U03	Presentation, discussion, project
Social Competences	
K01	Presentation, discussion, project
Evaluation methods	Evaluation of the test and project.
Exam	No
References	1. ANSYS Fluent - User's Guide 2. Blazek J. Computational Fluid Dynamics: Principles and Applications. Elsevier, 2001
Subject website	–
D. Student's contribution	
Number of ECTS points	3
Number of hours of student's work connected with achieving learning outcomes:	1) Number of contact hours - 30 hours (15 h of lecture and 15 of practicals). 2) Student's own work – 30 hours, including: a) literature study: 15 hours. b) Work on preparing the project: 15 hours. c) project – 15 h; 3) TOTAL – 75 hours.
Number of ECTS points for classes requiring direct participation of members of academic staff:	1 ECTS points – number of contact hours - 30 hours (15 h of lecture and 15 of practicals).
Number of ECTS points obtained by a student within practical	2 ECTS points - 45 hours of student's work, including: a) work on preparing the project – 15 hours; b) literature study: 15 hours c) 15 h – preparing a project,
E. Additional information	
Comments	-
Update date	3.10.2022 r.

Description of a subject					
Subject code					
Subject	**APPLIED GAS DYNAMICS AND TURBOCHARGING SYSTEMS FOR INTERNAL COMBUSTION ENGINES**				
Subject version	2022/23				
A. Placing the subject within the study system					
Level of study	II degree				
Form of study	Full-time study				
Field of study	Mechanical Engineering				
Profile of study	General academic				
Degree program	Advanced Machinery and Vehicles Engineering				
Supervising unit	Faculty of Automotive and Construction Machinery Engineering				
Performing unit	Faculty of Automotive and Construction Machinery Engineering				
Subject coordinator					
B. General characteristics of the subject					
Subject kind	Specialised				
Subject level	Intermediate				
Subject group	Elective B				
Language of instruction	English				
Nominal semester	3				
Course delivery in the academic year	Winter				
Pre-requisites	Basic knowledge of thermodynamics, fluid mechanics and internal combustion engines theory (at a bachelor's level)				
Limit of number of students	30				
C. Learning outcomes and the manner of conducting classes					
Aim of the subject	Studying the theory of turbocharging including fundamentals of gas dynamic processes that are taking place in the turbocharging systems of internal combustion engines. Transformation of the theoretical knowledge into relevant practical cases.				
Subject outcomes					

Code	***Description of the outcomes***	***Reference to learning outcomes in the learning area***	***Learning outcomes for field of study***
Knowledge			
W01	Student who has passed the subject knows the fundamental laws of Gas Dynamics governing one-dimensional gas flow.	I.P7S_WG.o	K_W03
W02	Has knowledge of fundamental gas dynamic processes that are taking place in the compressor and turbine stage of turbocharging systems used in internal combustion engines. Has an applied knowledge in the field of simulations and testing of turbocharging systems.	I.P7S_WG.o	K_W03 K_W05 K_W12
Skills			
U01	Able to calculate basic parameters which reflect performance of turbine, compressor, turbocharger and intercooler.	I.P7S_UW.o III.P7S_UW.o	K_U01
U02	Is able to conduct CFD analysis and estimate gas dynamic performance of the main components used in the turbocharging systems of internal combustion engines.	I.P7S_UW.o III.P7S_UW.o	K_U08
Social Competences			
K01	Has a critical approach in analysis of obtained CFD simulations results. Ability to deliver recommendations in design improvements based on the knowledge related to technical problems solving in machines and vehicles engineering.	I.P7S_KO I.P7S_KR	K_K01

Form of classes and their duration	Lecture	Exercises	Laboratory	Project	Computer classes
Timetables	1	0	0	1	0
Throughout the semester	15	0	0	15	0

Learning content	Lectures: • Fundamentals of Gas Dynamics • Fundamentals of turbocharging systems for ICE • Turbocharging systems for ICE: current solutions and future trends • CFD as an engineering tool for design and analysis of turbocharging systems Projects of 3D Flow simulations: • Flow analysis in the nozzles and diffusors • Pressure drop losses calculations • Intercooler efficiency calculations based on CFD analysis • Flow analysis in the blade channel of the rotating impeller • 3D simulations of the flow in the turbocharger's volutes
Learning methods	preparing a project Project: Gas Dynamics System.

Methods of examination of learning outcomes	
Code	***Evaluation methods***
Knowledge	
W01	Written test. Preparing a project
W02	Written test. Preparing a project
W03	Written test. Preparing a project
Skills	
U01	Written test. Preparing a project
U02	Written test. Preparing a project
U03	Written test. Preparing a project
Social Competences	
K01	Written test. Preparing a project
K02	Written test. Preparing a project

