MARITIME UNIVERSITY OF SZCZECIN
FACULTY OF MARINE ENGINEERING

PLANS AND PROGRAMMES OF FIRST CYCLE FULL-TIME STUDIES

PART 1

FIELD OF STUDY - MECHANICAL ENGINEERING

SPECIALISATION - MARINE POWER PLANT OPERATION

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Date	Contents of change	Notes
17 September 2019	Updating the programmes for Physics; Technical chemistry; Chemistry of water, fuel and lubricant.	
18 June 2020	Changing the name of On-Board Training to Semestral Practical Training, Adding the possibility of distance learning, remote subject completion and conducting distance examination for all courses.	

1. GENERAL CHARACTERISTICS OF THE STUDIES

FACULTY:	Faculty of Marine Engineering
LEVEL OF EDUCATION (STUDIES):	1st cycle (engineering studies)
EDUCATION PROFILE:	practical
BRANCH OF SCIENCE:	engineering and technical sciences,
SCIENTIFIC DISCIPLINE:	mechanical engineering - 100%

PROFESSIONAL TITLE OBTAINED BY THE GRADUATE:	engineer
NUMBER OF ECTS CREDITS / NUMBER OF SEMESTERS:	full-time: 240 ECTS / number of sem. 8

2. GRADUATE QUALIFICATIONS

The profile of the graduate of Mechanical Engineering and Machine Design at the Faculty of Marine Engineering takes into account the requirements of, inter alia, the regulations on the qualifications of sea-crews, employers' requirements and factors characterizing the future working environment, requirements and changes that will occur in the period of at least forty years of professional activity of engineers. The ongoing changes in the socio-economic environment require the graduate to have knowledge and skills to quickly adapt to market expectations. This specifically applies to modern digital technologies or the use of modern tools supporting the work of an engineer.

The developed study programme enables the graduate to obtain the first degree qualifications in the area of Mechanical Engineering and Machine Design, in particular, preparation for the supervision and operation of machinery and technical devices typical for ship applications and preparation for safe work on a ship as a ship mechanic officer at the operational and management level, as well as safe maintenance of land-based technical equipment and systems.

A graduate of the first degree studies with a practical profile is prepared for the following:

- implementation of the manufacturing process, assembly, operation and recycling of machines and devices typical for ship applications,
- works supporting the design of simple engineering tasks, selection of engineering materials used as machine elements and supervision over their operation mainly in shipyards and production and repair plants,
- functioning in the structures of sustainable waste management,
- work in a team, technical services of classification societies, shipowners' technical inspection services, crew members of vessels as a ship engineer officer, technical inspection bodies,
- diagnostics of the technical condition of power machinery and equipment, industrial systems, cooling systems and recycling systems,
- organizing, managing and performing repairs of power equipment, industrial systems, cooling systems and recycling systems,
- coordination of works related to the course of the equipment operation process,
- operating marine power plants, confirmed by an assistant engineer officer diploma issued by a relevant maritime administration body,
- managing the servicing of a marine power plant after meeting additional requirements of the maritime administration.

A graduate acquires the first degree qualifications, receives the professional title of engineer and the right to obtain a ship mechanic diploma at the management level, on the basis of separate regulations.

3. LEARNING OUTCOMES

The learning outcomes take into account the universal characteristics of the first degree studies specified in the Act of 22 December 2015 on the Integrated Qualifications System, as well as the characteristics of the second degree of learning outcomes for qualifications at the PQ 6 level typical for qualifications obtained under the higher education system and post-graduate education, full qualification at level 4 and the characteristics of the second degree of learning outcomes for qualifications at level 6 of PQF that enable obtaining engineering competences.

3.1. Learning outcomes taking into account the universal characteristics of the first degree of the Integrated Qualifications System for qualifications at level 6 of the Polish Qualifications Framework

Table 1 presents the learning outcomes taking into account the universal characteristics of the first degree of the Integrated Qualifications System for qualifications at level 6 of the Polish Qualifications Framework

Table 1.Learning outcomes taking into account the universal characteristics of the first degree of the Integrated Qualifications System (IQS) for qualifications at level 6 of the Polish Qualifications Framework

UNIVERSAL CHARACTERISTICS OF IQS - LEVEL 6 OF THE POLISH QUALIFICATIONS FRAMEWORK					
KNOWLEDGE		SKILLS		SOCIAL COMPETENCES	
KNOWS AND UNDERSTANDS:		CAN:		IS READY FOR:	
P6U_W	- to an advanced degree - facts, theories, methods and complex relationships between them - various, complex conditions of the conducted activity	P6U_U	- perform tasks in an innovative way and solve complex and unusual problems in changing and not fully predictable conditions - independently plan their own learning throughout life - communicate with the environment, justify your position	P6U_K	- cultivating and popularizing patterns of proper conduct in the work environment and beyond it - independent decision-making, critical evaluation of own activities, activities of the teams one manages and the organizations in which one participates, taking responsibility for the effects of these activities

3.2. Learning outcomes taking into account the characteristics of the second degree of the Integrated Qualifications System for qualifications at level 6 of the Polish Qualifications Framework

Table 2 presents the learning outcomes taking into account the characteristics of the second degree of the Integrated Qualifications System for qualifications at level 6 of the Polish Qualifications Framework

Table 2. Learning outcomes taking into account the characteristics of the second degree of the Integrated Qualifications System for qualifications at level 6 of the Polish Qualifications Framework

SECOND DEGREE LEARNING OUTCOMES CHARACTERISTICS - LEVEL 6 OF THE POLISH QUALIFICATIONS FRAMEWORK					
KNOWLEDGE		SKILLS		SOCIAL COMPETENCES	
KNOWS AND UNDERSTANDS:		CAN:		IS READY FOR:	
P6S_WG	- at an advanced level, selected facts, objects and phenomena as well as their methods and theories explaining the complex relationships between them, constituting basic general knowledge in the field of scientific or artistic disciplines forming the theoretical basis and selected issues in the field of detailed knowledge - appropriate for the study programme, and in the case of studies with a practical profile - also practical applications of this knowledge in professional activities related to their field of study	P6S_UW	- use the acquired knowledge - formulate and solve complex, and unusual problems as well as perform tasks in conditions not fully predictable though the following: • proper selection of sources and information obtained from them, evaluation, critical analysis and synthesis of that information • selection and use of appropriate methods and tools, including advanced information and communication techniques - use one's knowledge - formulate and solve problems and perform tasks typical for professional activities related to the field of study - in the case of studies with a practical profile	P6S_KK	- critical evaluation of knowledge and received content - recognizing the importance of knowledge in solving cognitive and practical problems and consulting experts in the event of difficulties in solving the problem on its own

P6S_WK	- fundamental dilemmas of modern civilization - basic business, legal, ethical and other conditions for various types of professional activity related to the field of study, including basic concepts and principles in the field of protection of industrial property and copyright - basic principles of creating and developing various forms of entrepreneurship	P6S_UK	- communicate with the environment using specialized terminology - participate in the debate - to present, evaluate and discuss various opinions and positions - use a foreign language at the level of B2 of the Common European Framework for Languages	P6S_KO	- fulfilling social obligations, co-organizing activities for the benefit of the social environment - initiating activities for the public interest - think and act in an entrepreneurial manner
		P6S_UO	- plan and organize individual work and team work - interact with other people as part of team work (also of an interdisciplinary nature)	P6S_KR	- exercising professional roles responsibly, including: • complying with the rules of professional ethics and requiring the same from others, • caring about the achievements and traditions of the profession
		P6S_UU	- independently plan and carry out one's own learning throughout life		

3.3. Learning Outcomes for Qualifications Including Engineering Competences at level 6 of the Polish Qualifications Framework for the practical profile

Table 3 presents the learning outcomes taking into account the characteristics of the second degree of the Integrated Qualifications System for qualifications at level 6 of the Polish Qualifications Framework enabling the acquisition of engineering competences.

Table 3. Learning outcomes taking into account the characteristics of the second degree of the Integrated Qualifications System for qualifications at level 6 of the Polish Qualifications Framework enabling the acquisition of engineering competences.

<table>
<tr><th colspan="5">SECOND DEGREE CHARACTERISTICS - LEVEL 6 OF THE POLISH QUALIFICATIONS FRAMEWORK, ENGINEERING COMPETENCES</th></tr>
<tr><th colspan="2">KNOWLEDGE</th><th colspan="2">SKILLS</th><th>SOCIAL COMPETENCES</th></tr>
<tr><th colspan="2">KNOWS AND UNDERSTANDS:</th><th colspan="2">CAN:</th><th>IS READY FOR:</th></tr>
<tr><td>P6S_WG</td><td>- basic processes in the life cycle of devices, facilities and technical systems</td><td rowspan="2">P6S_UW</td><td rowspan="2">- plann and carry out experiments, including computer measurements and simulations, interpreting obtained results and drawing conclusions.
- when identifying and formulating specifications for engineering tasks and solving them:
• use analytical, simulation and experimental methods,
• see their systemic and non-technical aspects, including ethical aspects,
• make a preliminary economic assessment of the proposed solutions and undertaken engineering activities
- perform a critical analysis of the functioning of existing technical solutions and evaluating these solutions
- design - in accordance with the given specification - and developing simple devices, objects, systems typical for the field of study or implementing processes using appropriately selected methods, techniques, tools and materials
- solve practical engineering tasks requiring the use of engineering standards and norms and the use of technologies appropriate for the field of study, using the experience gained in an environment professionally involved in engineering activities - in the case of studies with a practical profile
- use the experience gained in the environment professionally dealing with engineering activities related to the maintenance of devices, facilities and systems typical for the field of study - in the case of studies with a practical profile</td><td rowspan="2"></td></tr>
<tr><td>P6S_WK</td><td>- basic principles of creating and developing various forms of individual entrepreneurship</td></tr>
</table>

3.4. Field learning outcomes

The learning outcomes and the programme for the practical profile must meet the requirements of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW 78/95) and the requirements of the European Union contained in the EMSA regulation (*European Maritime Safety Agency*).

Key:

EK (before the underscore)	- field learning outcomes
P6S (before the underscore)	- code of the description component of the Polish Qualifications Framework level 6.
W...	- knowledge category
...G	- category: depth and scope
...K	- category: context
U...	- skill category
...W	- category: knowledge use
...K	- category: communication
...O	- category: work organization
...U	- category: learning
K (after the underscore)	- category of social competences
...K	- category: assessments (critical approach)
...O	- category: responsibility
...R	- category: professional role
01, 02, 03, etc.	- learning outcome number
K. (col. 2, before the underscore)	- field learning outcomes included in the Senate resolution AM 11/2012

Table 4. Field learning outcomes in relation to the Integrated Qualifications System for qualifications at level 6 of the Polish Qualifications Framework

Field learning outcomes	**Field learning outcomes according to Annex 6. of the Resolution of the Senate AM 11/2012**	**Characteristics of the 2nd degree of learning outcomes for qualifications at level 6**	**Symbol**	
			Char. of 2nd degree	**Char. of 1st degree**
1	*2*	*3*	*4*	*5*
Knowledge				
EK_W01	K_W07	Knows and understands the basic processes taking place in the life cycle of devices, facilities and technical systems.	P6S_WG	P6S_W
EK_W02	K_W03, K_W07, K_W08, K_W09, K_W10, K_W11	Knows and understands selected facts and phenomena at an advanced level, as well as their methods and theories explaining the complex relationships between them, constituting general, basic knowledge in the field of mechanical engineering, forming the theoretical foundations.		

1	*2*	*3*	*4*	*5*
EK_W03	K_W04, K_W05, K_W06	Knows and understands selected issues in the field of detailed knowledge, as well as the practical application of this knowledge in professional activities related to the field of Mechanical Engineering and Machine Design.		
EK_W04	K_W12, K_W13, K_W15	Knows and understands the basic principles of creating and developing various forms of individual entrepreneurship.	P6S_WK	
EK_W05	K_W01, K_W02, K_W03, K_W14, K_W16	Knows and understands the fundamental dilemmas of modern civilization, including business, legal, ethical and other basic conditions for various types of professional activity related to the field of study, including the basic concepts and principles in the field of protection of industrial property and copyright law. Knows and understands the basic principles of creating and development of various forms of entrepreneurship.		
Skills				
EK_U01	K_U08, K_U09, K_U10, K_U14	Can plan and carry out experiments, including measurements and computer simulations, interpret the obtained results and draw conclusions when identifying and formulating specifications for engineering tasks and solving them, including: • using analytical, simulation and experimental methods, • noticing their systemic and non-technical aspects as well as their ethical aspects, • making a preliminary economic assessment of the proposed solutions and undertaken engineering activities	P6S_UW	P6S_U
EK_U02	K_U15	Can perform a critical analysis of the functioning of existing technical solutions and evaluate these solutions		
EK_U03	K_U18	In accordance with the given specification, one can design and develop simple devices, objects, systems, typical for the field of Mechanical Engineering and Machine Design, or carry out processes using appropriately selected methods, techniques, tools and materials.		

1	2	3	4	5
EK_U04	K_U11, K_U21, K_U22	Can solve practical engineering tasks requiring the use of engineering standards and norms as well as the use of technologies appropriate for the faculty of Mechanical Engineering and Machine Design, using the experience gained in an environment professionally involved in engineering activities. Can use the experience gained in this environment in activities related to the maintenance of devices, facilities and systems typical for the course of Mechanical Engineering and Machine Design.		
EK_U05	K_U01, K_U04, K_U16, K_U19, K_U20, K_U22	Can use the acquired knowledge - formulate and solve complex, and unusual problems as well as perform tasks in conditions not fully predictable though the following: • proper selection of sources and information obtained from them, evaluation, critical analysis and synthesis of that information • selection and use of appropriate methods and tools, including advanced information and communication techniques		
EK_U06	K_U17	Can use one's knowledge, formulate and solve problems and perform tasks typical for professional activities related to the field of Mechanical Engineering and Machine Design.		
EK_U07	K_U02, K_U03, K_U07	Can communicate with the environment using the appropriate, specialized terminology.	P6S_UK	
EK_U08	K_U04	Can take part in debates, present, evaluate and discuss different opinions and positions.		
EK_U09	K_U06	Can use a foreign language at the level of B2 of the Common European Framework for Languages		
EK_U10	K_U11, K_U12, K_U13, K_U18	Can plan and organize individual work and team work, cooperate with other people as part of team work - also of an interdisciplinary nature.	P6S_UO	
EK_U11	K_U05	Can plan and carry out one's own learning throughout life, independently.	P6S_UU	
Social skills				
EK_K01	K_K01, K_K03, K_K12	Is ready to critically assess one's knowledge and perceived content, recognize the importance of knowledge in solving cognitive and practical problems, and consult experts in the case of	P6S_KK	P6S_K

1	*2*	*3*	*4*	*5*
		difficulties in solving the problem on one's own.		
EK_K02	K_K04, K_K05, K_K06, K_K11	Is ready to fulfil social obligations, co-organize activities for the benefit of the social environment Is willing to initiate activities in the public interest to think and act in an entrepreneurial manner.	P6S_KO	
EK_K03	K_K02, K_K07, K_K08, K_K09, K_K10, K_K11	Is ready to fulfil professional roles responsibly, including: • complying with the rules of professional ethics and requiring the same from others, • caring about the achievements and traditions of the profession	P6S_KR	

4. MATRIX OF DIRECTIONAL LEARNING OUTCOMES IN REFERENCE TO THE SUBJECTS IMPLEMENTED

Table 5 presents the matrix of field learning outcomes in relation to the courses implemented.

Table 5. Matrix of field learning outcomes with respect to courses and internships implemented in the study programme

No.	**Course**	**Field learning outcomes**																		
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*
		EK_W01	EK_W02	EK_W03	EK_W04	EK_W05	EK_U01	EK_U02	EK_U03	EK_U04	EK_U05	EK_U06	EK_U07	EK_U08	EK_U09	EK_U10	EK_U11	EK_K01	EK_K02	EK_K03
1	English*										x		x		x			x		
2	Physical education		x								x						x	x	x	
3	Communication techniques#	x				x			x									x	x	x
4	Entrepreneurship economy#		x		x	x														x
5	Human resources management#		x		x		x				x		x		x		x		x	
6	Intellectual property protection#		x			x					x						x			
7	Mathematics					x	x					x	x			x	x	x		
8	Physics					x	x				x						x	x		x
9	Mechanics*					x					x									
10	Material strength*					x					x									
11	Engineering graphics*					x				x										
12	Introduction to applied computer science#		x				x						x			x			x	
13	Fundamentals of machine construction		x						x	x	x					x		x		x

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
14	Marine materials science*		x	x		x				x						x				
15	Engineering of manufacturing I*			x		x										x				
16	Engineering of manufacturing II – workshop practice*		x	x			x		x	x	x					x		x		
17	Engineering of manufacturing III – welding*	x				x				x		x								
18	Repair technology*	x	x	x						x	x	x				x				
19	Technical thermodynamics*		x			x	x				x						x			
20	Fluid mechanics*		x			x					x						x			
21	Introduction to electrotechnics and electronics*					x					x		x		x	x	x			
22	Electrical machines and propulsion*		x	x		x	x	x					x		x	x				
23	Marine electrical engineering*	x	x	x	x		x	x		x	x		x			x				
24	Fundamentals of automation and robotics*			x		x	x				x									
25	Marine automation and metrology*			x		x	x	x		x		x	x			x	x			
26	Technical Chemistry					x	x										x			
27	Chemistry of water, fuel and lubricants*	x	x	x		x	x	x		x	x		x				x	x		x
28	Use of fuels and lubricants*			x	x											x				
29	Marine reciprocating engines*		x				x				x					x			x	
30	Marine boilers*		x			x	x		x		x									
31	Marine machinery and equipment*		x	x			x	x		x		x	x			x			x	x
32	Refrigeration and air conditioning*		x	x			x	x		x	x	x	x			x			x	x
33	Marine power plants*	x	x	x						x	x					x			x	x
34	Introduction to ship construction and crew organization*		x		x						x		x					x		x
35	Ship theory and construction*	x	x	x						x	x									
36	Ecological aspects of ship operation*			x				x		x	x		x					x		
37	Operation of marine power plant equipment simulator*	x		x	x			x		x	x					x		x	x	
38	Management of safe ship operation*		x		x	x				x			x					x	x	
39	Organization of sea-going ships technical supervision*	x	x	x	x	x				x			x					x	x	x
40	Maritime law and insurance*		x								x									
41	Diploma seminar					x					x			x						
42.1	Contemporary design of marine reciprocating engines			x	x	x	x				x		x			x				
43.1	Ecological indicators of operational efficiency			x				x		x	x		x					x		
44.1	Marine propulsion systems			x	x		x	x			x		x			x				
45.1	Ship energy management		x	x	x	x	x			x										
42.2	Operation of marine steam and gas turbines				x		x			x	x					x				
43.2	Main steam boilers		x				x		x		x									
44.2	Ship turbine support equipment and systems		x				x		x		x									
45.2	Operation of marine turbosteam power plants		x	x			x		x							x				
42.3	Construction of tankers and chemical tankers		x	x	x			x		x	x		x			x		x		x
43.3	Operation of tankers and chemical tankers		x	x	x			x		x	x		x			x		x		x
44.3	Ecological aspects of tanker and chemical tanker operation		x							x	x									

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
45.3	Work safety on tankers and chemical tankers		x							x	x									
42.4	Construction of ships for the transportation of liquefied gases		x	x	x			x		x	x		x			x		x		x
43.4	Operation of ships for the transport of liquefied gases		x	x	x			x		x	x		x			x		x		x
44.4	Ecological aspects of gas tanker operation		x							x	x									
45.4	Work safety on gas tankers		x							x	x									
42.5	Programming control systems					x	x				x		x							
43.5	Algorithms and data structures					x	x				x		x							
44.5	Distributed control systems					x	x				x		x							
45.5	Data transmission protocols					x	x				x		x							
46	Internship (Ministry of Science and Higher Education standards)									x	x		x					x	x	x
47	Semester internship (STCW)									x	x							x	x	
48	Diploma thesis	comprehensive Field Learning Outcomes verification																		

* - contains STCW programme content
\# - modules and electives

5. SPECIAL REQUIREMENTS

5.1. Duration of the studies

Full-time first-degree studies with a practical profile lasts 8 semesters (240 ECTS credits). In full-time studies, each academic year includes at least 30 weeks of classes (without examination sessions), after adding the period of programme internships assigned to a given year. Classes may be conducted and assessed in the form of direct contact at the University's premises or with the use of remote learning methods and techniques. The Dean of the Faculty of Marine Engineering/the person responsible for the course, in accordance with generally applicable law, decides about the use of a given form of classes or their proportions.