Evaluation methods	Written test. Preparing a project.
Exam	No
References	1.Fundamentals of Compressible Fluid Mechanics, Minneapolis, MN55414-2411, 2013, 400p. 2.Computational Fluid Dynamics Second Edition. T. J. CHUNG, Cambridge university press, 2010, 1034p. 3.Fluid Mechanics and Thermodynamics of Turbomachinery Seventh Edition. University of Cambridge. UK, 2014, 535p. 4.Michael J. Moran, Howard N. Shapiro. Fundamentals of engineering thermodynamics. John Wiley& Sons Ltd, England 2006 5.Heywood John B.: Internal combustion engine fundamentals, McGrew Hill 1998.
Subject website	–
D. Student's contribution	
Number of ECTS points	3
Number of hours of student's work connected with achieving learning outcomes:	1) Number of contact hours – 40 h, including: a) practicals – 30 h.; b) consultations – 10 2) Student's own work – 35 h, including: a) literature study – 10 h; b) student's preparation for tutorials – 10 h; c) preparation a project15 h; 3) TOTAL – 75 h
Number of ECTS points for classes requiring direct participation of members of academic staff:	1.5 ECTS points – number of contact hours – 40 hours, including: a) practicals – 30 hours; b) consultations – 10 hour
Number of ECTS points obtained by a student within practical	1.5 ECTS points – 35 h, including: a) student's preparation for tutorials – 10 h b) preparation a project 15 h;
E. Additional information	
Comments	-

Update date	3.10.2022 r.

Description of a subject			
Subject code			
Subject	**BODYWORK DESIGN**		
Subject version	2022/23		
A. Placing the subject within the study system			
Level of study	II degree		
Form of study	Full-time study		
Field of study	Mechanical Engineering		
Profile of study	General academic		
Degree program	Advanced Machinery and Vehicles Engineering		
Supervising unit	Faculty of Automotive and Construction Machinery Engineering		
Performing unit	Faculty of Automotive and Construction Machinery Engineering		
Subject coordinator			
B. General characteristics of the subject			
Subject kind	Specialised		
Subject level	Intermediate		
Subject group	Elective B		
Language of instruction	English		
Nominal semester	3		
Course delivery in the academic year	Winter		
Pre-requisites	Construction Materials, Material Strength, Basics of Machine Construction, Manufacturing Techniques		
Limit of number of students	30		
C. Learning outcomes and the manner of conducting classes			
Aim of the subject	Learning about support structures of vehicle bodywork. Theoretical basics concerning design of machines and vehicles, as well as construction materials will enable to understand the operation of support structures of vehicles. Learning to obtain information from literature and other properly chosen sources within the scope of the subject; can integrate the obtained information, interpret it and draw conclusions and formulate and justify opinions within the scope of the design of vehicle bodywork support structures.		
Subject outcomes			
Code	***Description of the outcomes***	***Reference to learning outcomes in the learning area***	***Learning outcomes for field of study***
Knowledge			
W01	Knows how to design support structure of a vehicle	I.P7S_WG.o	K_W01
W02	Has detailed knowledge in the field of design of support structures of vehicle bodywork.	I.P7S_WG.o	K_W01
W03	Knows how to design support structures of vehicle bodywork.	I.P7S_WG.o	K_W01
Skills			
U01	Is prepared to obtain information from literature and other properly chosen sources within the scope of the subject; can integrate the obtained information, interpret it and draw conclusions and formulate and justify opinions within the scope of the design of vehicle bodywork support structures.	I.P7S_UW.o	K_U15
U02	Knows how to make a written and oral presentation of a prepared solution to a support structure of a vehicle bodywork.	I.P7S_UW.o	K_U15

U03	Knows how to individually obtain knowledge within the scope of issues pertaining to the design of support structures and can establish direction for self-study	I.P7S_UW.o	K_U15
Social Competences			
K01	Understands the influence of application of different solutions while designing bodywork and of application of materials on vehicle technical properties and knows how to convey this information to society	I.P7S_KO I.P7S_KR	K_K01
K02	Can think and act in an entrepreneurial manner	I.P7S_KO I.P7S_KR	K_K01

Form of classes and their duration	Lecture	Exercises	Laboratory	Project	Computer classes
Timetables	1	0	0	1	0
Throughout the semester	15	0	0	15	0

Learning content	1. Organizational matters. Benefits and examples of advanced applications of the CFD numerical modelling in industry. 2. Derivation of the compressible Navier-Stokes equations. 3. Derivation of the compressible energy equations. 4. Presentation of the basic principles of creating a numerical mesh. 5. Overview of possible boundary conditions. 6. Overview of methods to validate the solution and present the results. 7. Simulation analysis of gas expansion in de Laval nozzle and comparison with analytical solution. 8. Aerodynamic simulation analysis of the object for supersonic velocity. Analysis of shock wave. 9. Simulation analysis of cavitation – learning two phase fluid flow technics. 10. Simulation analysis of gas flow in the mobile valve system. Learning dynamic mesh technics. 11. Simulation analysis of isobaric combustion.
Learning methods	preparing a project lecture presentation

Methods of examination of learning outcomes	
Code	***Evaluation methods***
Knowledge	
W01	Written test. Presentation, discussion.
W02	Written test. Presentation, discussion.
W03	Written test. Presentation, discussion.
Skills	
U01	Written test. Presentation, discussion. Evaluation a project
U02	Written test. Presentation, discussion. Evaluation a project
U03	Written test. Presentation, discussion.
Social Competences	
K01	Written test. Presentation, discussion. Evaluation a project
K02	Written test. Presentation, discussion.

Evaluation methods	Evaluation of the test and project.
Exam	No
References	1. CATIA V5R20 for Designers Paperback – 1 January 2010 by Prof. Sham Purdue Tickoo Univ.
Subject website	–
D. Student's contribution	
Number of ECTS points	3
Number of hours of student's work connected with achieving learning outcomes:	1) Number of contact hours - 30, including: a) lecture - 15 h.; b) project – 15 h; 2) Student's own work: a) 15 h – literature studies, b) 15 h – preparing for test from lectures/presentations, c) 15 h – preparing project, 3) TOTAL – 75 h
Number of ECTS points	1 ECTS point – number of contact hours - 30, including:

for classes requiring direct participation of members of academic staff:	a) lecture - 15 h; b) project – 15 h;
Number of ECTS points obtained by a student within practical	2 ECTS point - 45 h, including: 1) 15 h – preparing a project of a controlled suspension system, 2) 15 h – preparing for a test/presentation 3) 15 h – preparing project,
E. Additional information	
Comments	-
Update date	3.10.2022 r.

Description of a subject			
Subject code			
Subject	**KNOWLEGDE BASED SYSTEMS IN ENGINEERING DESIGN**		
Subject version	2022/23		
A. Placing the subject within the study system			
Level of study	II degree		
Form of study	Full-time study		
Field of study	Mechanical Engineering		
Profile of study	General academic		
Degree program	Advanced Machinery and Vehicles Engineering		
Supervising unit	Faculty of Automotive and Construction Machinery Engineering		
Performing unit	Faculty of Automotive and Construction Machinery Engineering		
Subject coordinator			
B. General characteristics of the subject			
Subject kind	Specialised		
Subject level	Advanced		
Subject group	Elective A		
Language of instruction	English		
Nominal semester	4		
Course delivery in the academic year	Summer		
Pre-requisites	Design Theory		
Limit of number of students	30		
C. Learning outcomes and the manner of conducting classes			
Aim of the subject	Obtaining basic knowledge on expert systems application in engineering design, Knowledge Based Engineering and Knowledge Management methods and tools.		
Subject outcomes			
Code	***Description of the outcomes***	***Reference to learning outcomes in the learning area***	***Learning outcomes for field of study***
Knowledge			
W01	Has knowledge in the field of the engineering knowledge modeling.	I.P7S_WG.o	K_W01
W02	Has detailed knowledge of the engineering knowledge modeling.	I.P7S_WG.o	K_W11
W03	Has knowledge within the scope of methods and tools in engineering knowledge modeling.	I.P7S_WG.o	K_W01
Skills			
U01	Is prepared to obtain information from literature and other properly chosen sources within the scope of the subject; can integrate the obtained information, interpret it and draw conclusions and formulate	I.P7S_UW.o	K_U15

	and justify opinions within the scope of the application of engineering knowledge modelling.		
U02	Knows how to make a written and oral presentation within the scope of application of engineering knowledge modeling, structuring and sharing.	I.P7S_UW.o	K_U15
U03	Knows how to obtain knowledge on their own, within the scope of issues related to application of engineering knowledge modeling and can establish directions for self-study.	I.P7S_UW.o	K_U15
Social Competences			
K01	Understands the influence of application of engineering knowledge modeling and knows how to convey this information to society.	I.P7S_KO I.P7S_KR	K_K01
K02	Can think and act in an entrepreneurial manner.		

Form of classes and their duration	Lecture	Exercises	Laboratory	Project	Computer classes
Timetables	2	0	0	0	0
Throughout the semester	30	0	0	0	0

Learning content	1. Expert systems in mechanical engineering. 2. Knowledge representations in expert systems. 3. Knowledge Based Engineering- methods and tools. 4. Knowledge Based Engineering – examples of application. 5. Knowledge Management Systems. 6. Knowledge Management Systems – examples of application. 7. Repositories of engineering design knowledge. 8. Functional modeling of product. 9. Case Based Reasoning in engineering design. 10. Blackboard architecture in mechanical engineering. 11. Intelligent Personal Assistant systems in engineering design. 12. Design product/process models.
Learning methods	lecture presentation

Methods of examination of learning outcomes	
Code	***Evaluation methods***
Knowledge	
W01	Written test. Presentation, discussion
W02	Written test.
W03	Written test.
Skills	
U01	Written test.
U02	Written test.
U03	Written test.
Social Competences	
K01	Written test.
K02	Discussing

Evaluation methods	Written test. Presentation, discussion
Exam	No
References	Materials in English (for each lecture, based on different knowledge sources)
Subject website	–

D. Student's contribution	
Number of ECTS points	2
Number of hours of student's work connected with achieving learning outcomes:	1) Number of contact hours - 30, including: a) lecture - 30 h.; 2) Student's own work: a) 15 h – literature studies, b) 15 h – preparing for tests from lectures/presentations, 3) TOTAL – 60 h
Number of ECTS points for classes requiring direct participation of members of academic	1 ECTS point – number of contact hours - 30, including: a) lecture - 30 h;

staff:	
Number of ECTS points obtained by a student within practical	1 ECTS point - 30 h, including: 1) 15 h – preparing a project of a specific method application, 2) 15 h – preparing for tests
E. Additional information	
Comments	-
Update date	3.10.2022 r.