5.2. The form of teaching, number of hours of classes

In the case of full-time studies, the number of ECTS points assigned to classes shaping practical skills is greater than 50% of the total number of points assigned to classes related to the implementation of the study programme.

5.3. Requirements for the ability to communicate in foreign languages

In accordance with the requirements specified in the IQS, the ability to use a foreign language at the B2 level of the European System for the Description of Language Education is required.

In particular, for the fields covered by the provisions of the STCW Convention, the ability to communicate in English is necessary, in accordance with the requirements contained in the Regulation of the Minister responsible for maritime economy on training programmes and examination requirements in the area of professional qualifications of sailors.

5.5. Internships

Internships covering a total of 4–12 weeks are carried out in production or repair yards, industrial plants, repair workshops (maximum 14 ECTS points) and on training ships or other vessels. As internships with a short duration, they are designed to provide students with basic knowledge about the functioning of real economic entities and allow them to confront the knowledge gained during the classes with the realities.

One-semester practical training (30 ECTS points) should be related to the major chosen by the student and the subject of the engineering diploma thesis. Experience in cooperation with the industry shows that only long-term internships allow students to deepen their skills and acquire good practices.

5.6. Diploma thesis

A diploma thesis is a specific independent study of a scientific, practical issue or a technical achievement, presenting the student's general knowledge and skills related to the studies in a given field, level and profile, as well as the ability to analyse and draw conclusions independently. The diploma thesis may constitute, in particular, a written work, a published article project work, including the design and execution of computer software or system, and a construction or a technological work. The diploma thesis may be written in a language other than Polish.

In accordance with the Act, the University checks written diploma theses before the diploma examination with the use of anti-plagiarism systems, in particular, the Unified Antiplagiarism System.

The diploma thesis is entered into the repository of written diploma theses immediately after passing the diploma examination and transferred to the Main Library of the University

The student prepares the engineering diploma thesis under the supervision of an authorized academic teacher with at least a master's degree.

A student may complete a diploma thesis outside the University as part of an inter-university exchange. In this case, the thesis supervisor may be a person appointed by the competent body of the partner university with the dean's consent.

The student has the right to choose the approved topic of the thesis and the thesis supervisor. If a student cannot obtain the consent of any academic teacher to prepare the thesis under his/her supervision, the supervisor is appointed by the Dean. The subject of the diploma thesis is deemed to be established when the student obtains the supervisor's written consent.

The diploma thesis is evaluated by the supervisor and one reviewer appointed by the dean. In the event of a discrepancy in grades, the Dean may seek the opinion of a second reviewer and, on its basis, decide to admit the student to the diploma examination.

Failure to submit the diploma thesis within the indicated period constitutes the basis for removing the student from the list of students.

5.7. Form and scope of diploma examination

The diploma examination should verify the knowledge gained throughout the study period and should mostly check the ability to properly associate (integrate) the knowledge obtained in various courses.

For the specializations covered by the certificate of recognition for the compliance of education with the requirements of the STCW Convention, the university provides the possibility of participation of a representative of the Central Maritime Examination Commission in the composition of the examination board conducting the examination.

The condition for the admission to the diploma examination is as follows:

- obtaining all learning outcomes and the required number of ECTS credits provided for in the study programme for a given field, level and profile of studies;
- obtaining positive opinions from the thesis supervisor and reviewer, confirming that the substantive and formal requirements for theses have been met;
- payment of all fees related to the course of studies.

The diploma examination is an oral exam, during which the examination board checks the student's level of preparation for the profession in the specialty being the subject of studies.

At the student's or supervisor's request, an open diploma examination is conducted. Such a request must be made when submitting the thesis.

5.8. ECTS credits

Table 6 presents the characteristic of the number and hours of the study programme.

Table 6. Number characteristics of ECTS points assigned to the study programme

Indicator name	Number of ECTS points Number of hours
Number of semesters necessary for graduation	8
Number of ECTS credits assigned to the study programme	240
Total number of hours of classes (depending on the field of diploma specialisation)	2653-2668
Total number of ECTS points that the student receives during classes in the field of humanities or social sciences	19
Total number of ECTS credits and hours assigned to elective courses	67
Number of ECTS credits that the student obtains during practical classes, such as laboratory and project classes (depending on the field of diploma specialisation)	144-147[1]
Total number of ECTS credits assigned to internships	44
Number of hours of physical education classes	84

[1] In the case of the practical profile, at least 50% of the ECTS points related to the study curriculum are assigned to classes shaping practical skills.

5.9. Verification of the students achieving learning outcomes

Learning outcomes are achieved by students during auditorium lectures, tutorials, laboratories, project work and interim papers, seminars and practical trainings. The knowledge acquired during the lectures is verified during classes when credits are awarded, as well as during tests and written or oral exams. The skills acquired during the tutorials are verified by means of tests or work in the form of tasks to be solved on one's own. Knowledge, skills and social competences acquired during laboratory classes are verified through reports, short written tests or during oral answers. The methods of verifying the learning outcomes acquired in practical classes confirm the achievement of the engineering effects assigned to the field of study. The most important element that comprehensively verifies the achieved learning outcomes in the field of Mechanical Engineering and Machine Design is the diploma thesis.

The basis for assessing the achievement of the assumed learning outcomes in the classroom is the record of learning results (grades). After the end of the semester, the regularly recorded student achievements are entered by the academic teacher conducting the classes into the periodic student achievement cards as well as the test and exam protocols. The achievement evaluation procedure also includes the verification of the effects obtained during compulsory internship and diploma thesis.

5.10. Citing international standards

The learning outcomes and programme content in the specialties covered by the provisions of the STCW Convention must meet the requirements of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW 78/95) and the requirements of the European Union contained in the regulation of the EMSA (*European Maritime Safety Agency*).

The description of learning outcomes in the field of technical studies corresponds in detail to international "standards" - in this respect it is comparable to EUR-ACE and IEA, more detailed than ABET and JABEE, and less detailed than CDIO.

The level of competence in the description of learning outcomes for the first-degree studies is comparable to the requirements adopted in EUR-ACE, ABET and JABEE, and lower than the requirements adopted in IEA and CDIO.

5.11. Elective courses

The study programme allows students to choose courses that have been assigned a total of 73 ECTS credits, which is over 30% of the total number of credits assigned to the programme. The elective courses include:

- module of courses related to the specialization chosen by the student in the field of Mechanical Engineering and Machine Design (courses no: 18, 42-45 - 13 ECTS),
- basic vocational practice according to the standards of the Ministry of Science and Higher Education (14 ECTS),
- semester practical training according to STCW standards (30 ECTS),
- engineering thesis (10 ECTS),

- course in the field of humanities or social sciences carried out in the first year of studies (2 ECTS),
- module of courses in the field of humanities or social sciences carried out in the fourth year of studies (3 ECTS),
- course in computer science and computational methods (1 ECTS).

6. STUDY PLAN AND SCHEDULE

A detailed study schedule is presented in table 7. The courses covered by the study Curriculum were listed along with a summary of the number of hours completed in each group of courses along with the number of ECTS points assigned to them. The study Plans in the field of Mechanical Engineering, specializations Marine Power Plant Operation at the 1st cycle full-time studies conducted at the Faculty of Marine Engineering, contain highlighted course modules related to the diploma field chosen by students. A detailed list of the programme content is included in part 2 of this study.

Table 7. Study schedule field of Mechanical Engineering

NO.	***GROUP*** **/ SUBJECT NAME**	
	A. GENERAL EDUCATION COURSES (19 ECTS)	357 h.
1.	English*	
2.	Physical education	
3.	Communication techniques#	
4.	Entrepreneurship economy#	
5.	Human resources management#	
6.	Intellectual property protection#	
	B. BASE COURSES (43 ECTS)	525 h.
7.	Mathematics	
8.	Physics	
9.	Mechanics*	
10.	Material strength*	
11.	Engineering graphics*	
12.	Introduction to applied computer science#	
	C. FIELD SPECIFIC COURSES (64 ECTS)	831 h.
13.	Fundamentals of machine construction	
14.	Marine materials science*	
15.	Engineering of manufacturing I*	
16.	Engineering of manufacturing II – workshop practice*	
17.	Engineering of manufacturing III – welding*	
18.	Repair technology*	
19.	Technical thermodynamics*	
20.	Fluid mechanics*	

21.	Introduction to electrotechnics and electronics*	
22.	Electrical machines and propulsion*	
23.	Marine electrical engineering*	
24.	Fundamentals of automation and robotics*	
25.	Marine automation and metrology*	
	D. VOCATIONAL COURSES (54 ECTS)	820 h.
26.	Technical Chemistry	
27.	Chemistry of water, fuel and lubricants*	
28.	Use of fuels and lubricants*	
29.	Marine reciprocating engines*	
30.	Marine boilers*	
31.	Marine machinery and equipment*	
32.	Refrigeration and air conditioning*	
33.	Marine power plants*	
34.	Introduction to ship construction and crew organization*	
35.	Ship theory and construction*	
36.	Ecological aspects of ship operation*	
37.	Operation of marine power plant equipment simulator*	
38.	Management of safe ship operation*	
39.	Organization of sea-going ships technical supervision*	
40.	Maritime law and insurance*	
41.	Diploma seminar	
	E. VOCATIONAL COURSES IMPLEMENTED AS PART OF DIPLOMA FIELDS: ***Reciprocating engine powertrains (6 ECTS)***	121 h.
42.1	*Contemporary constructions of marine reciprocating engines#*	
43.1	*Ecological indicators of operational efficiency#*	
44.1	*Marine propulsion systems#*	
45.1.	*Ship energy management#*	
	Turbine drives (6 ECTS)	120 h.
42.2	*Operation of marine steam and gas turbines#*	
43.2.	*Main steam boilers#*	
44.2	*Equipment and installations supporting ship turbines#*	
45.2	*Operation of marine turbosteam power plants#*	
	Operation of tankers and chemical tankers (6 ECTS)	121 h.
42.3	*Construction of tankers and chemical tankers#*	
43.3.	*Operation of tankers and chemical tankers#*	
44.3.	*Ecological aspects of tanker and chemical tanker operation#*	
45.3	*Work safety on tankers and chemical tankers#*	

Gas carriers operation (6 ECTS)		121 h.
42.4	*Construction of ships for the transportation of liquefied gases#*	
43.4.	*Operation of ships for the transport of liquefied gases#*	
44.4	*Ecological aspects of ship operation#*	
45.4	*Work safety on gas carriers#*	
Computer control systems for a marine power plant (6 ECTS)		135 h.
42.5.	*Programming of control systems#*	
43.5	*Algorithms and data structures#*	
44.5	*Distributed control systems#*	
45.5	*Data transmission protocols#*	
F. PRACTICAL TRAININGS		
46.	Basic vocational practice (internship) according to the standards of the Ministry of Science and Higher Education (14 ECTS),	14 weeks
47.	Semestral practical training according to STCW standards (30 ECTS)	16 weeks
G. DIPLOMA THESIS		
48.	Bachelor level diploma thesis (10 ECTS)	300 h.

* - contains STCW programme content

\# - modules and elective courses

STUDY PLAN - FIRST-CYCLE FULL-TIME STUDIES

STUDY PLAN – FULL-TIME FIRST CYCLE STUDIES

Maritime University of Szczecin Faculty of Marine Engineering	Field: Mechanical Engineering Specialization: Marine Power Plant Operation Diploma awarding field: Reciprocating engine powertrains	Approved by the Resolution of the Senate of Maritime University of Szczecin of 18.06.2020	Mandatory from the academic year 2020/2021 For first year student groups

No.	Course unit name	Hours Σ	Hours W	Hours Ć	Hours L	Hours S	ECTS Σ	ECTS U.Pr.	ECTS Poz.
1	English*	198	0	0	198	0	14	14	
2	Physical education	84	0	0	84	0	0		
3	Communication techniques#	30	15	15	0	0	2	1	1
4	Entrepreneurship economy#	15	15	0	0	0	1		1
5	Human resources management#	15	15	0	0	0	1		1
6	Protection of intellectual property#	15	15	0	0	0	1		1
7	Mathematics	156	72	84	0	0	14	6	8
8	Physics	105	45	0	60	0	9	4	5
9	Mechanics*	90	45	30	15	0	8	3	5
10	Material strength*	84	27	27	30	0	6	4	2
11	Engineering graphics*	75	0	0	75	0	5	5	
12	Introduction to applied computer science#	15	0	0	15	0	1	1	
13	Fundamentals of machine construction	108	54	0	54	0	8	3	5
14	Marine materials science*	60	30	0	30	0	5	2	3
15	Engineering of manufacturing I*	36	12	0	24	0	3	2	1
16	Engineering of manufacturing II – workshop practice*	69	0	0	69	0	5	5	
17	Engineering of manufacturing III – welding*	36	0	0	36	0	2	2	
18	Repair technology*	108	54	0	54	0	7	4	3
19	Technical thermodynamics*	69	30	15	24	0	6	3	3
20	Fluid mechanics*	30	15	15	0	0	2	1	1
21	Introduction to electrotechnics and electronics*	66	39	15	12	0	6	2	4
22	Electrical machines and propulsion*	75	45	0	30	0	7	2	5
23	Marine electrical engineering*	48	24	0	24	0	3	2	1
24	Fundamentals of automation and robotics*	45	15	15	15	0	4	2	2
25	Marine automation and metrology*	81	30	0	45	6	6	3	3
26	Technical Chemistry	45	15	0	30	0	3	2	1
27	Chemistry of water, fuel and lubricants*	44	14	0	30	0	3	2	1
28	Use of fuels and lubricants*	30	30	0	0	0	2		2
29	Marine reciprocating engines*	123	69	0	54	0	10	4	6
30	Marine boilers*	40	30	6	0	4	3		3
31	Marine machinery and equipment*	99	54	0	45	0	7	3	4
32	Refrigeration and air conditioning*	65	30	0	30	5	5	2	3
33	Marine power plants*	114	54	6	0	54	5	1	4
34	Introduction to ship construction and crew organization*	30	30	0	0	0	2		2
35	Ship theory and construction*	55	47	8	0	0	4	1	3
36	Ecological aspects of ship operation*	25	21	0	4	0	2	1	1
37	Operation of marine power plant equipment simulator*	45	15	0	0	30	2	1	1
38	Management of safe ship operation*	45	25	20	0	0	3	2	1
39	Organization of sea-going ships technical supervision*	30	15	15	0	0	1	1	
40	Maritime law and insurance*	15	15	0	0	0	1		1
41	Diploma seminar	15	15	0	0	0	1	1	
42.1	*Contemporary design of marine reciprocating engines*	30	15	0	0	15	1		1
43.1	*Ecological indicators of operational efficiency*	36	15	0	15	6	2	1	1
44.1	*Marine propulsion systems*	25	15	0	0	10	1		1
45.1	*Ship energy management*	30	15	0	0	15	2	1	1
46	Internship (Ministry of Science and Higher Education standards)	0	0	0	0	0	14	14	
47	Semestral internship (STCW)	0	0	0	0	0	30	30	
48	Diploma thesis	0	0	0	0	0	10	10	
	Total:	2654	1136	271	1102	145	240	148	92
	Weekly workload:								

Weekly lectures/classes in semester

No.	I Semester 15 weeks W	Egz.	Ć	L	S	ECTS Σ	U.Pr.	Poz.	II Semester 15 weeks W	Egz.	Ć	L	S	ECTS Σ	U.Pr.	Poz.
1				3		3	3					3		3	3	
2												1		0		
3	1		1			2	1	1								
4																
5																
6																
7	2	E	2			6	2	4	2		2			5	2	3
8	1			2		3	2	1	2	E		2		6	2	4
9	2	E	2			6	2	4	1			1		2	1	1
10																
11				2		2	2					3		3	3	
12				1		1	1									
13																
14	2	E		2		5	2	3								
15																
16																
17																
18																
19									2	E	1			4	1	3
20									1		1			2	1	1
21									1		1			2	1	1
22																
23																
24																
25																
26									1			2		3	2	1
27																
28																
29																
30																
31																
32																
33																
34	2					2		2								
35																
36																
37																
38																
39																
40																
41																
42.1																
43.1																
44.1																
45.1																
46																
47																
48																
Total:	10	3	5	10	0	30			10	2	5	12	0	30		
Weekly workload:	25,0								27,0							

No.	III Semester 12 weeks W	Egz.	Ć	L	S	ECTS Σ	U.Pr.	Poz.	IV Semester 15 weeks W	Egz.	Ć	L	S	ECTS Σ	U.Pr.	Poz.	V Semester 12 weeks W	Egz.	Ć	L	S/P	ECTS Σ	U.Pr.	Poz.
1				2		2	2					2		2	2			E		2		2	2	
2				1		0						1		0						1		0		
3																								
4																								
5																								
6																								
7	1	E	2			3	2	1																
8																								
9																								
10	1	E	1			2	1	1	1		1	2		4	3	1								
11																								
12																								
13	2					2		2	2	E		2		5	2	3				2		1	1	
14																								
15	1			2		3	2	1																
16				2		2	2					3		3	3									
17																				3		2	2	
18																	2			2		3	2	1
19				2		2	2																	
20																								
21	2	E		1		4	1	3																
22									3	E		2		7	2	5								
23																	2			2		3	2	1
24									1	E	1	1		4	2	2								
25																								
26																								
27																	0,5			1,3		1	1	
28																								
29																	2	E		2		4	2	2
30																	2,5	E	0,5		0,3	3		3
31																	2					1		1
32																								
33																	2		0,5		2	2		2
34																								
35	2					2		2	1,5		0,5			2	1	1								
36																	1,8			0,3		2	1	1
37																								
38									1,7		1,3			3	2	1								
39																								
40																								
41																								
42.1																								
43.1																								
44.1																								
45.1																								
46						8	8															6	6	
47																								
48																								
Total:	9	3	3	10	0	30			10	3	3,9	13	0	30			14,8	3	1	15,6	2,3	30		
Weekly workload:	22,0								30,1								33,0							