Description of a subject			
Subject code			
Subject	**MODELING OF MACHINE ELEMENTS BY USING ORIGINAL PROGRAMS IN FEM**		
Subject version	2022/23		
A. Placing the subject within the study system			
Level of study	II degree		
Form of study	Full-time study		
Field of study	Mechanical Engineering		
Profile of study	General academic		
Degree program	Advanced Machinery and Vehicles Engineering		
Supervising unit	Faculty of Automotive and Construction Machinery Engineering		
Performing unit	Faculty of Automotive and Construction Machinery Engineering		
Subject coordinator			
B. General characteristics of the subject			
Subject kind	Specialised		
Subject level	Advanced		
Subject group	Elective B		
Language of instruction	English		
Nominal semester	4		
Course delivery in the academic year	Summer		
Pre-requisites	Finite Element Methods, Mechanics, Theory of Vibrations		
Limit of number of students	30		
C. Learning outcomes and the manner of conducting classes			
Aim of the subject	Learning how to built original computer programs for stress and flexibility calulation of machine elements by using finite element method. Help to develop small Matlab mechanical models for use in mechanical and servo-mechanical systems. Learning to obtain information from literature and other properly chosen sources within the scope of the subject; can integrate the obtained information, interpret it and draw conclusions, formulate and justify opinions within the scope of the application of finite element technique in machine design.		
Subject outcomes			
Code	***Description of the outcomes***	***Reference to learning outcomes in the learning area***	***Learning outcomes for field of study***
Knowledge			
W01	Has well-ordered and theoretically-based knowledge in the field of materials mechanics, indispensable to perform strength analysis of construction elements, including the use of computer systems.	I.P7S_WG.o	K_W01
W02	Has in-depth knowledge in the field of computer modeling of machine and vehicle design issues.	I.P7S_WG.o	K_W11
W03	Knows and understands basic methods applied in modeling of technical systems.	I.P7S_WG.o	K_W01
Skills			
U01	Knows how to use learnt mathematical and physical methods and models to support implementation of engineering processes, by means of	I.P7S_UW.o	K_U15

	assessments and critical analysis.		
U02	Knows how to successfully perform modelling and synthesizing process of advanced mechanical systems, and to critically assess the obtained solutions.	I.P7S_UW.o	K_U15
U03	Can practically implement knowledge in the field of computer, advanced modelling in order to analyze and technically simulate issues of machine and vehicle construction.	I.P7S_UW.o	K_U15
Social Competences			
K01	Understands the need to critically analyze of a content and appreciation of knowledge while solving engineering problems within the field of machine and vehicle construction, and the importance of a proper attitude while formulating and conveying to a society in a commonly understandable manner information and opinions relating to achievements in the field of machine and vehicle construction, as well as other aspects of a mechanical engineer's activity responsibility and a proper attitude towards observing ethics and safety procedures related to a particular job.	I.P7S_KO I.P7S_KR	K_K01

Form of classes and their duration	Lecture	Exercises	Laboratory	Project	Computer classes
Timetables	1	0	0	1	0
Throughout the semester	15	0	0	15	0

Learning content	1. Deriving matrix equations of motion. Formulate computer programs in Matlab code. 2. Finite element analysis used in description of rigid mechanism motion. Comparison with classical methods of theory of mechanisms. 3. Finite element modeling of shaft joints, clamped masses, continuous loading. 4. Writing a computer program for transient elements by using Timoshenko beam and CST elements - example of main connection rod of a star engine. 5. Stress and strain calculations of Belleville disc springs. 6. Example of vibration analysis of beams – discussion on structural damping.
Learning methods	lecture presentation Project: preparing a short computer program for calculations of machine elements based on FEM.

Methods of examination of learning outcomes	
Code	***Evaluation methods***
Knowledge	
W01	Written test. Preparing a computer program
W02	Written test. Preparing a computer program
W03	Written test. Preparing a computer program
Skills	
U01	Written test. Preparing a computer program
U02	Written test. Preparing a computer program
U03	Written test. Preparing a computer program
Social Competences	
K01	Written test. Preparing a computer program
K02	Written test. Preparing a computer program

Evaluation methods	Written test. Preparing a computer program
Exam	No
References	1. Bathe K.J., Finite element procedures in engineering analysis, Prentice Hall, New Jersey 1982. 2. Hatch M.R., Vibration simulation using Matlab and Ansys, Chapman&Hall/Crc, Boca Raton 2001.
Subject website	–
D. Student's contribution	
Number of ECTS points	3
Number of hours of student's work connected with	1) Number of contact hours – 40 h, including: a) practicals – 30 h.; b) consultations – 10 2) Student's own work – 35 h, including:

achieving learning outcomes:	a) literature study – 10 h; b) student's preparation for tutorials – 10 h; c) preparation a project15 h; 3) TOTAL – 75 h
Number of ECTS points for classes requiring direct participation of members of academic staff:	1.5 ECTS points – number of contact hours – 40 hours, including: a) practicals – 30 hours; b) consultations – 10 hour
Number of ECTS points obtained by a student within practical	1.5 ECTS points – 35 h, including: a) student's preparation for tutorials – 10 h b) preparation a project 15 h;
E. Additional information	
Comments	-
Update date	3.10.2022 r.

Social Competences			
K01	Understands the influence of application in web databases systems and knows how to convey this information to society.	I.P7S_KO I.P7S_KR	K_K01
K02	Can think and act in an entrepreneurial manner.	I.P7S_KO I.P7S_KR	K_K01

Form of classes and their duration	Lecture	Exercises	Laboratory	Project	Computer classes
Timetables	1	0	0	1	0
Throughout the semester	15	0	0	15	0

Learning content	1. Overview of the databases systems 2. PHPMyAdmin 3. Creating database structures 4. Operations in database 5. Creating views in database 6. Triggers in database
Learning methods	lecture presentation project: preparing a computer program (web database).