No.	VI Semester 15 weeks. W	Egz.	Ć	L	S	ECTS Σ	U.Pr.	Poz.	VII Semester 15 weeks W	Egz.	Ć	L	S	ECTS Σ	U.Pr.	Poz.	VIII Semester 15 weeks W	Egz.	Ć	L	S	ECTS Σ	U.Pr.	Poz.
1												2		2	2									
2												1		0						1		0		
3																								
4																	1					1		1
5																	1					1		1
6																	1					1		1
7																								
8																								
9																								
10																								
11																								
12																								
13																								
14																								
15																								
16																								
17																								
18									2			2		4	2	2								
19																								
20																								
21																								
22																								
23																								
24																								
25									2	E		3	0,4	6	3	3								
26																								
27																	0,5			1		2	1	1
28									2					2		2								
29									2					2		2	1	E		2		4	2	2
30																								
31									2	E		3		6	3	3								
32									2			2	0,3	5	2	3								
33									2	E			2	3	1	2								
34																								
35																								
36																								
37																	1				2	2	1	1
38																								
39																	1		1			1	1	
40																	1					1		1
41																	1					1	1	
42.1																	1				1	1		1
43.1																	1			1	0,4	2	1	1
44.1																	1				0,7	1		1
45.1																	1	E			1	2	1	1
46																								
47		E				30	30																	
48																						10	10	
Total:	0	*1	0	0	0	30			14	3	0	13	2,7	30			13	2	1	5	5,1	30		
Weekly workload:	n/d								29,7								23,6							

	Compulsory courses required by the STCW	1st semester	2nd semester	3rd semester	4th semester	5th semester	6th semester	7th semester	8th semester
1	Training in the basic principles of providing medical first aid	X	–	–	–	–	–	–	–
2	Training in personal safety and shared responsibility	X	–	–	–	–	–	–	–
3	Training in individual rescue techniques	X	–	–	–	–	–	–	–
4	Fire protection training - basic level	X	–	–	–	–	–	–	–
5	Ship security training	–	–	–	X	–	–	–	–
6	Training for crew members assigned with security duties.	–	–	–	X	–	–	–	–
7	Training in command of a ship's power plant	–	–	–	–	–	–	–	X

* - includes STCW programme content

STUDY PLAN - FIRST-CYCLE FULL-TIME STUDIES

STUDY PLAN – FULL-TIME FIRST CYCLE STUDIES

Maritime University of Szczecin Faculty of Marine Engineering	Field: Mechanical Engineering Specialization: Marine Power Plant Operation Diploma awarding field: Turbine drives	Approved by the Resolution of the Senate of Maritime University of Szczecin of 18.06.2020	Mandatory from the academic year 2020/2021 For first year student groups

No.	Course unit name	Hours Σ	Hours W	Hours Ć	Hours L	Hours S	ECTS Σ	ECTS U.Pr.	ECTS Poz.
1	English*	198	0	0	198	0	14	14	
2	Physical education	84	0	0	84	0	0		
3	Communication techniques#	30	15	15	0	0	2	1	1
4	Entrepreneurship economy#	15	15	0	0	0	1		1
5	Human resources management#	15	15	0	0	0	1		1
6	Intellectual property protection#	15	15	0	0	0	1		1
7	Mathematics	156	72	84	0	0	14	6	8
8	Physics	105	45	0	60	0	9	4	5
9	Mechanics*	90	45	30	15	0	8	3	5
10	Material strength*	84	27	27	30	0	6	4	2
11	Engineering graphics*	75	0	0	75	0	5	5	
12	Introduction to applied computer science#	15	0	0	15	0	1	1	
13	Fundamentals of machine construction	108	54	0	54	0	8	3	5
14	Marine materials science*	60	30	0	30	0	5	2	3
15	Engineering of manufacturing I*	36	12	0	24	0	3	2	1
16	Engineering of manufacturing II – workshop practice*	69	0	0	69	0	5	5	
17	Engineering of manufacturing III – welding*	36	0	0	36	0	2	2	
18	Repair technology*	108	54	0	54	0	7	4	3
19	Technical thermodynamics*	69	30	15	24	0	6	3	3
20	Fluid mechanics*	30	15	15	0	0	2	1	1
21	Introduction to electrotechnics and electronics*	66	39	15	12	0	6	2	4
22	Electrical machines and propulsion*	75	45	0	30	0	7	2	5
23	Marine electrical engineering*	48	24	0	24	0	3	2	1
24	Fundamentals of automation and robotics*	45	15	15	15	0	4	2	2
25	Marine automation and metrology*	81	30	0	45	6	6	3	3
26	Technical Chemistry	45	15	0	30	0	3	2	1
27	Chemistry of water, fuel and lubricants*	44	14	0	30	0	3	2	1
28	Use of fuels and lubricants*	30	30	0	0	0	2		2
29	Marine reciprocating engines*	123	69	0	54	0	10	4	6
30	Marine boilers*	40	30	6	0	4	3		3
31	Marine machinery and equipment*	99	54	0	45	0	7	3	4
32	Refrigeration and air conditioning*	65	30	0	30	5	5	2	3
33	Marine power plants*	114	54	6	0	54	5		5
34	Introduction to ship construction and crew organization*	30	30	0	0	0	2		2
35	Ship theory and construction*	55	47	8	0	0	4	1	3
36	Ecological aspects of ship operation*	25	21	0	4	0	2		2
37	Operation of marine power plant equipment simulator*	45	15	0	0	30	2	1	1
38	Management of safe ship operation*	45	25	20	0	0	3	2	1
39	Organization of sea-going ships technical supervision*	30	15	15	0	0	1	1	
40	Maritime law and insurance*	15	15	0	0	0	1		1
41	Diploma seminar	15	15	0	0	0	1		1
42.2	*Operation of marine steam and gas turbines*	35	30	0	0	5	2		2
43.2	*Main steam boilers*	30	15	0	10	5	1	1	
44.2	*Ship turbine support equipment and systems*	25	15	0	0	10	1		1
45.2	*Operation of marine turbosteam power plants*	30	15	0	0	15	2		2
46	Internship (Ministry of Science and Higher Education standards)	0	0	0	0	0	14	14	
47	Semestral internship (STCW)	0	0	0	0	0	30	30	
48	Diploma thesis	0	0	0	0	0	10	10	
	Total:	2653	1151	271	1097	134	240	144	96
	Weekly workload:								

Weekly lectures/classes in semester

No.	I Semester 15 weeks W	Egz.	Ć	L	S	ECTS Σ	ECTS U.Pr.	ECTS Poz.	II Semester 15 weeks W	Egz.	Ć	L	S	ECTS Σ	ECTS U.Pr.	ECTS Poz.
1				3		3	3					3		3	3	
2												1		0		
3	1		1			2	1	1								
4																
5																
6																
7	2	E	2			6	2	4	2		2			5	2	3
8	1			2		3	2	1	2	E		2		6	2	4
9	2	E	2			6	2	4	1			1		2	1	1
10																
11				2		2	2					3		3	3	
12				1		1	1									
13																
14	2	E		2		5	2	3								
15																
16																
17																
18																
19									2	E	1			4	1	3
20									1		1			2	1	1
21									1		1			2	1	1
22																
23																
24																
25																
26									1			2		3	2	1
27																
28																
29																
30																
31																
32																
33																
34	2					2		2								
35																
36																
37																
38																
39																
40																
41																
42.2																
43.2																
44.2																
45.2																
46																
47																
48																
Total:	10	3	5	10	0	30			10	2	5	12	0	30		
Weekly workload:	25,0								27,0							

No.	III Semester 12 weeks W	Egz.	Ć	L	S	ECTS Σ	ECTS U.Pr.	ECTS Poz.	IV Semester 15 weeks W	Egz.	Ć	L	S	ECTS Σ	ECTS U.Pr.	ECTS Poz.
1				2		2	2					2		2	2	
2				1		0						1		0		
3																
4																
5																
6																
7	1	E	2			3	2	1								
8																
9																
10	1	E	1			2	1	1	1		1	2		4	3	1
11																
12																
13	2					2		2	2	E		2		5	2	3
14																
15	1			2		3	2	1								
16				2		2	2					3		3	3	
17																
18																
19				2		2	2									
20																
21	2	E		1		4	1	3								
22									3	E		2		7	2	5
23																
24									1	E	1	1		4	2	2
25																
26																
27																
28																
29																
30																
31																
32																
33																
34																
35	2					2		2	1,5		0,5			2	1	1
36																
37																
38									1,7		1,3			3	2	1
39																
40																
41																
42.2																
43.2																
44.2																
45.2																
46						8	8									
47																
48																
Total:	9	3	3	10	0	30			10	3	3,9	13	0	30		
Weekly workload:	22,0								27,1							

No.	V Semester 12 weeks W	Egz.	Ć	L	S/P	ECTS Σ	ECTS U.Pr.	ECTS Poz.	VI Semester 15 weeks. W	Egz.	Ć	L	S	ECTS Σ	ECTS U.Pr.	ECTS Poz.
1		E		2		2	2									
2				1		0										
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																
13				2		1	1									
14																
15																
16																
17				3		2	2									
18	2			2		3	2	1								
19																
20																
21																
22																
23	2			2		3	2	1								
24																
25																
26																
27	0,5			1,3		1	1									
28																
29	2	E		2		4	2	2								
30	2,5	E	0,5		0,3	3		3								
31	2					1		1								
32																
33	2		0,5		2	2		2								
34																
35																
36	1,8			0,3		2		2								
37																
38																
39																
40																
41																
42.2																
43.2																
44.2																
45.2																
46						6	6									
47										E				30	30	
48																
Total:	14,8	3	1	15,6	2,3	30			0	*1	0	0	0	30		
Weekly workload:	33,0								0,0							

No.	VII Semester 15 weeks W	Egz.	Ć	L	S	ECTS Σ	ECTS U.Pr.	ECTS Poz.	VIII Semester 15 weeks W	Egz.	Ć	L	S	ECTS Σ	ECTS U.Pr.	ECTS Poz.
1				2		2	2									
2				1		0						1		0		
3																
4									1					1		1
5									1					1		1
6									1					1		1
7																
8																
9																
10																
11																
12																
13																
14																
15																
16																
17																
18	2			2		4	2	2								
19																
20																
21																
22																
23																
24																
25	2	E		3	0,4	6	3	3								
26																
27									0,5			1		2	1	1
28	2					2		2								
29	2					2		2	1	E		2		4	2	2
30																
31	2	E		3		6	3	3								
32	2			2	0,3	5	2	3								
33	2	E			2	3		3								
34																
35																
36																
37									1				2	2	1	1
38																
39									1		1			1	1	
40									1					1		1
41									1					1		1
42.2									2				0,3	2		2
43.2									1			0,7	0,3	1	1	
44.2									1				0,7	1		1
45.2									1	E			1	2		2
46																
47																
48														10	10	
Total:	14	3	0	13	2,7	30			14	2	1	5	4,3	30		
Weekly workload:	29,7								23,5							

	Compulsory courses required by the STCW	1st semester	2nd semester	3rd semester	4th semester	5th semester	6th semester	7th semester	8th semester
1	Training in the basic principles of providing medical first aid	X	–	–	–	–	–	–	–
2	Training in personal safety and shared responsibility	X	–	–	–	–	–	–	–
3	Training in individual rescue techniques	X	–	–	–	–	–	–	–
4	Fire protection training - basic level	X	–	–	–	–	–	–	–
5	Ship security training	–	–	–	X	–	–	–	–
6	Training for crew members assigned with security duties.	–	–	–	X	–	–	–	–
7	Training in command of a ship's power plant	–	–	–	–	–	–	–	X

[*] - includes STCW programme content

STUDY PLAN - FIRST-CYCLE FULL-TIME STUDIES

STUDY PLAN – FULL-TIME FIRST CYCLE STUDIES

Maritime University of Szczecin
Faculty of Marine Engineering

Field: Mechanical Engineering
Specialization: Marine Power Plant Operation
Diploma awarding field: Operation of tankers and chemical tankers

Approved by the Resolution of the Senate of Maritime University of Szczecin of 18.06.2020

Mandatory from the academic year 2020/2021
For first year student groups

Weekly lectures/classes in semester

No.	Course unit name	Hours Σ	Hours W	Hours Ć	Hours L	Hours S	ECTS Σ	ECTS U.Pr.	ECTS Poz.	I Semester (15 weeks) W	Egz.	Ć	L	S	ECTS Σ	U.Pr.	Poz.	II Semester (15 weeks) W	Egz.	Ć	L	S	ECTS Σ	U.Pr.	Poz.
1	English*	198	0	0	198	0	14	14					3		3	3					3		3	3	
2	Physical education	84	0	0	84	0	0														1		0		
3	Communication techniques#	30	15	15	0	0	2	1	1	1		1			2	1	1								
4	Entrepreneurship economy#	15	15	0	0	0	1		1																
5	Human resources management#	15	15	0	0	0	1		1																
6	Intellectual property protection#	15	15	0	0	0	1		1																
7	Mathematics	156	72	84	0	0	14	6	8	2	E	2			6	2	4	2		2			5	2	3
8	Physics	105	45	0	60	0	9	4	5	1			2		3	2	1	2	E		2		6	2	4
9	Mechanics*	90	45	30	15	0	8	3	5	2	E	2			6	2	4	1			1		2	1	1
10	Material strength*	84	27	27	30	0	6	4	2																
11	Engineering graphics*	75	0	0	75	0	5	5					2		2	2					3		3	3	
12	Introduction to applied computer science#	15	0	0	15	0	1	1					1		1	1									
13	Fundamentals of machine construction	108	54	0	54	0	8	3	5																
14	Marine materials science*	60	30	0	30	0	5	2	3	2	E		2		5	2	3								
15	Engineering of manufacturing I*	36	12	0	24	0	3	2	1																
16	Engineering of manufacturing II – workshop practice*	69	0	0	69	0	5	5																	
17	Engineering of manufacturing III – welding*	36	0	0	36	0	2	2																	
18	Repair technology*	108	54	0	54	0	7	4	3																
19	Technical thermodynamics*	69	30	15	24	0	6	3	3									2	E	1			4	1	3
20	Fluid mechanics*	30	15	15	0	0	2	1	1									1		1			2	1	1
21	Introduction to electrotechnics and electronics*	66	39	15	12	0	6	2	4									1		1			2	1	1
22	Electrical machines and propulsion*	75	45	0	30	0	7	2	5																
23	Marine electrical engineering*	48	24	0	24	0	3	2	1																
24	Fundamentals of automation and robotics*	45	15	15	15	0	4	2	2																
25	Marine automation and metrology*	81	30	0	45	6	6	3	3																
26	Technical Chemistry	45	15	0	30	0	3	2	1									1			2		3	2	1
27	Chemistry of water, fuel and lubricants*	44	14	0	30	0	3	2	1																
28	Use of fuels and lubricants*	30	30	0	0	0	2		2																
29	Marine reciprocating engines*	123	69	0	54	0	10	4	6																
30	Marine boilers*	40	30	6	0	4	3		3																
31	Marine machinery and equipment*	99	54	0	45	0	7	3	4																
32	Refrigeration and air conditioning*	65	30	0	30	5	5	2	3																
33	Marine power plants*	114	54	6	0	54	5		5																
34	Introduction to ship construction and crew organization*	30	30	0	0	0	2		2	2					2		2								
35	Ship theory and construction*	55	47	8	0	0	4	1	3																
36	Ecological aspects of ship operation*	25	21	0	4	0	2		2																
37	Operation of marine power plant equipment simulator*	45	15	0	0	30	2	1	1																
38	Management of safe ship operation*	45	25	20	0	0	3	2	1																
39	Organization of sea-going ships technical supervision*	30	15	15	0	0	1	1																	
40	Maritime law and insurance*	15	15	0	0	0	1		1																
41	Diploma seminar	15	15	0	0	0	1		1																
42.3	*Construction of tankers and chemical tankers*	30	15	0	0	15	1		1																
43.3	*Operation of tankers and chemical tankers*	36	15	0	15	6	2	1	1																
44.3	*Ecological aspects of tanker and chemical tanker operation*	25	15	0	0	10	1		1																
45.3	*Work safety on tankers and chemical tankers*	30	15	0	0	15	2		2																
46	Internship (Ministry of Science and Higher Education standards)	0	0	0	0	0	14	14																	
47	Semestral internship (STCW)	0	0	0	0	0	30	30																	
48	Diploma thesis	0	0	0	0	0	10	10																	
	Total:	2654	1136	271	1102	145	240	144	96	10	3	5	10	0	30			10	2	5	12	0	30		
	Weekly workload:									25,0								27,0							

No.	III Semester (12 weeks) W	Egz.	Ć	L	S	ECTS Σ	U.Pr.	Poz.	IV Semester (15 weeks) W	Egz.	Ć	L	S	ECTS Σ	U.Pr.	Poz.	V Semester (12 weeks) W	Egz.	Ć	L	S/P	ECTS Σ	U.Pr.	Poz.
1				2		2	2					2		2	2			E		2		2	2	
2				1		0						1		0						1		0		
3																								
4																								
5																								
6																								
7	1	E	2			3	2	1																
8																								
9																								
10	1	E	1			2	1	1	1		1	2		4	3	1								
11																								
12																								
13	2					2		2	2	E		2		5	2	3				2		1	1	
14																								
15	1			2		3	2	1																
16				2		2	2					3		3	3									
17																				3		2	2	
18																	2			2		3	2	1
19				2		2	2																	
20																								
21	2	E		1		4	1	3																
22									3	E		2		7	2	5								
23																	2			2		3	2	1
24									1	E	1	1		4	2	2								
25																								
26																								
27																	0,5			1,3		1	1	
28																								
29																	2	E		2		4	2	2
30																	2,5	E	0,5		0,3	3		3
31																	2					1		1
32																								
33																	2		0,5		2	2		2
34																								
35	2					2		2	1,5		0,5			2	1	1								
36																	1,8			0,3		2		2
37																								
38									1,7		1,3			3	2	1								
39																								
40																								
41																								
42.3																								
43.3																								
44.3																								
45.3																								
46						8	8															6	6	
47																								
48																								
Total:	9	3	3	10	0	30			10	3	3,9	13	0	30			14,8	3	1	15,6	2,3	30		
Weekly workload:	22,0								27,1								33,0							

No.	VI Semester (15 weeks.) W	Egz.	Ć	L	S	ECTS Σ	U.Pr.	Poz.	VII Semester (15 weeks) W	Egz.	Ć	L	S	ECTS Σ	U.Pr.	Poz.	VIII Semester (15 weeks) W	Egz.	Ć	L	S	ECTS Σ	U.Pr.	Poz.
1												2		2	2									
2												1		0						1		0		
3																								
4																	1					1		1
5																	1					1		1
6																	1					1		1
7																								
8																								
9																								
10																								
11																								
12																								
13																								
14																								
15																								
16																								
17																								
18									2			2		4	2	2								
19																								
20																								
21																								
22																								
23																								
24																								
25									2	E		3	0,4	6	3	3								
26																								
27																	0,5			1		2	1	1
28									2					2		2								
29									2					2		2	1	E		2		4	2	2
30																								
31									2	E		3		6	3	3								
32									2			2	0,3	5	2	3								
33									2	E			2	3		3								
34																								
35																								
36																								
37																	1				2	2	1	1
38																								
39																	1		1			1	1	
40																	1					1		1
41																	1					1		1
42.3																	1				1	1		1
43.3																	1			1	0,4	2	1	1
44.3																	1				0,7	1		1
45.3																	1	E			1	2		2
46																								
47		E				30	30																	
48																						10	10	
Total:	0	*1	0	0	0	30			14	3	0	13	2,7	30			13	2	1	5	5,1	30		
Weekly workload:	0,0								29,7								23,6							

	Compulsory courses required by the STCW	1st semester	2nd semester	3rd semester	4th semester	5th semester	6th semester	7th semester	8th semester
1	Training in the basic principles of providing medical first aid	X	–	–	–	–	–	–	–
2	Training in personal safety and shared responsibility	X	–	–	–	–	–	–	–
3	Training in individual rescue techniques	X	–	–	–	–	–	–	–
4	Fire protection training - basic level	X	–	–	–	–	–	–	–
5	Ship security training	–	–	–	X	–	–	–	–
6	Training for crew members assigned with security duties.	–	–	–	X	–	–	–	–
7	Training in command of a ship's power plant	–	–	–	–	–	–	–	X

* - includes STCW programme content

STUDY PLAN - FIRST-CYCLE FULL-TIME STUDIES

STUDY PLAN – FULL-TIME FIRST CYCLE STUDIES

Maritime University of Szczecin Faculty of Marine Engineering	Field: Mechanical Engineering Specialization: Marine Power Plant Operation Diploma awarding field: Gas carriers operation	Approved by the Resolution of the Senate of Maritime University of Szczecin of 18.06.2020	Mandatory from the academic year 2020/2021 For first year student groups

No.	Course unit name	Hours Σ	W	Ć	L	S	ECTS Σ	ECTS U.Pr.	ECTS Poz.
1	English*	198	0	0	198	0	14	14	
2	Physical education	84	0	0	84	0	0		
3	Communication techniques#	30	15	15	0	0	2	1	1
4	Entrepreneurship economy#	15	15	0	0	0	1		1
5	Human resources management#	15	15	0	0	0	1		1
6	Intellectual property protection#	15	15	0	0	0	1		1
7	Mathematics	156	72	84	0	0	14	6	8
8	Physics	105	45	0	60	0	9	4	5
9	Mechanics*	90	45	30	15	0	8	3	5
10	Material strength*	84	27	27	30	0	6	4	2
11	Engineering graphics*	75	0	0	75	0	5	5	
12	Introduction to applied computer science#	15	0	0	15	0	1	1	
13	Fundamentals of machine construction	108	54	0	54	0	8	3	5
14	Marine materials science*	60	30	0	30	0	5	2	3
15	Engineering of manufacturing I*	36	12	0	24	0	3	2	1
16	Engineering of manufacturing II – workshop practice*	69	0	0	69	0	5	5	
17	Engineering of manufacturing III – welding*	36	0	0	36	0	2	2	
18	Repair technology*	108	54	0	54	0	7	4	3
19	Technical thermodynamics*	69	30	15	24	0	6	3	3
20	Fluid mechanics*	30	15	15	0	0	2	1	1
21	Introduction to electrotechnics and electronics*	66	39	15	12	0	6	2	4
22	Electrical machines and propulsion*	75	45	0	30	0	7	2	5
23	Marine electrical engineering*	48	24	0	24	0	3	2	1
24	Fundamentals of automation and robotics*	45	15	15	15	0	4	2	2
25	Marine automation and metrology*	81	30	0	45	6	6	3	3
26	Technical Chemistry	45	15	0	30	0	3	2	1
27	Chemistry of water, fuel and lubricants*	44	14	0	30	0	3	2	1
28	Use of fuels and lubricants*	30	30	0	0	0	2		2
29	Marine reciprocating engines*	123	69	0	54	0	10	4	6
30	Marine boilers*	40	30	6	0	4	3		3
31	Marine machinery and equipment*	99	54	0	45	0	7	3	4
32	Refrigeration and air conditioning*	65	30	0	30	5	5	2	3
33	Marine power plants*	114	54	6	0	54	5		5
34	Introduction to ship construction and crew organization*	30	30	0	0	0	2		2
35	Ship theory and construction*	55	47	8	0	0	4	1	3
36	Ecological aspects of ship operation*	25	21	0	4	0	2		2
37	Operation of marine power plant equipment simulator*	45	15	0	0	30	2	1	1
38	Management of safe ship operation*	45	25	20	0	0	3	2	1
39	Organization of sea-going ships technical supervision*	30	15	15	0	0	1	1	
40	Maritime law and insurance*	15	15	0	0	0	1		1
41	Diploma seminar	15	15	0	0	0	1		1
42.4	*Construction of ships for the transportation of liquefied gases*	30	15	0	0	15	1		1
43.4	*Operation of ships for the transport of liquefied gases*	36	15	0	15	6	2	1	1
44.4	*Ecological aspects of gas tanker operation*	25	15	0	0	10	1		1
45.4	*Work safety on gas tankers*	30	15	0	0	15	2		2
46	Internship (Ministry of Science and Higher Education standards)	0	0	0	0	0	14	14	
47	Semestral internship (STCW)	0	0	0	0	0	30	30	
48	Diploma thesis	0	0	0	0	0	10	10	
	Total:	2654	1136	271	1102	145	240	144	96
	Weekly workload:								

Weekly lectures/classes in semester

No.	I Semester 15 weeks W	Egz.	Ć	L	S	ECTS Σ	U.Pr.	Poz.	II Semester 15 weeks W	Egz.	Ć	L	S	ECTS Σ	U.Pr.	Poz.
1				3		3	3					3		3	3	
2												1		0		
3	1		1			2	1	1								
4																
5																
6																
7	2	E	2			6	2	4	2		2			5	2	3
8	1			2		3	2	1	2	E		2		6	2	4
9	2	E	2			6	2	4	1			1		2	1	1
10																
11				2		2	2					3		3	3	
12				1		1	1									
13																
14	2	E		2		5	2	3								
15																
16																
17																
18																
19									2	E	1			4	1	3
20									1		1			2	1	1
21									1		1			2	1	1
22																
23																
24																
25																
26									1			2		3	2	1
27																
28																
29																
30																
31																
32																
33																
34	2					2		2								
35																
36																
37																
38																
39																
40																
41																
42.4																
43.4																
44.4																
45.4																
46																
47																
48																
Total:	10	3	5	10	0	30			10	2	5	12	0	30		
Weekly workload:	25,0								27,0							

No.	III Semester 12 weeks W	Egz.	Ć	L	S	ECTS Σ	U.Pr.	Poz.	IV Semester 15 weeks W	Egz.	Ć	L	S	ECTS Σ	U.Pr.	Poz.
1				2		2	2					2		2	2	
2				1		0						1		0		
3																
4																
5																
6																
7	1	E	2			3	2	1								
8																
9																
10	1	E	1			2	1	1	1		1	2		4	3	1
11																
12																
13	2					2		2	2	E		2		5	2	3
14																
15	1			2		3	2	1								
16				2		2	2					3		3	3	
17																
18																
19				2		2	2									
20																
21	2	E		1		4	1	3								
22									3	E		2		7	2	5
23																
24									1	E	1	1		4	2	2
25																
26																
27																
28																
29																
30																
31																
32																
33																
34																
35	2					2		2	1,5		0,5			2	1	1
36																
37																
38									1,7		1,3			3	2	1
39																
40																
41																
42.4																
43.4																
44.4																
45.4																
46						8	8									
47																
48																
Total:	9	3	3	10	0	30			10	3	3,9	13	0	30		
Weekly workload:	22,0								27,1							

No.	V Semester 12 weeks W	Egz.	Ć	L	S/P	ECTS Σ	U.Pr.	Poz.	VI Semester 15 weeks. W	Egz.	Ć	L	S	ECTS Σ	U.Pr.	Poz.
1		E		2		2	2									
2				1		0										
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																
13				2		1	1									
14																
15																
16																
17				3		2	2									
18	2			2		3	2	1								
19																
20																
21																
22																
23	2			2		3	2	1								
24																
25																
26																
27	0,5			1,3		1	1									
28																
29	2	E		2		4	2	2								
30	2,5	E	0,5		0,3	3		3								
31	2					1		1								
32																
33	2		0,5		2	2		2								
34																
35																
36	1,8			0,3		2		2								
37																
38																
39																
40																
41																
42.4																
43.4																
44.4																
45.4																
46						6	6									
47										E				30	30	
48																
Total:	14,8	3	1	15,6	2,3	30			0	*1	0	0	0	30		
Weekly workload:	33,0								0,0							

No.	VII Semester 15 weeks W	Egz.	Ć	L	S	ECTS Σ	U.Pr.	Poz.	VIII Semester 15 weeks W	Egz.	Ć	L	S	ECTS Σ	U.Pr.	Poz.
1				2		2	2									
2				1		0						1		0		
3																
4									1					1		1
5									1					1		1
6									1					1		1
7																
8																
9																
10																
11																
12																
13																
14																
15																
16																
17																
18	2			2		4	2	2								
19																
20																
21																
22																
23																
24																
25	2	E		3	0,4	6	3	3								
26																
27									0,5			1		2	1	1
28	2					2		2								
29	2					2		2	1	E		2		4	2	2
30																
31	2	E		3		6	3	3								
32	2			2	0,3	5	2	3								
33	2	E			2	3		3								
34																
35																
36																
37									1				2	2	1	1
38																
39									1		1			1	1	
40									1					1		1
41									1					1		1
42.4									1				1	1		1
43.4									1			1	0,4	2	1	1
44.4									1				0,7	1		1
45.4									1	E			1	2		2
46																
47																
48														10	10	
Total:	14	3	0	13	2,7	30			13	2	1	5	5,1	30		
Weekly workload:	29,7								23,6							

	Compulsory courses required by the STCW	1st semester	2nd semester	3rd semester	4th semester	5th semester	6th semester	7th semester	8th semester
1	Training in the basic principles of providing medical first aid	X	–	–	–	–	–	–	–
2	Training in personal safety and shared responsibility	X	–	–	–	–	–	–	–
3	Training in individual rescue techniques	X	–	–	–	–	–	–	–
4	Fire protection training - basic level	X	–	–	–	–	–	–	–
5	Ship security training	–	–	–	X	–	–	–	–
6	Training for crew members assigned with security duties.	–	–	–	X	–	–	–	–
7	Training in command of a ship's power plant	–	–	–	–	–	–	–	X

* - includes STCW programme content

STUDY PLAN - FIRST-CYCLE FULL-TIME STUDIES

STUDY PLAN – FULL-TIME FIRST CYCLE STUDIES

Maritime University of Szczecin Faculty of Marine Engineering	Field: Mechanical Engineering Specialization: Marine Power Plant Operation Diploma awarding field: Computer control systems for a marine power plant	Approved by the Resolution of the Senate of Maritime University of Szczecin of 18.06.2020	Mandatory from the academic year 2020/2021 For first year student groups

Hours

No.	Course unit name	Σ	W	Ć	L	S	ECTS Σ	ECTS U.Pr.	ECTS Poz.
1	English*	198	0	0	198	0	14	14	
2	Physical education	84	0	0	84	0	0		
3	Communication techniques#	30	15	15	0	0	2	1	1
4	Entrepreneurship economy#	15	15	0	0	0	1		1
5	Human resources management#	15	15	0	0	0	1		1
6	Intellectual property protection#	15	15	0	0	0	1		1
7	Mathematics	156	72	84	0	0	14	6	8
8	Physics	105	45	0	60	0	9	4	5
9	Mechanics*	90	45	30	15	0	8	3	5
10	Material strength*	84	27	27	30	0	6	4	2
11	Engineering graphics*	75	0	0	75	0	5	5	
12	Introduction to applied computer science#	15	0	0	15	0	1	1	
13	Fundamentals of machine construction	108	54	0	54	0	8	3	5
14	Marine materials science*	60	30	0	30	0	5	2	3
15	Engineering of manufacturing I*	36	12	0	24	0	3	2	1
16	Engineering of manufacturing II – workshop practice*	69	0	0	69	0	5	5	
17	Engineering of manufacturing III – welding*	36	0	0	36	0	2	2	
18	Repair technology*	108	54	0	54	0	7	4	3
19	Technical thermodynamics*	69	30	15	24	0	6	3	3
20	Fluid mechanics*	30	15	15	0	0	2	1	1
21	Introduction to electrotechnics and electronics*	66	39	15	12	0	6	2	4
22	Electrical machines and propulsion*	75	45	0	30	0	7	2	5
23	Marine electrical engineering*	48	24	0	24	0	3	2	1
24	Fundamentals of automation and robotics*	45	15	15	15	0	4	2	2
25	Marine automation and metrology*	81	30	0	45	6	6	3	3
26	Technical Chemistry	45	15	0	30	0	3	2	1
27	Chemistry of water, fuel and lubricants*	44	14	0	30	0	3	2	1
28	Use of fuels and lubricants*	30	30	0	0	0	2		2
29	Marine reciprocating engines*	123	69	0	54	0	10	4	6
30	Marine boilers*	40	30	6	0	4	3		3
31	Marine machinery and equipment*	99	54	0	45	0	7	3	4
32	Refrigeration and air conditioning*	65	30	0	30	5	5	2	3
33	Marine power plants*	114	54	6	0	54	5		5
34	Introduction to ship construction and crew organization*	30	30	0	0	0	2		2
35	Ship theory and construction*	55	47	8	0	0	4	1	3
36	Ecological aspects of ship operation*	25	21	0	4	0	2		2
37	Operation of marine power plant equipment simulator*	45	15	0	0	30	2	1	1
38	Management of safe ship operation*	45	25	20	0	0	3	2	1
39	Organization of sea-going ships technical supervision*	30	15	15	0	0	1	1	
40	Maritime law and insurance*	15	15	0	0	0	1		1
41	Diploma seminar	15	15	0	0	0	1		1
42.5	*Programming control systems*	45	15	0	30	0	1	1	
43.5	*Algorithms and data structures*	30	15	0	10	5	2	1	1
44.5	*Distributed control systems*	40	25	0	0	15	2		2
45.5	*Data transmission protocols*	20	10	0	10	0	1	1	
46	Internship (Ministry of Science and Higher Education standards)	0	0	0	0	0	14	14	
47	Semestral internship (STCW)	0	0	0	0	0	30	30	
48	Diploma thesis	0	0	0	0	0	10	10	
	Total:	2668	1141	271	1137	119	240	146	94
	Weekly workload:								

Weekly lectures/classes in semester

No.	I Semester 15 weeks W	Egz.	Ć	L	S	ECTS Σ	U.Pr.	Poz.	II Semester 15 weeks W	Egz.	Ć	L	S	ECTS Σ	U.Pr.	Poz.
1				3		3	3					3		3	3	
2												1		0		
3	1		1			2	1	1								
4																
5																
6																
7	2	E	2			6	2	4	2		2			5	2	3
8	1			2		3	2	1	2	E		2		6	2	4
9	2	E	2			6	2	4	1			1		2	1	1
10																
11				2		2	2					3		3	3	
12				1		1	1									
13																
14	2	E		2		5	2	3								
15																
16																
17																
18																
19									2	E	1			4	1	3
20									1		1			2	1	1
21									1		1			2	1	1
22																
23																
24																
25																
26									1			2		3	2	1
27																
28																
29																
30																
31																
32																
33																
34	2					2		2								
35																
36																
37																
38																
39																
40																
41																
42.5																
43.5																
44.5																
45.5																
46																
47																
48																
Total:	10	3	5	10	0	30			10	2	5	12	0	30		
Weekly workload:	25,0								27,0							

No.	III Semester 12 weeks W	Egz.	Ć	L	S	ECTS Σ	U.Pr.	Poz.	IV Semester 15 weeks W	Egz.	Ć	L	S	ECTS Σ	U.Pr.	Poz.
1				2		2	2					2		2	2	
2				1		0						1		0		
3																
4																
5																
6																
7	1	E	2			3	2	1								
8																
9																
10	1	E	1			2	1	1	1		1	2		4	3	1
11																
12																
13	2					2		2	2	E		2		5	2	3
14																
15	1			2		3	2	1								
16				2		2	2					3		3	3	
17																
18																
19				2		2	2									
20																
21	2	E		1		4	1	3								
22									3	E		2		7	2	5
23																
24									1	E	1	1		4	2	2
25																
26																
27																
28																
29																
30																
31																
32																
33																
34																
35	2					2		2	1,5		0,5			2	1	1
36																
37																
38									1,7		1,3			3	2	1
39																
40																
41																
42.5																
43.5																
44.5																
45.5																
46						8	8									
47																
48																
Total:	9	3	3	10	0	30			10	3	3,9	13	0	30		
Weekly workload:	22,0								27,1							

No.	V Semester 12 weeks W	Egz.	Ć	L	S/P	ECTS Σ	U.Pr.	Poz.	VI Semester 15 weeks. W	Egz.	Ć	L	S	ECTS Σ	U.Pr.	Poz.
1		E		2		2	2									
2				1		0										
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																
13				2		1	1									
14																
15																
16																
17				3		2	2									
18	2			2		3	2	1								
19																
20																
21																
22																
23	2			2		3	2	1								
24																
25																
26																
27	0,5			1,3		1	1									
28																
29	2	E		2		4	2	2								
30	2,5	E	0,5		0,3	3		3								
31	2					1		1								
32																
33	2		0,5		2	2		2								
34																
35																
36	1,8			0,3		2		2								
37																
38																
39																
40																
41																
42.5																
43.5																
44.5																
45.5																
46						6	6									
47										E				30	30	
48																
Total:	14,8	3	1	15,6	2,3	30			0	*1	0	0	0	30		
Weekly workload:	33,0								0,0							

No.	VII Semester 15 weeks W	Egz.	Ć	L	S	ECTS Σ	U.Pr.	Poz.	VIII Semester 15 weeks W	Egz.	Ć	L	S	ECTS Σ	U.Pr.	Poz.
1				2		2	2									
2				1		0						1		0		
3																
4									1					1		1
5									1					1		1
6									1					1		1
7																
8																
9																
10																
11																
12																
13																
14																
15																
16																
17																
18	2			2		4	2	2								
19																
20																
21																
22																
23																
24																
25	2	E		3	0,4	6	3	3								
26																
27									0,5			1		2	1	1
28	2					2		2								
29	2					2		2	1	E		2		4	2	2
30																
31	2	E		3		6	3	3								
32	2			2	0,3	5	2	3								
33	2	E			2	3		3								
34																
35																
36																
37									1				2	2	1	1
38																
39									1		1			1	1	
40									1					1		1
41									1					1		1
42.5									1			2		1	1	
43.5									1			0,7	0,3	2	1	1
44.5									1,7	E			1	2		2
45.5									1			0,7		1	1	
46																
47																
48														10	10	
Total:	14	3	0	13	2,7	30			13	2	1	7	3,3	30		
Weekly workload:	29,7								24,5							

	Compulsory courses required by the STCW	1st semester	2nd semester	3rd semester	4th semester	5th semester	6th semester	7th semester	8th semester
1	Training in the basic principles of providing medical first aid	X	–	–	–	–	–	–	–
2	Training in personal safety and shared responsibility	X	–	–	–	–	–	–	–
3	Training in individual rescue techniques	X	–	–	–	–	–	–	–
4	Fire protection training - basic level	X	–	–	–	–	–	–	–
5	Ship security training	–	–	–	X	–	–	–	–
6	Training for crew members assigned with security duties.	–	–	–	X	–	–	–	–
7	Training in command of a ship's power plant	–	–	–	–	–	–	–	X

* - includes STCW programme content

Maritime University of Szczecin
FACULTY OF MARINE ENGINEERING

PLANS AND PROGRAMMES OF FIRST CYCLE FULL-TIME STUDIES

PART 2

FIELD OF STUDY - MECHANICAL ENGINEERING

SPECIALISATION - MARINE POWER PLANT OPERATION

Programmes approved by the Senate of the Maritime University of Szczecin 18.06.2020 - in force since the academic year 2020/2021

SZCZECIN 2020

Content and technical editing

Piotr Treichel, PhD Eng. / Marcin Szczepanek, PhD Eng.