Methods of examination of learning outcomes	
Code	***Evaluation methods***
Knowledge	
W01	Written test. Preparing a computer program
W02	Written test. Preparing a computer program
W03	Written test. Preparing a computer program
Skills	
U01	Written test. Preparing a computer program
U02	Written test. Preparing a computer program
U03	Written test. Preparing a computer program
Social Competences	
K01	Written test. Preparing a computer program
K02	Written test. Preparing a computer program

Evaluation methods	Written test. Preparing a computer program
Exam	No
References	Materials in English will be shared electronically.
Subject website	–
D. Student's contribution	
Number of ECTS points	3
Number of hours of student's work connected with	1) Number of contact hours – 40 h, including: a) practicals – 30 h.; b) consultations – 10

achieving learning outcomes:	2) Student's own work – 35 h, including: a) literature study – 10 h; b) student's preparation for tutorials – 10 h; c) preparation a project15 h; 3) TOTAL – 75 h
Number of ECTS points for classes requiring direct participation of members of academic staff:	1.5 ECTS points – number of contact hours – 40 hours, including: a) practicals – 30 hours; b) consultations – 10 hour
Number of ECTS points obtained by a student within practical	1.5 ECTS points – 35 h, including: a) student's preparation for tutorials – 10 h b) preparation a project 15 h;
E. Additional information	
Comments	-
Update date	3.10.2022 r.

Description of a subject			
Subject code			
Subject	**ART OF PRESENTATION**		
Subject version	2022/23		
A. Placing the subject within the study system			
Level of study	II degree		
Form of study	Full-time study		
Field of study	Mechanical Engineering		
Profile of study	General academic		
Degree program	Advanced Machinery and Vehicles Engineering		
Supervising unit	Faculty of Automotive and Construction Machinery Engineering		
Performing unit	Faculty of Automotive and Construction Machinery Engineering		
Subject coordinator			
B. General characteristics of the subject			
Subject kind	Basic		
Subject level	Basic		
Subject group	Elective HES 1		
Language of instruction	English		
Nominal semester	1		
Course delivery in the academic year	Winter		
Pre-requisites	Basic engineering knowledge		
Limit of number of students	30		
C. Learning outcomes and the manner of conducting classes			
Aim of the subject	The course aims to familiarize students with the art of presentation, the body language, the art of public speaking. Learning to obtain information from literature and other properly chosen sources within the scope of the subject; can integrate the obtained information, interpret it and draw conclusions, formulate and justify opinions within the scope of the art of presentation.		
Subject outcomes			
Code	***Description of the outcomes***	***Reference to learning outcomes in the learning area***	***Learning outcomes for field of study***
Knowledge			
W01	Has basic knowledge in the field of the art of presentation.	I.P7S_WG.o	K_W01

W02	Has detailed knowledge of the art of presentation.	I.P7S_WG.o	K_W11
W03	Has knowledge within the scope of the art of presentation.	I.P7S_WG.o	K_W01
Skills			
U01	Is prepared to obtain information from literature and other properly chosen sources within the scope of the subject; can integrate the obtained information, interpret it and draw conclusions and formulate and justify opinions within the scope of the art of presentation.	I.P7S_UW.o	K_U15
U02	Knows how to make a written and oral presentation within the scope of the art of presentation.	I.P7S_UW.o	K_U15
U03	Knows how to obtain knowledge on their own, within the scope of issues related to the art of presentation.	I.P7S_UW.o	K_U15
Social Competences			
K01	Understands the need to formulate and communicate in a commonly understandable way the information and opinions on the achievements in the art of presentation.	I.P7S_KO I.P7S_KR	K_K01
K02	Can think and act in an entrepreneurial manner.	I.P7S_KO I.P7S_KR	K_K01

Form of classes and their duration	Lecture	Exercises	Laboratory	Project	Computer classes
Timetables	2	0	0	0	0
Throughout the semester	30	0	0	0	0

Learning content	1. Organizational matters. Introduction to issues connected with the art of presentation. 2. Art of public speaking. 3. Assertiveness. 4. Decision-making. 5. Time management. 6. Shyness. 7. Techniques of exerting impact, how to effectively achieve goals. 8. Body language. 9. Test. Student presentations.
Learning methods	lecture presentation Presentation a project of the art of presentation.

Methods of examination of learning outcomes	
Code	***Evaluation methods***
Knowledge	
W01	Written test. Presentation, discussion
W01	Written test. Presentation, discussion
W01	Written test. Presentation, discussion
Skills	
U01	Written test. Presentation, discussion. Evaluation a project
U02	Written test. Presentation, discussion. Evaluation a project
U03	Written test. Presentation, discussion.
Social Competences	
K01	Written test. Presentation, discussion. Evaluation a project
K02	Presentation, discussion. Evaluation a project

Evaluation methods	Written test. Presentation, discussion. Evaluation a project
Exam	No
References	1.J. Stovall, R. H. Hull, The Art of Presentation: Your Competitive Edge, Publisher: Sound Wisdom, 2017. 2.R. Hall, Brilliant Presentation 3e: What the best presenters know, do and say, Publisher: Pearson Education Limited, 2012. 3.J. van Emden, L. Becker, Presentation Skills for Students, Publisher: Macmillan Education UK, 2016. 4.G. Reynolds, Presentation Zen: Simple Ideas on Presentation Design and Delivery, Publisher: Pearson Education US, 2011. 5.N. Duarte, The Art and Science of Creating Great Presentations, Publisher: O'Reilly Media,

	2008.
Subject website	–
D. Student's contribution	
Number of ECTS points	2
Number of hours of student's work connected with achieving learning outcomes:	1) Number of contact hours - 30, including: a) lecture - 30 h; 2) Student's own work: a) 15 h – literature studies; b) 15 h – preparing for test from lectures/presentations; 3) TOTAL – 60 h
Number of ECTS points for classes requiring direct participation of members of academic staff:	1 ECTS point – number of contact hours - 30, including: a) lecture - 30 h;
Number of ECTS points obtained by a student within practical	1 ECTS point - 30 h, including: 1) 15 h – preparing a project of the art of presentation ; 2) 15 h – preparing for a test/presentation;
E. Additional information	
Comments	-
Update date	3.10.2022 r.

Description of a subject			
Subject code			
Subject	**BUSINESS ETHICS**		
Subject version	2022/23		
A. Placing the subject within the study system			
Level of study	II degree		
Form of study	Full-time study		
Field of study	Mechanical Engineering		
Profile of study	General academic		
Degree program	Advanced Machinery and Vehicles Engineering		
Supervising unit	Faculty of Automotive and Construction Machinery Engineering		
Performing unit	Faculty of Automotive and Construction Machinery Engineering		
Subject coordinator			
B. General characteristics of the subject			
Subject kind	Basic		
Subject level	Basic		
Subject group	Elective HES 1		
Language of instruction	English		
Nominal semester	1		
Course delivery in the academic year	Winter		
Pre-requisites	Basic engineering knowledge		
Limit of number of students	30		
C. Learning outcomes and the manner of conducting classes			
Aim of the subject	The course aims to familiarize students with business ethics and its issues, ethical standards of a good manager, ethical dilemmas, conflict of values, decision-making, processes in business and management. Learning to obtain information from literature and other properly chosen sources within the scope of the subject; can integrate the obtained information, interpret it and draw conclusions, formulate and justify opinions within the scope of business ethics.		
Subject outcomes			
Code	***Description of the outcomes***	***Reference to***	***Learning***

		learning outcomes in the learning area	*outcomes for field of study*
Knowledge			
W01	Has basic knowledge in the field of business ethics.	I.P7S_WG.o	K_W01
W02	Has detailed knowledge of business ethics.	I.P7S_WG.o	K_W11
W03	Has knowledge within the scope of business ethics.	I.P7S_WG.o	K_W01
Skills			
U01	Is prepared to obtain information from literature and other properly chosen sources within the scope of the subject; can integrate the obtained information, interpret it and draw conclusions and formulate and justify opinions within the scope of business ethics.	I.P7S_UW.o	K_U15
U02	Knows how to make a written and oral presentation within the scope of business ethics.	I.P7S_UW.o	K_U15
U03	Knows how to obtain knowledge on their own, within the scope of issues related to business ethics and can establish directions for self-study.	I.P7S_UW.o	K_U15
Social Competences			
K01	Understands the need to formulate and communicate in a commonly understandable way the information and opinions on the achievements in business ethics.	I.P7S_KO I.P7S_KR	K_K01
K02	Can think and act in an entrepreneurial manner.	I.P7S_KO I.P7S_KR	K_K01

Form of classes and their duration	Lecture	Exercises	Laboratory	Project	Computer classes
Timetables	2	0	0	0	0
Throughout the semester	30	0	0	0	0

Learning content	1. Organizational matters. Introduction to issues connected with business ethics. 2. Purpose and scope of ethics. 3. Business ethics and its issues. 4. Ethical dilemmas, conflict of values, decision-making processes in business and management. 5. Ethical standards of a good manager. 6. Corporate social responsibility – idea and implementation. 7. Work ethics – rights and duties of employees. 8. Tools for shaping ethical attitudes in organizations. 9. Moral and legal aspects of the obligation to keep a secret. 10. Test. Student presentations.
Learning methods	lecture presentation presentation : preparing a project of business ethics.

Methods of examination of learning outcomes	
Code	***Evaluation methods***
Knowledge	
W01	Written test. Presentation, discussion
W01	Written test. Presentation, discussion
W01	Written test. Presentation, discussion
Skills	
U01	Written test. Presentation, discussion. Evaluation a project
U02	Written test. Presentation, discussion. Evaluation a project
U03	Written test. Presentation, discussion.
Social Competences	
K01	Written test. Presentation, discussion. Evaluation a project
K02	Presentation, discussion. Evaluation a project

Evaluation methods	Written test. Presentation, discussion. Evaluation a project
Exam	No
References	1.William H. Shaw, Vincent Barry, Moral Issues in Business, Cengage, 2014. 2.Andrew W. Ghillyer, Business Ethics Now, Publisher: McGraw-Hill/ Irwin, 2011.