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* - includes STCW programme content
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List of changes

Date	Contents of change	Notes
17 September 2019	Updating the programmes for Physics; Technical chemistry; Chemistry of water, fuel and lubricant.	
18 June 2020	Changing the name of On-Board Training to Semestral Practical Training, Adding the possibility of distance learning, remote subject completion and conducting distance examination for all courses.	

Date	Contents of change	Notes

General information about the course:

No.:	1	Course:	English *				
Major:	**Mechanical Engineering**	Specialisation:		**Marine Power Plant Operation**			
Studies cycle:	**First**	Form of studies:	**full-time**	Year of studies:	**1st-3rd, 4th.**	Semesters:	**1st-5th, 7th**
Course status:	**mandatory**	Course group:	**general**				

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	T	L	E	S	P	SE	IP	PR	A	T	L	E	S	P	SE	IP	PR	
First	15			3									45							3
2nd	15			3									45							3
3rd	12			2									24							2
4th	15			2									30							2
5th	12			2E									24							2
7th	15			2									30							2
Total during studies													198							14

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	General knowledge of a foreign language at the B1 level according to CEF

Course objectives:

1.	Acquiring the ability to use professional mechanical register of English at the B2 level according to CEF, allowing for professional work. Language competences in accordance with the STCW convention requirements tested by Marlins tests
2.	Acquisition of oral communication, writing and reading comprehension skills according to CEF B2 level

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Demonstrates knowledge of spoken and written English language, in the scope of technical vocabulary required in a professional environment	EK_U05, EK_U07, EK_U09, EK_K01
EKP2	Is fluent in Standard Marine Communication Phrases (STCW)	EK_U05, EK_U07, EK_U09, EK_K01
EKP3	Communicates with a team on operational level	EK_U05, EK_U07, EK_U09, EK_K01

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		1st	
L	EKP1,2,3	*The Marine Engineering Student* - exchange of information required in professional environment; *Present Simple* tense	45
	EKP1,2,3	*At sea* - nautical alphabet, numerals, spelling; *Present Simple* tense	
	EKP1,2,3	Pronouns, plural, articles	
	EKP1,2,3	*Places on Board* - description and positioning of items; *There is/are* construction, prepositions of place	
	EKP1,2,3	*Routine Activities on Board* - *Present Simple* tense, prepositions of time, reason, manner	
	EKP1,2,3	*Common operating & maintenance procedures in the power plant* - communication about servicing a ship power plant	
	EKP1,2,3	*What's happening on board the vessel?* - *Present Continuous* temse, contrastive exercises: *Present Simple vs. Present Continuous*, static verbs	
	EKP1,2,3	*Which way to the power plant?* - imperative; standard machine commands	
	EKP1,2,3	*In the messroom* - polite questions; *Can/Could you…*, *would like* constructions, indefinite pronouns	
	EKP1,2,3	*Cargo & supplies* - types of cargo; quantifiers *some/any/a lot* (*of*) / *much/many*	
	EKP1,2,3	*A new vessel* - adjective and adverb gradability	
	EKP1,2,3	*The last voyage* - *Past Simple* tense, irregular verbs, expressions *used to/would* for description of past habits, construction *be/get used to*	
	EKP1,2,3	*Incidents at sea & personal injuries* - ship safety, work safety	
Total in the semester:			45

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	45	3
Self study	25 (including e-learning)	
Participation in final tests and exams apart from classes	10	
Total	75	

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		2nd	
L	EKP1,2,3	*Maintenance duties* - communication regarding marine power plant operation, communication with crew members; *Present Perfect*, *Present Perfect Continuous* tenses	45
	EKP1,2,3	*What were you doing when the accident happened? - Past Continuous* tense, contrastive exercises: *Past Simple vs. Past Continuous*	
	EKP1,2,3	*Safety & emergency* - communication in alarm and emergency situations; imperative, modal verbs *must / needn't, mustn't*	
	EKP1,2,3	*Vessel in distress* - standard phrases for maritime communication in alarm and emergency situations, maritime safety vocabulary, description of behavior in emergency situations	
	EKP1,2,3	*My next voyage - Future Simple, Future Continuous, Future* Perfect, Future Perfect Continuous tenses, *be going to* construction	
	EKP1,2,3	Temporal sentences about the future, conjunctions: *as soon as, when, before, as long as, until*	
	EKP1,2,3	Sentences about the past, *Past Perfect, Past Perfect Continuous* tenses	
	EKP1,2,3	*Obligations, skills, duties, needs of marine engineer* - modal verbs: *must / have to, can / be able to, may / be allowed to, should / should have III, needn't have III, to be to*	
	EKP1,2,3	Grammar and vocabulary revision	
Total in the semester:			45

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	45	3
Self study	20 (including e-learning)	
Participation in final tests and exams apart from classes	10	
Total	75	

Programme content:

Form of clas-ses	EKP relation	Implemented content	Number of hours
Semester:		3rd	
L	EKP1,2,3	*Pirates on Board* - grammar and vocabulary revision	24
	EKP1,2,3	*Fire protection, fire fighting, checking equipment, damage control* - communication regarding ship handling, communication in alarm and emergency situations	

	EKP1,2,3	*Parts of the ship & her dimensions*, *General Arrangement Plan* - Ship construction terminology: hull structure, bulkheads, compartments, deck, tanks etc.; construction materials; ship theory terminology: dimensions, displacement, deadweight, planes, sections, plans, propellers etc.; passive voice	
	EKP1,2,3	*Engine room, manning it, basic equipment* - passive voice, *have sth done* structure	
	EKP1,2,3	*Measuring & fitting tools, basic instruments* - measuring and assembly tools as well as devices used during renovation and their application; passive voice, a passive structure for expressing a common opinion *The vessel is said to*	
Total in the semester:			24

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	**Estimated number of hours to complete the activity**	**ECTS points**
Total hours	24	2
Self study	15 (including e-learning)	
Participation in final tests and exams apart from classes	10	
Total	49	

Programme content:

Form of clas-ses	**EKP relation**	**Implemented content**	**Num-ber of hours**
Semester:		4th	
L	EKP1,2,3	*Ship propulsion* - typical drive units, elements of drive units	30
	EKP1,2,3	*Diesel Engines* - internal combustion piston engines, their types, structure, principle of operation	
	EKP1,2,3	*Fuel system* - types of fuels, properties, bunkering and fuel transport installation, fuel system, centrifuges	
	EKP1,2,3	*Lubrication* - function and systems of lubrication	
	EKP1,2,3	*Cooling the engine* - coolant types, cooling systems, cooling water installation, sea water installation, fresh water production equipment	
	EKP1,2,3	*Auxiliary Engines* - pumps and pumping systems, ballast installation, potable water installation, bilge water installation, bilge water treatment facilities, bilge water and sanitary sewage treatment facilities, ship operating fluids, incinerators, fire installation, ship boilers and steam installations, equipment and electrical installations, steering gear, deck equipment, hydraulic and pneumatic equipment and installations, compressors	
Total in the semester:			30

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	30	2
Self study	15 (including e-learning)	
Participation in final tests and exams apart from classes	10	
Total	60	

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		5th	
L	EKP1,2,3	*Operating procedures, maintenance, surveys* - terminology regarding repairs, procedures, documents, technological processes	24
	EKP1,2,3	*Maintenance & fault chart* - communication regarding marine power plant operation, messages of power plant monitoring devices, communication with crew members, communication in alarm and emergency situations, detection and removal of damage/defects, corrective actions; conditionals, *wish* construction	
	EKP1,2,3	*Relaying statements, questions, commands* - indirect speech, sequence of tenses, construction *had better, would rather*	
	EKP1,2,3	*Pollution prevention, preparing safety measures, ballast handling, liquid goods* - ship handling communication, ISM and ISPS procedures; expressing assumptions with modal verbs *must / may / might / can't be, must / may / might / can't have been*	
	EKP1,2,3	Revision of grammar, vocabulary and standard sea communication phrases	
	EKP1,2,3	Elements and measurements of control system, open-, closed-loop	
Total in the semester:			24

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	24	3
Self study	30 (including e-learning)	
Participation in final tests and exams apart from classes	15	
Total	69	

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		7th	
L	EKP1,2,3	Correspondence: orders, scope of repairs, complaints, defect description, post-accident protocol, reports, professional opinion, permits for special works, checklists	30
	EKP1,2,3	*Typical Diesel engines* - internal combustion piston engines, their elements, functional systems, operating parameters	
	EKP1,2,3	*Operating manuals* – reading and translation of manuals	
	EKP1,2,3	*How to write a CV?* - preparation of a curriculum vitae, job applications, preparation for an interview	
	EKP1,2,3	*Incidents & accidents, personal & occupational safety* - accidents on board, personal protection, work safety measures on board	
	EKP1,2,3	Typical Diesel engines - MAN, Sulzer	
	EKP1,2,3	General remarks on business letter writing - orders, reports, claims etc.	
Total in the semester:			30

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	30	2
Self study	20 (including e-learning)	
Participation in final tests and exams apart from classes	10	
Total	65	

Assessment methods and criteria:

Grades	**2**	**3**	**3.5–4**	**4.5 – 5**
Grading method	Written assignments; pop quiz; test (min. 2); e-learning tasks; oral answers; colloquium (min. 1) Grading possible with the use of distance learning methods and techniques			
EKP 1,2,3	A student does not answer or shows a very limited knowledge of vocabulary and linguistic structures making it impossible to perform the task, they construct statements chaotically, very poor content, are non-communicative, confuse and distort basic information. A student receives less than 51% of points for written assignments and oral presentations	A student shows limited knowledge of vocabulary and linguistic structures, commits numerous linguistic errors significantly disrupting communication and fluency of speech, errors in pronunciation and intonation, formulates incomplete answers to some questions, answers partially deviating from question asked, makes incomplete, one-sided	Represents a satisfactory knowledge of vocabulary and linguistic structures, commits linguistic errors that slightly disrupt communication, slight disturbances in the fluency of speech, uses correct pronunciation and intonation, formulates full answers slightly deviating from the matter of the question asked, demonstrates practical use of messages according to the given formulas in written form and	The skills demonstrated by the student, knowledge, language skills, used language structures and vocabulary go beyond the programme norms, student demonstrates the ability to formulate an action plan, creates original ideas (to score 5). Shows a very good level of knowledge of vocabulary and linguistic structures, makes few linguistic errors that do not interfere with communication, constructs a fluent utterance, uses correct pronunciation and intonation, acquires the skills

		oral or written presentations of the given material , presentation is reproductive. A student receives over 51% of points in written assignments and oral presentations	aspect of speech, correctly constructs presentations which are rich in content. Obtains 70–80% of points for written assignments and oral presentations	of interpreting and evaluating, and formulating problems and hypotheses (grade 4+). A student receives more than 80% of points from written assignments and oral presentations
Attendance	More than 6 hours of unjustified absence			

Or

Test Marlins	**X**	**Written - 80%**	**Level - junior engineer**	**Oral - Intermediate**

Teaching tools:

Type	Description
Computer lab + desktop and internet apps	50 vocational, grammar and testing programs + Professional DVD: VHF, Mareng, Marlins, Oxford, Professor Henry, Seagull, Videotel etc.
Multimedia room + exercise sets	Programs supplementing textbooks, DVD scripts, own presentations
Tape recorders + student's books, scripts	Comprehension exercises - professional and original programs
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature

1. Augustyniak-Klimczuk A., Mastalerz K .: *English basics for marine engineering students*.
2. Marlins: *English for seafarers*. Study Pack 1 & 2.
3. MARENG - computer program
4. *Standard maritime communication phrases* - IMO
5. Wysocki H .: *English for students of marine engineering*.
6. Buczkowska W .: *English across marine engineering*.
7. Jędraszczak H., Mastalerz K .: *English-Polish & Polish-English marine engineering dictionary*.
8. van Kluijven P .: *An English course for students St Marine College and for on board training*.

Complementary literature

1. Gunia M., Mastalerz K .: *Workbook on English grammar for mechanical engineering students*.
2. Cowley J .: *Running and maintenance of marine machinery*.
3. Puchalski J .: *Illustrated English Polish seaman's dictionary*.
4. Comfort J. et all: *Basic technical English*.
5. Seagull computer software and DVD
6. DVD - Videotell
7. Goral Z .: *An English-Polish description of a ship engine simulator*.
8. Góral Z .: *An English-Polish reference dictionary for a ship mechanic*.
9. Jakowczyk E .: *English for chief engineers*.
10. Jakowczyk E .: *English for mechanical engineering students*.
11. Babicz J .: *Shipbuilding dictionary*.
12. Babicz J .: *Dictionary of marine technology*.
13. MacGeorge HD: *Marine auxiliary machinery*.

14. Blakey TN: *English for maritime studies*.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Krzysztof Mastalerz, MA	k.mastalerz@am.szczecin.pl	SNJO
Other teachers:		
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Agnieszka Misiak, MA	a.misiak@am.szczecin.pl	SNJO
Katarzyna Zawadzka, MA	k.zawadzka@am.szczecin.pl	SNJO

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	2	Course:	Physical education				
Major:		Mechanical Engineering	Specialisation:		Marine Power Plant Operation		
Studies cycle:		First	Form of studies:	full-time	Year of studies:	1st-3rd, 4th.	Semesters: 2nd-5th, 7th-8th
Course status:		mandatory	Course group:	general			

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	T	L	E	S	P	SE	IP	PR	A	T	L	E	S	P	SE	IP	PR	
2nd	15			1									15							0
3rd	12			1									12							0
4th	15			1									15							0
5th * SSA	12			1									12							0
7th * SSA	15			1									15							0
8th * SSA	15			1									15							0
Total during studies													84							0

*** SSA - SELECTABLE SPORTS ACTIVITIES**

1. Students declare participation and implementation of sports activities selected from physical recreation activities:
   a) basic classes - classes organized by SWFiS: crossfit, fitness, team games, swimming, strength sports, rowing, other activities (e.g. at the students' request - corrective gymnastics);
   b) extended classes - classes organized by SWFiS in cooperation with the university club AZS AM (paid in part - AZS fee required): crossfit, fitness, team games, athletics, karate, swimming and diving, strength sports, sport shooting, table tennis, rowing and boating and sailing;
   c) advanced classes - classes organized in selected sports clubs and associations (fees apply - the university does not bear any costs of student participation).
2. Applying for credit for PE classes by recognizing the student's sports achievements:
   a) confirmed membership and participation in sports clubs and associations is the basis for applying for credit for PE classes.
   b) preparation and participation of university representatives at the Polish Academic Championships or other sports competitions are the basis for applying for credit for PE classes.
   c) it is also allowed to obtain credit for participation in PE classes as part of sports activities other than those mentioned in point 1, confirmed in a formal manner. Decisions in this matter are made by the head of the SWFiS.
3. If SSA (selective sports activities) are conducted in the semester, the student is responsible for choice of the activities. A student is allowed to participate in PE classes if they submit a written declaration to the SWFiS within the deadline provided to the students, and after launching the functionality at the Virtual University - a declaration submitted via the VU platform. Students who do not submit a written/electronic declaration on time will be assigned to groups or sections with vacancies.