	3.Anne T. Lawrence, Business and Society: Stakeholders, Ethics, Public Policy, Publisher: McGraw-Hill Education, 2016. 4.Craig E. Johnson, Meeting the Ethical Challenges of Leadership, Publisher: SAGE Publications, 2017. 5.O. C. Ferrell, J. Fraedrich, Business Erhics: Ethical Decision Making and Cases, Publisher: South Western, 2000. 6. http://www.bg.pw.edu.pl/index.php/en/resources/database-list,
Subject website	–
D. Student's contribution	
Number of ECTS points	2
Number of hours of student's work connected with achieving learning outcomes:	1) Number of contact hours - 30, including: a) lecture – 30 h; 2) Student's own work: a) 15 h – literature studies; b) 15 h – preparing for test from lectures/presentations; 3) TOTAL – 60 h
Number of ECTS points for classes requiring direct participation of members of academic staff:	1 ECTS point – number of contact hours - 30, including: a) lecture - 30 h.;
Number of ECTS points obtained by a student within practical	1 ECTS point - 30 h, including: 1) 15 h – preparing a project of business ethics; 2) 15 h – preparing for a test/presentation;
E. Additional information	
Comments	-
Update date	3.10.2022 r.

Description of a subject	
Subject code	
Subject	**PATENT LAW**
Subject version	2022/23
A. Placing the subject within the study system	
Level of study	II degree
Form of study	Full-time study
Field of study	Mechanical Engineering
Profile of study	General academic
Degree program	Advanced Machinery and Vehicles Engineering
Supervising unit	Faculty of Automotive and Construction Machinery Engineering
Performing unit	Faculty of Automotive and Construction Machinery Engineering
Subject coordinator	
B. General characteristics of the subject	
Subject kind	Basic
Subject level	Basic
Subject group	Elective HES 2
Language of instruction	English
Nominal semester	4
Course delivery in the academic year	Summer
Pre-requisites	-
Limit of number of students	30
C. Learning outcomes and the manner of conducting classes	

Aim of the subject	The course aims to familiarize students with patent law, patent office and transfer of rights to industrial property objects. Learning to obtain information from literature and other properly chosen sources within the scope of the subject; can integrate the obtained information, interpret it and draw conclusions, formulate and justify opinions within the scope of patent law. Learning about intellectual value in business.

Subject outcomes

Code	***Description of the outcomes***	***Reference to learning outcomes in the learning area***	***Learning outcomes for field of study***
Knowledge			
W01	Has basic knowledge in the field of patent law.	I.P7S_WG.o	K_W01
W02	Has detailed knowledge of patent law and impact on business.	I.P7S_WG.o	K_W11 K_W19
W03	Has knowledge within the scope of patent law	I.P7S_WG.o	K_W01
Skills			
U01	Is prepared to obtain information from literature and other properly chosen sources within the scope of the subject; can integrate the obtained information, interpret it and draw conclusions and formulate and justify opinions within the scope of patent law	I.P7S_UW.o	K_U15
U02	Knows how to make a written and oral presentation within the scope of patent law	I.P7S_UW.o	K_U15
U03	Knows how to obtain knowledge on their own, within the scope of issues related to patent law and can establish directions for self-study.	I.P7S_UW.o	K_U15
Social Competences			
K01	Understands the need to formulate and communicate in a commonly understandable way the information and opinions on the achievements in patent law	I.P7S_KO I.P7S_KR	K_K01
K02	Can think and act in an entrepreneurial manner.	I.P7S_KO I.P7S_KR	K_K01

Form of classes and their duration	Lecture	Exercises	Laboratory	Project	Computer classes
Timetables	2	0	0	0	0
Throughout the semester	30	0	0	0	0

Learning content	1. Organizational matters. Introduction to issues connected with patent law. 2. Patent office and patent attorneys. 3. Inventive projects and subjects of rights to these projects. 4. Types and content of rights to industrial property objects. 5. Proceedings before the Patent Office. 6. Transfer of rights and licensing of industrial property objects. 7. General rules for combating unfair competition. 8. Test. Student presentations.
Learning methods	lecture presentation

Methods of examination of learning outcomes

Code	***Evaluation methods***
Knowledge	
W01	Written test. Presentation, discussion
W02	Written test. Presentation, discussion
W03	Written test. Presentation, discussion
Skills	
U01	Written test. Presentation, discussion. Evaluation a project
U02	Written test. Presentation, discussion. Evaluation a project
U03	Written test. Presentation, discussion.
Social Competences	
K01	Written test. Presentation, discussion. Evaluation a project
K02	Presentation, discussion. Evaluation a project

Evaluation methods	M.Sc. thesis
Exam	No
References	1.Janice M. Mueller, An Introduction to Patent Law, Publisher: Aspen Publishers Inc., U.S., 2003. 2.Janice M. Mueller, Patent Law, Publisher: Aspen Publishers Inc., U.S., 2012. 3.Herbert F. Schwartz, Patent Law and Practice, Publisher: Bna Books, Subsequent edition, 2003. 4.Amy L. Landers, Understanding Patent Law, Publisher: LexisNexis, second edition, 2012. 5.Craig Allen Nard, The Law of Patents, Publisher: Aspen Publishers, 2008.
Subject website	–
D. Student's contribution	
Number of ECTS points	3
Number of hours of student's work connected with achieving learning outcomes:	1) Number of contact hours – 40 h, including: a) practicals – 30 h.; b) consultations – 10 2) Student's own work – 35 h, including: a) literature study – 10 h; b) student's preparation for tutorials – 10 h; c) preparation a project15 h; 3) TOTAL – 75 h
Number of ECTS points for classes requiring direct participation of members of academic staff:	1.5 ECTS points – number of contact hours – 40 hours, including: a) practicals – 30 hours; b) consultations – 10 hour
Number of ECTS points obtained by a student within practical	1.5 ECTS points – 35 h, including: a) student's preparation for tutorials – 10 h b) preparation a project 15 h;
E. Additional information	
Comments	-
Update date	3.10.2022 r.