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	There are no contraindications to exercise

Course objectives:

1.	Equipped with knowledge and skills to properly respond to a life and health threatening situation
2.	Exhibiting knowledge and skills in the field of organization and participation in various forms of activity focused on the development and maintenance of physical and professional fitness
3.	Getting to know the safety rules during classes with the use of sports and recreational equipment and the implementation of various forms of individual and team physical exertion
4.	Shaping the habit of actively spending free time and creating pro-health attitudes to maintain physical fitness allowing for professional activity

Course outcome:

No.	Description	EK codes for the direction
EKP1	A student demonstrates knowledge of techniques and methods used to shape physical fitness in various forms of physical activity. Has knowledge of safety rules and the organization of free time. Understands the concept of health and pro-health behaviors in order to maintain physical fitness and professional suitability	EK_W02
EKP2	Student can apply their knowledge in activities (including the basics of water rescue), can carry out movement tasks of a sports and recreational nature in order to shape and maintain physical fitness. Student can choose the means of technical support for sports and recreation and safety activities and use them and the equipment of sports facilities. Has the ability to self-assess physical fitness and health	EK_U05 EK_U11
EKP3	Presents the attitude of systematic care for physical fitness allowing for professional activity. Student presents the attitude of readiness to cooperate in a team, responsibility for team members and the tasks performed. Promotes social and cultural importance of sport and physical activity	EK_K02 EK_K01

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		2nd	
L	EKP1	Getting to know the course programme, rules of using the facility as well as the organization and safety during sports and recreational activities in the water	15
	EKP1	Learning to adapt to the aquatic environment - getting used to the limitation of vision, breathing and hearing. Preliminary skills diagnosis	
	EKP3	The use of natural human movement in the aquatic environment	
	EKP2	Learning basic movements to stay afloat	
	EKP2	Learning to move economically in water	

	EKP3	Learning to regulate breathing and taking a safe position in the water while lying on one's back to freely exchange air	
	EKP3	Learning the alternate movement of arms and legs in order to economize and minimize energy expense of the body in the supine position	
	EKP2	Learning to work arms and legs together in order to economize and minimize energy expense of the body in the supine position	
	EKP1	Learning to hold breath lying on chest	
	EKP3	Learning to move in the water in chest position	
	EKP3	Learning to move lying on with air exchange	
	EKP3	Learning to safely jump into the water	
	EKP2	Learning to fish items out of water	
	EKP3	Learning to move under water	
	EKP3	Checking outcomes of learning in selected forms of physical activity	
Total in the semester:			15

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	**Estimated number of hours to complete the activity**	**ECTS points**
Total hours	15	0
Self study		
Participation in final tests and exams apart from classes		
Total	15	

Programme content:

Form of classes	**EKP relation**	**Implemented content**	**Number of hours**
Semester:		3rd	
L	EKP3	Learning the rescue crawl	12
	EKP3	Learning to swim on the side	
	EKP3	Learning to transport and tow on one's side - rescue techniques	
	EKP2	Learning to tow in the supine position - rescue techniques	
	EKP2	Learning to secure a person with rescue equipment	
	EKP1	Learning to behave in water with clothes on	
	EKP1	Learning to use a life raft in a rescue operation simulation	
	EKP3	Learning to behave in water in difficult weather conditions	
	EKP3	Use of swimming accessories for exercises improving the technique of moving in the water	
	EKP2	Learning to move and evacuate from under the water	
	EKP2	Improvement of stamina in water	
	EKP1	Checking outcomes of learning - stamina	

	EKP3	Checking the outcomes of learning - technique	
Total in the semester:			12

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	**Estimated number of hours to complete the activity**	**ECTS points**
Total hours	15	0
Self study		
Participation in final tests and exams apart from classes		
Total	15	

Programme content:

Form of classes	**EKP relation**	**Implemented content**	**Number of hours**
Semester:		4th	
L	EKP3	Acquainting with the programme of the course, facility regulations, credit requirements and discussing the safety of classes. The importance of pre-work warm up	15
	EKP3	Learning to move at heights with specialized protective equipment. Exercises preparing to work at heights	
	EKP2	Getting to know the basic principles of lifting and moving objects independently and in a team. Exercises preparing to work with heavy load	
	EKP2	Learning to perform tasks in confined spaces, preparatory activities	
	EKP1	Shaping the basic motor features for a selected activity with the use of specialized equipment	
	EKP1	Learning how to organize free time for physical exercise with the use of non-standard items	
	EKP3	Checking outcomes of learning - task track	
Total in the semester:			15

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	**Estimated number of hours to complete the activity**	**ECTS points**
Total hours	15	0
Self study		
Participation in final tests and exams apart from classes		
Total	15	

Programme content:

<table>
<tr><th>Form of classes</th><th>EKP relation</th><th>Implemented content</th><th>Num-ber of hours</th></tr>
<tr><td colspan="2">Semester:</td><td colspan="2">5th (12h), 7th (15h), 8th (15h)</td></tr>
<tr><td rowspan="10">L</td><td>EKP3</td><td>Getting to know the program of activities, rules of using the facility as well as the organization and safety during sports and recreational activities</td><td rowspan="10">42</td></tr>
<tr><td>EKP1</td><td>Warm up as the basic form of preparing the body for exercise</td></tr>
<tr><td>EKP1</td><td>Getting to know basic individual techniques of selected sports and recreational disciplines</td></tr>
<tr><td>EKP2</td><td>Getting to know the basic rules and regulations of selected sports and recreational disciplines</td></tr>
<tr><td>EKP3</td><td>Learning to act as a spotter during exercises in selected sports and recreational disciplines</td></tr>
<tr><td>EKP3</td><td>Getting to know the purpose and proper use of technical means of physical exercises support in sports and recreational activities (accessories, instruments, trainers) using the equipment of the facility or natural conditions</td></tr>
<tr><td>EKP3</td><td>Getting to know the methods of planning individual development of selected motor skills used in sport and recreation</td></tr>
<tr><td>EKP1</td><td>Getting to know the methods of planning individual development of selected technical skills used in sport and recreation</td></tr>
<tr><td>EKP3</td><td>Getting to know the rules of organizing physical activities and acting as a referee during games, sports and recreational activities</td></tr>
<tr><td>EKP3</td><td>Checking outcomes of learning in selected forms of physical activity</td></tr>
<tr><td colspan="3">Total in semesters 5th-6th and 8th:</td><td>42</td></tr>
</table>

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

<table>
<tr><th>Form of activity</th><th>Estimated number of hours to complete the activity</th><th>ECTS points</th></tr>
<tr><td>Total hours</td><td>42</td><td rowspan="4">0</td></tr>
<tr><td>Self study</td><td></td></tr>
<tr><td>Participation in final tests and exams apart from classes</td><td></td></tr>
<tr><td>Total</td><td>42</td></tr>
</table>

Assessment methods and criteria:

Grades	2	3	3.5–4	4.5 – 5
Grading method	pass			
EKP1	Student does not know techniques and methods used to shape physical fitness in various forms of physical activity. Has no knowledge of safety rules and the organization of free time. Does not understand the concept of health and pro-health behaviors in order to maintain physical fitness and professional suitability	Student has sufficient knowledge of techniques and methods used to shape physical fitness in various forms of physical activity as well as safety and organization of free time. Understands the concept of health and pro-health behaviors in order to maintain physical fitness and professional suitability	Demonstrates good knowledge of techniques and methods used to shape physical fitness in various forms physical activity, safety rules and organization of free time. Understands the concept of health and pro-health behaviors in order to maintain physical fitness and professional suitability	The acquired knowledge goes beyond the core programme regarding techniques and methods used to shape physical fitness in various forms of physical activity as well as safety and organization of free time. Understands the concept of health and pro-health behaviors in order to maintain physical fitness and professional suitability
EKP2	Student is not able to apply their knowledge in activities (including the basics of water rescue), is not able to carry out movement tasks of a sports and recreational nature in order to shape and maintain physical fitness. Student is not able to choose the means of technical support for sports and recreational and safety activities, to use them and to use the equipment of sports facilities. Does not have the ability to self-assess mobility and health	Student knows how to apply knowledge to activities (including the basics of water rescue) at a basic level. Physical tasks of a sports and recreational nature in order to shape and maintain physical fitness are sufficiently performed. Is able to choose the means of technical support for sports, recreation and safety activities, use them and the equipment of sports facilities. Has the ability to self-assess physical fitness and health	Makes good use of knowledge in activities (including the basics of water rescue). Can carry out motor tasks of a sport and recreational nature in order to shape and maintain physical fitness. Selects the means of technical support for sports and recreational and safety activities well, uses them and the equipment of sports facilities. Has the ability to self-assess physical fitness and health	Applies knowledge to activities (including the basics of water rescue) at a very good level. Performs sport and recreational techniques in order to shape and maintain physical fitness at an exemplary level. Advises others on how to choose the means of technical support for sports, recreation and safety activities, to use them and to use the equipment of sports facilities. Has the ability to self-assess physical fitness and health
EKP3	Does not show the attitude of systematic attention to physical fitness enabling professional activity. Does not show the attitude of readiness to cooperate in a team, responsibility for team members and the tasks performed. Does not promote the social, cultural importance of sport and physical activity	Presents the attitude of systematic care for physical fitness enabling basic professional activity. Cooperates sufficiently in the team and is responsible for team members and the tasks performed. Promotes the social and cultural importance of sport and physical activity to a minimal extent	Demonstrates a good attitude of systematic attention to physical fitness enabling professional activity and readiness to cooperate in a team and responsibility for team members and the tasks performed. Promotes social and cultural importance of sport and physical activity	Presents an exemplary attitude of systematic care for physical fitness enabling professional activity. Presents the attitude of readiness to cooperate in a team, responsibility for team members and the tasks performed, assuming a managerial function. Promotes the social and cultural importance of sport and physical activity by engaging in the activities of associations

Teaching tools:

Type	Description
Accessories	for swimming
	emergency services,
	harness, bodybuilding gym equipment, rope
Equipment	gymnastic ladders, truss, climbing ropes, trainers, lifeboats

References:

Core literature
1. Nawara H .: *Badminton*. 2. Laughlin T.: *Pływanie dla każdego*. 3. Bilski W.: *Tenis stołowy*. 4. Huciński T.: *Koszykówka*. 5. Zatyracz Z., Piasecki L.: *Piłka siatkowa*. 6. Orzech J.: *Monografia treningu siły mięśniowej.*
Complementary literature
1. Kruszewski M.: *Metody treningu i podstawy żywienia w sportach siłowych*. 2. Sieniek Cz.: *Sporty całego życia*. 3. Salski D.: *Vademecum ratownika wodnego*. 4. Wade P.: *Convict Conditioning*.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Artur Lipecki, MA	a.lipecki@am.szczecin.pl	SWFiS
Other teachers:		
Jakub Chuta, MA	j.chuta@am.szczecin.pl	SWFiS
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Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	**3**	Course:	**Communication techniques**					
Major:		**Mechanical Engineering**	Specialisation:		**Marine Power Plant Operation**			
Studies cycle:		**First**	Form of studies:	**full-time**	Year of studies:	**First**	Semesters:	**First**
Course status:		**elective**	Course group:	**general**				

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	T	L	E	S	P	SE	IP	PR	A	T	L	E	S	P	SE	IP	PR	
First	15	1	1								15	15								2
Total during studies											15	15								2

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Humanistic knowledge at the secondary school level
2.	Awareness of the need to improve one's communication skills

Course objectives:

1.	Introducing students to the principles of effective communication in broadly understood social situations
2.	Increasing communication skills useful in various social situations
3.	Practical preparation of students to communicate in an international work environment

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Shows theoretical knowledge in the field of social communication	EK_U03
EKP2	Understands the process of social communication and can effectively use communication techniques	EK_K01, EK_K03
EKP3	Differentiates social situations and has basic skills in creating correct forms of communication depending on the recipient group	EK_W05, EK_K02
EKP4	Is aware of cultural differences in terms of interpersonal communication	EK_W01
EKP5	Demonstrates practical group communication skills	EK_U03

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		First	
A	EKP1	Cultural aspects of interpersonal communication.	15
	EKP2	Psychology of communication.	
	EKP3	Interpersonal communication	
	EKP4	Group communication.	
E	EKP5	Communication barriers and conflict.	15
	EKP5	Indirect communication (via available media: telephone, computer, letters and others).	
	EKP5	Self-presentation in official situations. Job interview.	
Total in the semester:			30

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	30	2
Self study	20	
Participation in final tests and exams apart from classes	2	
Total	52	

Assessment methods and criteria:

Grades	**2**	**3**	**3.5–4**	**4.5 – 5**
Methods of evaluation	Assessment of activity in the classroom, written single-choice test. Assessment possible using distance learning methods and techniques			
EKP1	Student does not recognize rules important for communication	Knows and understands the essence of communication	Understands the essence, can discuss the goals of communication	Identifies all the rules of communication
EKP2	Does not know the basic mechanisms of group communication	Correctly defines the elements of the market mechanism when directed	Characterizes the elements and operation of the communication barrier mechanism	Defines interdependencies between the elements of the cultural aspect of interpersonal communication
EKP3	Does not know basics of and does not understand the concept of multiculturalism	Understands the principles of creating national income	Defines principles of creating Autopresentation in official situations	Shows in-depth knowledge of the principles of creating interpersonal communication
EKP4	Does not know basics of communication and self-presentation	Correctly identifies individual entities in the communication process when directed	Characterizes participation of individual entities in the communication process	Defines the principles of rational psychology of communication

Teaching tools:

Type	Description
Projector	Lectures partly conducted as a multimedia presentation
Academic textbooks	
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. Dobek-Ostrowska B., Podstawy komunikowania społecznego, Wrocław "Astrum", 2004
2. Aronson E., Człowiek istota społeczna, Wydawnictwo Naukowe PWN, Warszawa 2009.
Complementary literature
1. Boski P., Kulturowe Ramy Zachowań Społecznych. Podręcznik psychologii międzykulturowej, 2009, Wydawnictwo Naukowe PWN, Warszawa 2009..

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Patrycja Nrękiewicz, PhD Eng.	p.narekiewicz@am.szczecin.pl	WIET
Other teachers:		

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	4	Course:	Entrepreneurship economy					
Major:		**Mechanical Engineering**	Specialisation:		**Marine Power Plant Operation**			
Studies cycle:		**First**	Form of studies:	**full-time**	Year of studies:	**4th**	Semesters:	**8th**
Course status:		**elective**	Course group:	**general**				

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	E	L	EL	S	P	SE	TW	PR	A	E	L	EL	S	P	SE	TW	PR	
8th	15	1									15									1
Total during studies											15									1

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	

Course objectives:

1.	Preparation for working with principles characteristic of a market economy
2.	Getting to know the principles of creating, recording and distributing the national income as well as the issues of economic growth
3.	Explanation of the basic categories of market mechanisms
4.	Defining the role of individual entities in the management process

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Student knows and understands the essence, goals and rules of management	EK_W05, EK_K02
EKP2	Identifies the basic elements of the market mechanism	EK_W02, EK_W04, EK_W05
EKP3	Understands creation, recording and distribution of the national income and the issues of economic growth	EK_W02, EK_W05, EK_K03
EKP4	Defines the role of individual entities in the management process	EK_W02, EK_W05, EK_K03

Programme content:

Form of clas-ses	EKP relation	Implemented content	Num-ber of hours
Semester:		8th	
A	EKP1,3	1. The essence, goals and regularities of management	15
	EKP1,3	2. Economy as an economic system. Characteristics of basic economic systems	
	EKP1,4	3. Creation, recording and distribution of the national income	
	EKP1,2,3,4	4. Market economy - basic categories	
	EKP1,2,3,4	5. Market of goods and services	
	EKP2,3	6. Securities market Stock exchange functioning	
	SEKP6	7. Labour market Supply and demand for labor	
	EKP1,2	8. Unemployment as a manifestation of the labor market inbalance. Types, causes and effects of unemployment. Unemployment and in-flation.	
	EKP1,2,3,4	9. Enterprise in a market economy. Legal forms, enterprise develop-ment strategies	
	EKP2,3	10. Fiscal policy Government budget	
	EKP2,3	11. Budget income and expenses. Taxes - types	
	EKP2,3	12. Monetary policy Money - evolution of money, its functions, basic operations	
	EKP2,3	13. Banks' tasks and goals. The Central Bank	
	EKP1,3	14. International economic cooperation and economic integration	
	EKP1,3	15. The main socio-economic problems of the modern world	
Total in the semester:			15

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	15	1
Self study	8	
Participation in final tests and exams apart from classes	2	
Total	25	

Assessment methods and criteria:

Grades	2	3	3.5–4	4.5 – 5
Methods of evalua-tion	Assessment of activity in the classroom, written single-choice test. Assessment possible using distance learning methods and techniques			

EKP1	Student does not recognize essential management rules	Knows and understands the essence of management	Understands the essence, can discuss the goals of management	Determines all management rules
EKP2	Does not know the basic operation of the market mechanism	Correctly defines the elements of the market mechanism when directed	Characterizes the elements and operation of the market mechanism and relates them to the problems of economic growth	Defines the interdependencies between the elements of the market mechanism in terms of market equilibrium; analyzes the problems of economic growth
EKP3	Does not know the basic extent and does not understand the concept of national income	Understands the principles of creating national income	Characterizes the principles of creating and distributing the national income	Shows in-depth knowledge of the principles of creating and distributing the national income; defines measures of national income
EKP4	Does not know the basic scope of the management process and its elements	Correctly identifies individual entities in the management process, when directed	Characterizes the participation of individual entities in the management process	Defines the principles of rational management and applies them to business entities

Teaching tools:

Type	Description
Projector	Lectures partly conducted as a multimedia presentation
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
3. Samuelson P.K., Nordhaus W.D.: *Ekonomia.* PWN, Warszawa 2003. 4. Kwiatkowski E., Milewski R.: *Podstawy ekonomii.* PWN, Warszawa 2008. 5. Marciniak S.: *Makro- i mikroekonomia – Podstawowe problemy.* Wydawnictwo Naukowe PWN, Warszawa 2001.
Complementary literature
2. Nasiłowski M.: *Podstawy mikro- i makroekonomii*. Key Text, Warszawa 2006. 3. Beksiak J.: *Ekonomia*. Warszawa 2000.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
		WIET/
Other teachers:		

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	5	Course:	Human resources management				
Major:	Mechanical Engineering	Specialisation:		Marine Power Plant Operation			
Studies cycle:	First	Form of studies:	full-time	Year of studies:	4th	Semesters:	8th
Course status:	elective	Course group:	general				

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	E	L	EL	S	P	SE	TW	PR	A	E	L	EL	S	P	SE	TW	PR	
8th	15	1									15									1
Total during studies											15									1

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	

Course objectives:

1.	Acquiring knowledge of the basic concepts of work and management
2.	Acquiring organization and management skills
3.	Acquisition of teamwork organization skills
4.	Mastering the ability to motivate and communicate in the work process

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Student knows the basic concepts and functions regarding work and management	EK_W02, EK_W04, EK_U05, EK_U11, EK_U09, EK_U01
EKP2	Can plan and organize work in changing conditions	EK_W04, EK_U07, EK_U05, EK_U01, EK_K02

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		8th	
A	EKP1	1.Basic concepts of human work and management	15
	EKP1	2.Main legal acts regulating human work	
	EKP1,2	3.Basic management functions	
	EKP1,2	4.Principles of teamwork organization. Efficient work organization principles	
	EKP1,2	5.Human functions in the work process	

	EKP2	6.Work scheduling	
	EKP2	7.Managing people in the work process	
	EKP1,2	8.Motivating at work	
	EKP2	9.Rules of Professional Ethics Ethical aspects of working at sea	
	EKP2	0.Sources of stress in the seafaring profession. Conflicts at work	
	EKP2	1.Communication at work	
	EKP2	2.Work and management in changing conditions	
Total in the semester:			15

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	15	1
Self study	8	
Participation in final tests and exams apart from classes	2	
Total	25	

Assessment methods and criteria:

Grades	**2**	**3**	**3.5–4**	**4.5 – 5**
Methods of evaluation	Written or oral test, Assessment possible using distance learning methods and techniques.			
EKP1	Knowledge of issues related to work science and management below 50%	50% knowledge of issues in the field of work science and management	70% knowledge of issues in the field of work science and management	85% knowledge of issues in the field of work science and management
EKP2	Less than 50% knowledge of the subjects in question	50% knowledge of the subjects in question	70% knowledge of the subjects in question	85% knowledge of the subjects in question

Teaching tools:

Type	Description
computer, multimedia projector	Auditorium classes in the form of multimedia presentations and films
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature

1. Stoner J., Freemanm R., Gilbert D.: *Kierowanie*. Polskie Wydawnictwo Ekonomiczne, Warszawa 2011.
2. Penc J.: *Decyzje i zmiany w organizacji*. Centrum Doradztwa i Informacji Difin Sp. z o.o., Warszawa 2008.