Description of a subject	
Subject code	
Subject	**STRUCTURAL FUNDS**
Subject version	2022/23
A. Placing the subject within the study system	
Level of study	II degree
Form of study	Full-time study
Field of study	Mechanical Engineering
Profile of study	General academic
Degree program	Advanced Machinery and Vehicles Engineering
Supervising unit	Faculty of Automotive and Construction Machinery Engineering
Performing unit	Faculty of Automotive and Construction Machinery Engineering
Subject coordinator	
B. General characteristics of the subject	
Subject kind	Basic
Subject level	Basic
Subject group	Elective HES 2
Language of instruction	English
Nominal semester	4
Course delivery in the	Summer

academic year	
Pre-requisites	-
Limit of number of students	30

C. Learning outcomes and the manner of conducting classes

Aim of the subject	The course aims to familiarize students with the structural funds, operational programs in Poland, cohesion policy objectives. Learning to obtain information from literature and other properly chosen sources within the scope of the subject; can integrate the obtained information, interpret it and draw conclusions, formulate and justify opinions within the scope of structural funds.

Subject outcomes

Code	***Description of the outcomes***	***Reference to learning outcomes in the learning area***	***Learning outcomes for field of study***
Knowledge			
W01	Has basic knowledge in the field of structural funds.	I.P7S_WG.o	K_W01
W02	Has detailed knowledge of structural funds.	I.P7S_WG.o	K_W11 K_W19
W03	Has knowledge within the scope of structural funds.	I.P7S_WG.o	K_W01
Skills			
U01	Is prepared to obtain information from literature and other properly chosen sources within the scope of the subject; can integrate the obtained information, interpret it and draw conclusions and formulate and justify opinions within the scope of structural funds.	I.P7S_UW.o	K_U15
U02	Knows how to make a written and oral presentation within the scope of structural funds.	I.P7S_UW.o	K_U15
U03	Knows how to obtain knowledge on their own, within the scope of issues related to structural funds and can establish directions for self-study.	I.P7S_UW.o	K_U15
Social Competences			
K01	Understands the need to formulate and communicate in a commonly understandable way the information and opinions on the achievements in structural funds.	I.P7S_KO I.P7S_KR	K_K01
K02	Can think and act in an entrepreneurial manner.	I.P7S_KO I.P7S_KR	K_K01

Form of classes and their duration	Lecture	Exercises	Laboratory	Project	Computer classes
Timetables	2	0	0	0	0
Throughout the semester	30	0	0	0	0

Learning content	1. Organizational matters. Introduction to issues connected with structural funds. 2. Legal basis and genesis of cohesion policy. 3. Cohesion policy objectives. 4. Instruments for the implementation of cohesion policy. 5. Financing for individual purposes. 6. Operational programs in Poland. 7. Criteria for selecting projects for co-finansing. 8. Test. Student presentations.
Learning methods	lecture presentation

Methods of examination of learning outcomes

Code	***Evaluation methods***
Knowledge	
W01	Written test. Presentation, discussion
W02	Written test. Presentation, discussion
W03	Written test. Presentation, discussion
Skills	
U01	Written test. Presentation, discussion. Evaluation a project
U02	Written test. Presentation, discussion. Evaluation a project

U03	Written test. Presentation, discussion.
Social Competences	
K01	Written test. Presentation, discussion. Evaluation a project
K02	Presentation, discussion. Evaluation a project

Evaluation methods	Written test. Presentation, discussion
Exam	No
References	1.N. Christodoulakis, S. Kalyvitis, Structural Funds: Growth, Employment and the Environment, Publisher: Springer US, 2001. 2.P. Porretta, G. Pes, Microfinance, EU Structural Funds and Capacity Building for Managing Authorities, Publisher: Palgrave Macmillan UK, 2016. 3.A. Evans, The E.U. Structural Funds, Publisher: Oxford University Press, 1999. 4.J. Kostka, Financing Roma Inclusion with European Structural Funds, Publisher: Routledge, 2018. 5.E. Weiss, Innovativeness of industrial enterprises using European Union structural funds, Publisher: Vizja Press&IT, 2011.
Subject website	–
D. Student's contribution	
Number of ECTS points	3
Number of hours of student's work connected with achieving learning outcomes:	1) Number of contact hours – 40 h, including: a) practicals – 30 h.; b) consultations – 10 2) Student's own work – 35 h, including: a) literature study – 10 h; b) student's preparation for tutorials – 10 h; c) preparation a project15 h; 3) TOTAL – 75 h
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E. Additional information	
Comments	-
Update date	3.10.2022 r.