3. Jarmołowicz W.: *Gospodarowanie pracą we współczesnym przedsiębiorstwie.* Wydawnictwo Forum Naukowe, Poznań 2007. 4. Penc J.: *Nowoczesne kierowanie ludźmi.* Difin, Warszawa 2007. 5. Dannelon A.: *Kierowanie zespołami.* Helion, Gliwice 2007. 6. Hardingham A.: *Praca w zespole.* Petit, Warszawa 2004. 7. Sajkiewicz A., Sajkiewicz Ł.: *Nowe metody pracy z ludźmi.* Poltext, Warszawa 2002.
Complementary literature
1. Griffin R.W.: *Podstawy zarządzania organizacjami.* Wydawnictwo Naukowe PWN, Warszawa 2010. 2. Forsyth P.: *Efektywne zarządzanie czasem.* Wydawnictwo Helion, Gliwice 2004. 3. Anderson R.: *Organizacja zebrań.* K.E. Liber, Warszawa 2003. 4. Christowa Cz.: *Podstawy budowy i funkcjonowania portowych centrów logistycznych.* Wydawnictwo Akademii Morskiej w Szczecinie, Szczecin 2005.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Artur Rzempała, PhD	a.rzempala@am.szczecin.pl	WIET
Other teachers:		

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	6	Course:	Intelectual property protection					
Major:		**Mechanical Engineering**	Specialisation:		**Marine Power Plant Operation**			
Studies cycle:		**First**	Form of studies:	**full-time**	Year of studies:	**4th**	Semesters:	**8th**
Course status:		**elective**	Course group:	**general**				

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	E	L	EL	S	P	SE	TW	PR	A	E	L	EL	S	P	SE	TW	PR	
8th	15	1									15									1
Total during studies											15									1

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	

Course objectives:

1.	Developing the skills to use basic knowledge on copyright, protection of moral rights and economic copyrights, features of a patent and utility model and the procedure for their reporting, criminal liability in the field of copyright infringement and patent protection
2.	Developing the ability to solve problems related to "objects" subject to copyright and patent protection, using the provisions regulating copyright and patent protection as well as knowledge of the procedure of patent and utility model application

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Student can recognize and apply basic knowledge of copyright and patent protection in a proper way	EK_W02, EK_W05, EK_U05, EK_U11
EKP2	Has the ability to use the provisions governing copyright and patent protection	EK_W02, EK_W05, EK_U05, EK_U11

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		8th	
A	EKP 1.2	Regulations governing copyright and patent protection	15
	EKP1	Copyright law subject and object	
	EKP 1.2	Author's moral and proprietary copyrights	

	EKP 1.2	Scope of use of protected works and duration of economic copyrights	
	EKP1	Transfer and clearance of copyrights and property rights	
	EKP 1.2	Details of the protection of audiovisual works and computer programs	
	EKP 1.2	Protection of moral and economic copyrights	
	EKP 1.2	Protection of the image, the addressee of correspondence and the secrecy of information sources	
	EKP 1.2	Rights to artistic performances and scientific achievements	
	EKP 1.2	Collective organizations managing copyrights	
	EKP1	Patent protection - general information	
	EKP1	Patent - characteristics, reservation of rights	
	EKP1	Utility model - characteristics, reservation of rights	
	EKP1	Organization of patent protection in Poland - patent and utility model application procedure	
	EKP 1.2	Criminal liability for infringement of copyright and patent protection	
	Total		15
Total in the semester:			15

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	15	1
Self study	8	
Participation in final tests and exams apart from classes	2	
Total	25	

Assessment methods and criteria:

Grades	2	3	3.5–4	4.5 – 5
Methods of evaluation	Written work, Assessment possible with the use of distance learning methods and techniques.			
EKP1 EKP2	Student has no knowledge of copyright and patent law	Has minimal knowledge of copyright and patent law	Can properly partially use the issues related to copyright and patent law	Can properly use copyright and patent law in full extent

Teaching tools:

Type	Description
Projector	Auditorium classes in the form of a multimedia presentation

Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. The Act of February 4, 1994 on copyright and related rights 2. The Act of June 30, 2000 - Industrial property law
Complementary literature

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
		WIET
Other teachers:		

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,

E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	7	Course:	Mathematics				
Major:	Mechanical Engineering		Specialisation:		Marine Power Plant Operation		
Studies cycle:	First	Form of studies:	full-time	Year of studies:	1st-2nd	Semesters:	1st – 3rd
Course status:	mandatory	Course group:	primary				

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	E	L	EL	S	P	SE	TW	PR	A	E	L	EL	S	P	SE	TW	PR	
First	15	2E	2								30	30								6
2nd	15	2	2								30	30								5
3rd	12	1E	2								12	24								3
Total during studies											72	84								14

Prerequisite knowledge, skills and other competences

1.	Knowledge: core curriculum for secondary schools - operations in a set of real numbers, algebraic expressions, - functions: linear, quadratic, polynomials, exponential functions, trigonometric functions, - vector calculus and analytical geometry on a plane, - numerical sequences, - probability calculus and mathematical statistics
2.	Skills: - using short multiplication formulas, operations on powers and roots - solving algebraic equations and inequalities - operations on vectors - testing monotonicity of number sequences - using trigonometric formulas - calculating probability and basic statistical parameters

Course objectives:

1.	Providing knowledge on selected areas of mathematics and developing the ability to use mathematics to solve technical problems
2.	Acquainting with the basic mathematical disciplines necessary to study technical faculties
3.	Developing the ability to accurately formulate problems based on the mathematical language
4.	Achieving the skill of logical reasoning, using deduction to formulate and interpret conclusions

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Has structured and well-established knowledge of the basic areas of mathematics	EK_W05
EKP2	Has knowledge of mathematics necessary to formulate and solve problems in a selected engineering discipline	EK_W05
EKP3	Can use mathematical methods aided with digital techniques for computer simulations and drawing conclusions and interpreting the results of calculations	EK_W05, EK_U11, EK_U07, EK_U01
EKP4	Has the ability to use mathematical literature and internet resources	EK_U05, EK_U11, EK_U06
EKP5	Has the ability to apply knowledge of mathematics to study in a given field of technical studies	EK_U05, EK_U07, EK_U09, EK_K01

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		First	
A	EKP 1,2,3	Differential calculus of one real variable functions: supplementary information on functions (cyclometric functions), limits of sequences and functions, derivative and differentials of functions, derivatives and differentials of higher order, mean value theorems, Taylor's formula, de L'Hospital rules, comprehensive study of functions variability	30
	EKP 1,2,3	Integral calculus of one real variable functions; indefinite integral, basic theorems, integration methods, integration of rational, irrational and trigonometric functions, definite integral (definition according to Riemann), basic theorems and properties of definite integrals, improper integrals, definite integral applications in geometry	
	EKP 1,2,3	Differential calculus of multivariable functions: plane sets, definition of multivariable functions, limit and continuity of two-variable functions, partial derivatives, derivatives of complex functions, complete differential, higher order partial derivatives and complete differentials, application of the total differential in the error calculus, Taylor formula, extremes multivariable functions	
E	EKP 1,2,3	Finding derivatives of functions of one variable; determining the extremes of functions and monotonicity intervals; determination of inflection points and compartments of convexities and concavities; determining asymptotes; comprehensive studies of the variability of one real variable	30
	EKP 1,2,3	Finding the total differential and applying it in the calculus of errors; determination of local, global and conditional extremes of functions of several variables; expansion of functions of one and more variables according to the Taylor formula	
	EKP 1,2,3	Application of integration methods to determine indefinite integrals; calculation of definite integrals, improper integrals, multiple and line integrals; calculation of definite integrals, improper integrals, multiple and line integrals; calculating the areas of plane figures, lengths of arcs, volumes and areas of revolutions with the help of integrals	
Total in the semester:			60

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	60	6
Self study	40	
Participation in final tests and exams apart from classes	30	
Total	130	

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		2nd	
A	EKP 1,2,3	Higher algebra: complex numbers set, definition of a complex number, Cartesian and trigonometric form of a complex number, de Moivre formula, operations on complex numbers. Matrices and determinants: matrix definition, matrix types, matrix operations, inverse matrix, determinant definition and properties, matrix rank, systems of linear equations, Cramer's formulas, Kronecker-Capelli theorem	30
	EKP 1,2,3	Analytical geometry in R3 space: vector calculus, plane and line equations, distance between a point and a line, distance between a point and a plane and a straight line, distance between a straight line and a straight line, surface of the second degree, rotational surfaces	
	EKP 1,2,3	Integral calculus of multivariable functions: definition and basic properties of a double integral in the normal region, triple integral, conversion of multiple integrals into iterated integrals, variable replacement, curvilinear integrals, Green's theorem, geometric applications of multiple and line integrals	
E	EKP 1,2,3	Performing operations on complex numbers and solving algebraic equations in a complex numbers set; solving systems of linear equations with determinants and matrices	30
	EKP 1,2,3	Performing operations on vectors in the R3 space; determination of plane and line equations and distance calculation	
	EKP 1,2,3	Calculation of multiple and curvilinear integrals; application of multiple and curvilinear integrals in geometry	
Total in the semester:			60

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	60	5
Self study	40	
Participation in final tests and exams apart from classes	10	
Total	110	

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		3rd	
A	EKP 1,2,3	Numerical and functional series: definition of a number series, criteria of series convergence with non-negative terms, alternating series, conditionally and absolutely convergent number series, functional series and series, power series, Taylor series	12
	EKP 1,2,3	Ordinary differential equations: first-order differential equations (selected types), second-order differential equations (special cases), second-order linear differential equations with constant coefficients	
	EKP 1,2,3	Probability calculus: elementary events, random events, definition of probability, probability properties, conditional probability, independence of random events, Beroulli's scheme, total probability, Bayes' formula, random variables of step and continuous type, probability distributions of random variables, parameters of random variables, random variables two-dimensional step type and continuous type, covariance, correlation coefficient, correlated random variables, independence of random variables	
	EKP 1,2,3	Fundamentals of mathematical statistics: basic concepts and theorems, selected probability distributions occurring in mathematical statistics, estimators and their basic properties, methods of obtaining estimators, confidence intervals, verification of statistical hypotheses, basic statistical tests	
E	EKP 1,2,3,4	Study of convergence of numerical and functional series; expanding functions into Taylor series and determining non-elementary integrals using power series	24
	EKP 1,2,3	Solving selected types of ordinary differential equations of the 1st and 2nd order using the quadrature method	
	EKP 1,2,3	Calculating the probabilities of random events and determining the parameters of random variables; determination of confidence intervals; verification of statistical hypotheses	
Total in the semester:			36

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	36	3
Self study	20	
Participation in final tests and exams apart from classes	30	
Total	86	

Assessment methods and criteria:

Grades	**2**	**3**	**3.5–4**	**4.5 – 5**
Methods for evaluation	Oral exam, written exam, periodic assignments, tests, homework assignments. Assessment possible with the use of distance learning methods and techniques.			

Calculation of string boundaries numerical and function limits	Student cannot calculate any limit of sequence and function	Can calculate the limits of the sequence, the elements of which are quotients of polynomials, calculates the limits of elementary functions at and in ±∞, determines the asymptotes of rational functions	Same as for the "3 plus" grade: calculates moderately difficult boundaries of sequences and functions at the point w ±∞ leading to indefinite symbols ∞ / ∞, ∞ – ∞, examines the continuity of functions described by one equation, determines the asymptotes of irrational functions. Calculates limits of sequences and functions of varying difficulty, uses the three-sequence theorem to calculate limits of sequences, tests the continuity of spline functions	Same as for the "4 plus" grade: based on the definition, student shows that a given number is a sequence or function limit. Uses a specialized mathematical language to describe solutions to tasks and problems, uses number sequences and their limits, functions and their limits
Calculation of function derivatives	Cannot define derivatives of functions	Designates derivatives and differentials of elementary functions, sums of functions, difference of functions, constant product and function, product of two elementary functions, quotient of two elementary functions	Same as for the "3 plus" grade: student determines the derivatives and differentials of functions consisting of two functions, gives a geometric interpretation of the derivative of a function, uses the differential of the function in approximate calculations, and on the basis of the definition, determines the derivative of a rational function. Determines the derivatives and differentials of multiple complex functions, examines the differentiability of not too complicated functions, on the basis of definitions determines the derivative of trigonometric, logarithmic, irrational functions	Same as for the "4 plus" grade: investigates the differentiability of functions of various difficulty levels, applies the derivative inverse theorem. Uses a specialized mathematical language to describe solutions to tasks and problems, using the notion of the derivative of a function
Use of function derivatives	Cannot use derivatives of functions	Examines the monotonicity of elementary functions, determines the extremes of these functions, examines the convexity, concavity of elementary functions, determines their inflection points, applies the de l'Hospital rule to calculate the limit of the quotient of elementary functions	Same as for "3 plus" grade: examines the monotonicity of functions composed of two functions, determines the extremes of these functions, examines the convexity and concavity of these functions, determines their inflection points, uses the de l'Hospital rule to calculate the limits of the quotient, the product of the difference of such functions, determines the asymptotes of various functions. Examines the monotonicity, convexity, concavity of various functions, determines their extremes and inflection points, applies the de l'Hospital rule to determine the limits of various functions, writes the Taylor and Maclaurin formula for the polynomial of rational, exponential and trigonometric functions	Same as for "4 plus" grade: examines the course of variability of various functions. Uses a specialized mathematical language to describe solutions to tasks, problems leading to the study of monotonicity, convexity, concavity of functions, determining their extremes, inflection points
Defining partial derivatives of functions	Cannot calculate partial derivatives of functions	Finds first and second order partial derivatives of simple functions of two variables	Same as for the "3 plus" grade: determines the first, second and third order partial derivatives of simple functions of three variables. Defines complete differentials of functions of two variables	Same as for the 4 grade, plus: determines the total differentials of functions of three variables. Determines directional derivatives of functions of two variables

Use of partial functions derivatives	Cannot use partial derivatives	Determines the extremes of simple functions of two variables	Same as for the 3 grade, plus: Calculates the approximate value of an expression. Determines the smallest, the largest value of a simple function of two variables in a closed and bounded area	Same as for the 4 grade, plus: determines the extremes of different functions of two variables. Uses a specialized mathematical language to describe solutions to tasks, problems with the use of partial derivatives of functions of two variables
Calculation of integrals	Cannot calculate integral of a polynomial	Calculates integrals of polynomials	Uses integration by substitution or by parts in the indicated integrals. Applies integration by substitution and by parts to indicated integrals	Can independently choose the method of integration and apply it
Appointment of geometrical entities	Student is unable to draw the area specified by the task or is unable to define the section area	Draws an area based on Cartesian coordinates, calculates its area and defines that area	Determines the indicated geometrical entity in Cartesian coordinates. Determines the indicated geometrical entity in the parametric description	Determines the indicated geometrical entity in polar coordinates. Determines geometrical entities in any coordinates
Methods of evaluation	Periodic assignments, tests, homework. Assessment possible using distance learning methods and techniques			
Operations on sets of composite numbers	Cannot perform any operation on a set of complex numbers	Presents the Cartesian form, trigonometric form of a complex number and its geometric interpretation, presents the conjugate number to a given complex number, adds, subtracts, multiplies, divides the complex numbers in Cartesian form, multiplies and divides the complex numbers in trigonometric form, uses de Moivre's formula to denote n-th power of a complex number, uses the formula for k-th root of a complex number	Same as for 3 grade, plus: presents the exponential form of a complex number, marks n-th power of a complex number and notes the result (if possible) in Cartesian form, determines the roots of the complex number based on the definition and theorem, and leaves the result (if possible) in Cartesian form. Solves simple equations in the set of complex numbers	Same as for the 4 grade, plus: interprets the geometrically given sets of complex numbers. Uses a specialized mathematical language to describe solutions to tasks and problems in which complex numbers appear
Operations in the matrix set	Cannot perform any operations in the matrix set	Adds, subtracts matrices, multiplies a matrix by a scalar, finds a transposed matrix, multiplies square matrices, calculates the determinant of a matrix of degree 1, 2, and degree 3 using Saruss's formula	As for the "3 plus grade": determines the product of not necessarily square matrices, finds inverse matrix for a given example, calculates the determinant of a square matrix of n-th degree by definition (Laplace expansion). Performs sequences of operations on matrices, solves matrix equations, calculates the rank of a matrix using the concept of a minor	As for a 4 grade, plus : calculates the determinant of n-th degree matrix using the theorems and properties of the determinant, computes the rank of the matrix, bringing the matrix to its reduced form. Uses a specialized mathematical language to describe solutions to tasks and problems

Solving systems of linear equations	Student cannot solve systems of linear equations	Applies the matrix method and the Cramer method to solve a system of equations with three unknowns and three equations	As for the 3 grade, plus: uses the matrix method and the Cramer method to solve systems of equations for n unknowns and n equations. Based on the Kronecker-Capelli theorem, determines the number of solutions to a system of linear equations	As for the 4 grade, plus: solves systems of linear equations with n unknowns and m equations. Uses a specialized mathematical language to describe solutions to tasks, problems leading to systems of linear equations
Notes equation of a plane	Cannot note equation of a plane	Saves the plane equation based on a given point belonging to the plane and the normal vector of the plane, calculates the distance of the point from the plane, can determine the coordinates of the normal vector of the plane based on the determination of the vector coordinates and give the plane equation, finds the intersection point of the planes	As for 3 grade, plus: finds the plane equation based on two vectors parallel to this plane, but not parallel to each other, can write a plane equation based on three points belonging to this plane, examines whether two planes are parallel, perpendicular, determines the angle between these planes, calculates the distance between the planes. Finds the equation of a plane passing through a given point and parallel to another plane, finds the equation of a plane passing through a given point and perpendicular to two non-parallel planes, gives the segmental equation of a plane, finds the equation of a plane parallel to a given plane and distant from it by a given distance	As for the 4 grade, plus: finds the equations of planes of bisectors of angles between given planes, finds the equation of a plane passing through a given axis of the coordinate system and forming a given angle with a given plane, finds the symmetrical point of a given point in relation to a given plane. Uses a specialized mathematical language to describe solutions to tasks and problems
Notes the line equation in a 3-dimensional space	Student cannot note a line equation	Notes the parametric and canonical equation of the straight line with a given point belonging to the straight line and a vector parallel to this straight line, can give the parametric and canonical equation of the straight line having given two points belonging to the straight line	As for the 3 grade, plus: finds the straight line equation having a given point belonging to this line and the equation of a certain straight line parallel or perpendicular to the straight line, finds the angle between the lines given in the parametric or canonical form, finds the mutual position of the pairs of straight lines given in the parametric or canonical form, finds the distance of a point from a given line in the parametric or canonical form, finds the distance between the parallel lines given in the parametric or canonical form. Presents a line data in the form of an edge in the parametric form, finds the angle between the lines given in the form of an edge, finds the mutual position of pairs of lines given in the form of an edge, finds the distance of a point from a line given in the form of an edge, finds the distance between the lines of lines given in the form of an edge, finds the distance between the straight slants	As for the 4 grade, plus: finds the equations of bisectors of angles between straight lines given different equations, finds the equation of a straight line passing through a given point and crossing two straight lines, finds a point symmetrical to a given point in relation to a given straight line. Uses a specialized mathematical language to describe solutions to tasks and problems

Solves problems regarding straights and planes	Cannot solve any problem regarding straights and planes	Finds the intersection of a straight line given in parametric form and the plane	As for 3 grade, plus: calculates the angle of a straight line given in parametric or canonical form with a plane, finds the equation of a plane passing through the straight lines given in parametric or canonical form. Calculates the angle formed by the line given in the edge form with the plane, finds the equation of a plane passing through two given lines in the edge form, finds the equation of the plane passing through a given point and perpendicular to the line given in the edge form	As for the 4 grade, plus: student finds the projection of a straight line onto a plane, finds a projection of a point on a plane, finds a projection of a point on a straight line. Uses a specialized mathematical language to describe solutions to tasks and problems
Calculation of multiple and line integrals	Student cannot calculate any integral	Can calculate one selected type of integrals	Can calculate two selected types of integrals. Can calculate three, selected, types of integrals	Can independently distinguish types of integrals and calculate most of them. Can independently distinguish types of integrals and calculate them
Methods for evaluation	Oral exam, written exam, control papers, tests, homework. Assessment possible using distance learning methods and techniques			
Testing convergence of series	Student cannot test convergence of series	Checks conditions necessary for series convergence, finds sums of selected series, examines the convergence of simple number series with non-negative terms using the d'Alembert, Cauchy and integral criteria	As for the 3 grade, plus: examines the convergence of number series with non-negative terms of medium difficulty using the d'Alembert, Cauchy criteria, integral leading to direct integration, before substitution, by parts. Examines the convergence of number series with non-negative terms of varying degrees of difficulty using the d'Alembert criterion, the Cauchy integral leading to direct integration, before substituting by parts, examines the convergence of arbitrary series using the Leibniz criterion, determines the radius and interval of convergence of the selected power series	As for 4 grade, plus: examines the convergence of not too complicated series with non-negative words using the comparative criterion. Studies the uniform convergence of selected functional series
Developing functions into Taylor series	Cannot develop functions into Taylor series	Develops rational functions in the Taylor and Maclaurin series	As for the 3 grade, plus: expands in the Taylor and Maclaurin series selected irrational, trigonometric, exponential and logarithmic functions, calculates the approximate values of irrational numbers using the obtained expansions. Develops cyclometric functions in the Taylor and Maclaurin series	As for the 4 grade, plus: calculates the approximate values of the definite integrals using power series expansion and the relevant theorems on the integration and differentiation of functional series. Uses a specialized mathematical language to describe solutions to tasks, problems with the use of power series
Solving differential equations with separated variables	Cannot separate variables	Can separate the variables	Can separate the variables and calculate the integral for one variable. Can separate the variables and calculate integrals for both variables	Solves the equations and leaves the result as entangled figure. Solves equations and presents the result in a non-complex form

Solving homogeneous differential equations	Cannot transform equation into homogeneous form or can not apply substitution	Can transform an equation into a homogeneous form and apply a substitution	Can transform an equation into a homogeneous form, apply a substitution and calculate the integral for one variable. Can transform an equation into a homogeneous form, apply a substitution and calculate integrals for both variables	Solves the equations and leaves the result as entangled figure. Solves equations and presents the result in a non-complex form
Solving equations of different types	Cannot solve any of the indicated equations	Can solve one, selected type of equations	Can solve two selected types of equations. Can solve three selected types of equations	Can independently distinguish types of equations and solve them, leaving the results in a tangled form. Can independently distinguish types of equations and solve them, presenting the results in a non-complex form
Solving linear differential equations of second order	Cannot solve any of the indicated equations	Can solve a linear homogeneous differential equation	Can determine the special solution of homogeneous equations. Can solve a heterogeneous differential equation with constant coefficients	Can find a special solution of a non-homogeneous linear equation. Can solve the differential equation related to technical issues
Calculating event probability	Student is unable to determine the probability of random events	Calculates probability based on the classical definition of probability	As for the 3 grade, plus: determines the total probability, knows the concept of the Bernoulli scheme	As for the 4 grade, plus: determines the probability on the basis of the Bayes formula, uses a specialized mathematical language to describe the solutions of the tasks
Determination of a random variable, type of a random variable, determination of parameters of a random variable	Student does not know the concept of a random variable	Knows examples of a continuous and discrete type random variable. Determines the functions of random variables of the continuous type	As for the 3 grade, plus: determines the function of a random variable of discrete type and continuous type. Determines the parameters of a random variable. Calculates the probability based on the normal distribution	As for the 4 grade, plus: knows the basic distributions of discrete and continuous random variables, uses a specific mathematical language when describing solutions to problems
Determining confidence intervals	Student is unable to determine the parameters from the sample necessary to determine the indicated confidence interval	Calculates the parameters from the sample necessary for the determination of the indicated confidence interval	Determines all components of the indicated confidence interval, determines the confidence intervals	Determines the appropriate confidence interval, selects the appropriate method and evaluates the obtained results
Verification of statistical hypotheses	Student is unable to determine the test statistic based on the indicated sample	Determines the test statistic based on the indicated sample	Determines the test statistic and the critical value, verifies the presented hypothesis	Formulates own hypothesis, verifies it and interprets the obtained results

Teaching tools:

Type	Description
Conventional	Blackboard, projector, textbooks, scripts, task sets
Multimedia	Computer, multimedia projector
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. Lassak M.: *Matematyka dla studiów technicznych*. Supremum 2002. 2. Winnicki K., Landowski M.: *Wykłady z matematyki.* Skrypt dla studentów AM, Szczecin 2008. 3. *Zbiór zadań z matematyki*. Skrypt pod redakcją Krupińskiego R. Dział Wyd. AM w Szczecinie, Szczecin 2005. 4. Krupiński R., Zalewski Z.: *Rachunek prawdopodobieństwa*. Skrypt dla studentów WSM w Szczecinie, Szczecin 1992.
Complementary literature
1. Janowski W.: *Matematyka, tom I, II*. PWN, Warszawa. 2. Kasyk L., Krupiński R.: *Poradnik matematyczny*. Dział Wyd. AM w Szczecinie, 2006. 3. Krupiński R.: *Repetytorium z matematyki*. Dział Wyd. AM w Szczecinie, 2004. 4. Gajek L., Kałuszkac M.: *Wnioskowanie statystyczne*. WNT, Warszawa 1969.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Lech Kasyk, PhD	l.kasyk@am.szczecin.pl	Department of Mathematics
Other teachers:		

Abbreviations:
A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	8	Course:	**Physics**				
Major:	**Mechanical Engineering**	Specialisation:		**Marine Power Plant Operation**			
Studies cycle:	**First**	Form of studies:	**full-time**	Year of studies:	**First**	Semesters:	**1st-2nd**
Course status:	**mandatory**	Course group:	**primary**				

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	T	L	E	S	P	SE	IP	PR	A	T	L	E	S	P	SE	IP	PR	
First	15	1		2							15		30							3
2nd	15	2E		2							30		30							6
Total during studies											45		60							9

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Knowledge: In physics: curriculum for upper secondary schools. In mathematics: - algebraic expressions and mathematical operations; - operations on vectors (addition, subtraction, dot product, vector product); - linear, quadratic and logarithmic functions; - trigonometric functions, basic trigonometric formulas; - basics of differential calculus of functions of one variable; - function derivative and geometric interpretation; - definite and indefinite integral of functions of one variable
2.	Competences: In physics: - describing and explaining basic physical phenomena with the use of mathematical description applicable in secondary school. In mathematics: - use of mathematical apparatus and mathematical methods to describe and model physical phenomena and processes

Course objectives:

1.	Educating students in the basics of physics as a science about the properties of the world around us and the phenomena occurring in it, and associating the mutual dependence between the causes and effects of processes taking place in the material world
2.	Getting to know the physical theories constituting the basis of technological development
3.	Developing the skill of logical thinking - analyzing facts and drawing constructive conclusions based on them
4.	Understanding the need for continuous improvement of personal professional qualifications in conditions of continuous development of knowledge and technology

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Has basic theoretical and practical knowledge on classical and modern physics	EK_W05
EKP2	Has the ability to perform physical measurements, understand the methodology of physical measurements, analyze measurement data, present and interpret measurement results	EK_W05, EK_U05, EK_U01
EKP3	Has the ability to independently apply the acquired knowledge of physics to study a specialized field of technical studies and to develop own skills after starting professional work	EK_W05, EK_U05
EKP4	Demonstrates competency for independent and responsible diagnosis and innovative solving of technical / technological problems requiring the integration of knowledge from various fields, in particular knowledge of the physics course	EK_W05, EK_U05, EK_K03
EKP5	Has the ability to self-educate and effectively use information resources, including international sources of information in the field of laws and physical phenomena occurring in the real world. Understands that the necessity of lifelong learning in professional development, resulting from the pace of changes in the standard and the used technology, requires knowledge of the basic laws of physics	EK_U05, EK_U07, EK_U09, EK_K01

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		First	
A	EKP1,2,3,4	Elements of vector calculus. Material point kinematics. Rectilinear motion, uniform and variable. Curvilinear motion	15
	EKP1,2,3,4	Dynamics of a material point. Inertia forces.	
	EKP1,2,3,4	Work. Power. Energy. Principles of conservation of energy and momentum	
	EKP1,2,3,4	Moment of force and moment of inertia. Steiner's Theorem Principles of rotational motion dynamics. The energy of rotational motion. The principle of retaining angular momentum.	
	EKP1,2,3,4	Free, damped and forced harmonic vibrations. Resonance	
	EKP1,2,3,4	Mechanical waves. Wave classification criteria. Physical concepts and quantities describing wave motion. Equation of a plane harmonic wave	
	EKP1,2,3,4	Wave reflection and refraction, Huygens' principle. Wave diffraction and interference. Composition of parallel and perpendicular harmonics. Doppler effect	
	EKP1,2,3,4	Indicating the enthalpy of vaporization and fusion	30

L	EKP1,2,3,4	Determination of the linear expansion coefficient of solids by the electric method	
	EKP1,2,3,4	Determination of the speed of sound in the air	
	EKP1,2,3,4	Testing the natural vibrations of a string using the resonance method	
	EKP1,2,3,4	Appointment of the c_p/c_v ratio	
	EKP1,2,3,4	Determining the gravitational acceleration with the help of a reverse pendulum	
	EKP1,2,3,4	Determination of moment of inertia for a gyro	
	EKP1,2,3,4	Determination of the stiffness coefficient	
	EKP1,2,3,4	Determination of the generator frequency using beats and Lissajous curves	
	EKP1,2,3,4	Investigation of the of metal and semiconductor resistance dependence on temperature	
	EKP1,2,3,4	Determination of the electromotive force and internal resistance of a link using the compensation method	
	EKP1,2,3,4	Verifying the Steiner theorem	
	EKP1,2,3,4	Determining the logarithmic damping decrement using a physical pendulum	
	EKP1,2,3,4	Verifying Ohm's law for DC circuits	
	EKP1,2,3,4	Mechanical energy transformations on an inclined plane	
Total in the semester:			45

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	45	3
Self study	20	
Participation in final tests and exams apart from classes	10	
Total	75	

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		2nd	
A	EKP1,2,3,4,5	The concepts of a viscous and perfect liquid. The law of stream continuity. Pascal's and Archimedes' laws. Pressure units Bernoulli equation - examples and applications.	30

	EKP1,2,3,4,5	Temperature and heat. Fundamentals of the kinetic and molecular theory of gases. Thermodynamic parameters Maxwell-Boltzmann distribution Laws of thermodynamics. Gas transformations. Heat capacity Elements of calorimetry	
	EKP1,2,3,4,5	Basic laws of electrostatics, Coulomb's law, Gauss's law. Electric field - field intensity and potential. Electric capacitance	
	EKP1,2,3,4	Electric current. Ohm and Kirchhoff's laws. The concept of electrical resistance	
	EKP1,2,3,4	Magnetic field. Magnetic field around a current carrying conductor. Biot-Savart law	
	EKP, 2,3,4	Excitation of alternating currents. Vibrations in the LC circuit. Resonance in the RLC circuit. Maxwell's laws. Electromagnetic waves	
	EKP1,2,3,4	The nature of light. The law of reflection and refraction. Fission. Polarization.	
	EKP1,2,3,4	Geometric optics: mirrors and lenses. Optical instruments. Interference and diffraction of light.	
	EKP1,2,3,4	Basics of optoelectronics: generation, transmission and detection of electromagnetic radiation. Selected applications of optoelectronics	
L	EKP1,2,3,4,5	Determination of the e/m ratio	30
	EKP1,2,3,4	Determining the work function	
	EKP1,2,3,4	Determination of the primary magnetization curve	
	EKP1,2,3,4	Measurement of the electron velocity distribution of thermionic emission	
	EKP1,2,3,4	Determination of ultrasound speed	
	EKP1,2,3,4	Testing relaxation vibrations	
	EKP1,2,3,4	Testing the Stefan-Boltzmann law	
	EKP1,2,3,4	Study of the photoelectric phenomenon	
	EKP1,2,3,4	Resonance testing in an alternating current circuit	
	EKP1,2,3,4	Hall effect study	
	EKP1,2,3,4	Determination of light wavelength using a diffraction grating	
	EKP1,2,3,4	Determination of radiation absorption and energy	
	EKP1,2,3,4	Spectra examination using a spectroscope	
	EKP1,2,3,4	Determination of the Curie temperature of ferrite	
	EKP1,2,3,4	Determination of the characteristics of the Fe-Cu thermocouple	
Total in the semester:			60

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	60	6
Self study	30	
Participation in final tests and exams apart from classes	30	
Total	120	

Assessment methods and criteria:

Criteria / Assessment	2	3	3.5–4	4.5 – 5
Methods for evaluation	Reports, tests and control works in the semester, Assessment possible using distance learning methods and techniques			
EKP1 **Criterion 1** The scope of knowledge and its understanding	Student does not know and does not understand the basic laws of physics, does not know the basic units	Knows the basic rights and individuals, but has some problems with understanding and correct interpretation	Demonstrates a good understanding of issues and the ability to use the mathematical tools	Possesses a significantly broad, systematic knowledge, is able to use the recommended literature
Methods for evaluation	Reports, tests and control works in the semester, completion of exercises. Assessment possible using distance learning methods and techniques			
EKP2 **Criterion 1** The scope of knowledge and its understanding	Student is unable to perform basic measurements with the use of appropriate meters. Does not know the physical laws underlying the experiment	Can measure basic physical quantities with a little help from the teacher. Understands the phenomena occurring in the experiment	Can independently measure basic physical quantities, and can set up a simple measuring system. Can interpret the phenomena occurring in the experiment and draw the right conclusions	Can independently measure various physical quantities, as well as set up a measuring system. Understands occurring phenomena and causes of the error
EKP3 **Criterion 1** Ability to measure basic physical quantities	Student is unable to perform basic measurements with the use of appropriate meters	Can measure basic physical quantities with a little help from the teacher	Can independently measure basic physical quantities, and can set up a simple measuring system	Can independently measure various physical quantities, as well as set up a measuring system

EKP3 **Criterion 2** Knowledge of the errors and residuals	Student does not understand the causes of a measurement error or cannot determine it using analytical methods	Knows the causes of a measurement error and simple methods of errors and residuals	Additionally, student lists the limitations of methods, assumes a permitted error or approximation of calculations, illustrates them graphically	Assesses the possibilities of using methods in various cases. Provides examples.
EKP4 **Criterion 1** Scope of knowledge and correctness of calculations	Student doesn't know the basic laws or the equations that describe physical phenomena	Knows the basic equations and can transform them	Can analyze the problem by selecting the appropriate equations, transform them, and perform operations on units	Can find alternative solutions and point out the advantages and disadvantages of various methods
Methods for evaluation	Completion of exercises / laboratories, tests and control works in the semester. Assessment possible using distance learning methods and techniques			
EKP5 **Criterion 1** Effective use of classes, the ability to self-educate and understanding the need for continuous deepening of knowledge	Does not participate actively in class, does not show the ability to independently assimilate and deepen knowledge	Demonstrates activity necessary for effective learning	Demonstrates commitment to the learning process. Identifies and solves the problem with little help from the teacher	Works independently and is willing to broaden their knowledge. Develops his initiative, critical thinking and the need for professional development
EKP5 **Criterion 2** Ability to use source information	Student is unable to find basic information on the analyzed physical issues	Uses international publications and the Internet to basic extent	Independently uses international publications and other information resources, including electronic versions of data transmission	Freely uses international publications and other information resources to a great extent

Teaching tools:

Type	Description
Conventional	A board, projector, notes, textbooks, scripts, workplace instructions and sets of laboratory exercises, work regulations and health and safety instructions in the laboratory
Multimedia	Computer, multimedia projector, didactic programs for physics
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. Halliday D., Resnick R., Walker J.: *Podstawy fizyki*. PWN, 2007. 2. Bobrowski Cz.: *Fizyka – krótki kurs*. WNT, 2004. 3. Moebs et al., Fizyka dla szkół wyższych. Tom 1. Openstax: https://openstax.org/details/books/fizyka-dla-szkół-wyższych-tom-1 (mechanika; fale i akustyka)

4. Moebs et al., Fizyka dla szkół wyższych. Tom 2. OpenStax : https://openstax.org/details/books/fizyka-dla-szkół-wyższych-tom-2 (termodynamika; elektryczność i magnetyzm) 5. Moebs et al., Fizyka dla szkół wyższych. Tom 3. OpenStax: https://openstax.org/details/books/fizyka-dla-szkół-wyższych-tom-3 (optyka; fizyka współczesna) 6. Kirkiewicz J., Chrzanowski J., Bieg B., Pikuła R.: *Ćwiczenia laboratoryjne z fizyki*. *Cz. I.* Szczecin 2001. 7. *Ćwiczenia laboratoryjne z fizyki. Cz. II* pod redakcją J. Kirkiewicza. WSM, Szczecin 2003.

Complementary literature
1. Massalski J., Massalska M.: *Fizyka dla inżynierów*. *Cz. I*. WNT, Warszawa 2005. 2. Dryński T.: *Ćwiczenia laboratoryjne z fizyki*. Ed. VII, PWN, Warszawa 1977. 3. Januszajtis A.: *Fizyka dla politechnik*. PWN, Warszawa 1991. 4. Jezierski K., Kołodka B., Sierański K.: *Zadania z rozwiązaniami – skrypt do ćwiczeń z fizyki dla studentów I roku Wyższych Uczelni. Część I i II.* Oficyna Wydawnicza Scripta, Wrocław 2000.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Bohdan Bieg, PhD	j.chrzanowski@am.szczecin.pl	IMFiCh / ZF
Other teachers:		
Janusz Chrzanowski, PhD	b.bieg@am.szczecin.pl	IMFiCh / ZF
Marcin Krogulec, MA	m.krogulec@am.szczecin.pl	IMFiCh / ZF

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
EL- e-learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	9	Course:	**Mechanics***				
Major:	**Mechanical Engineering**	Specialisation:		**Marine Power Plant Operation**			
Studies cycle:	**First**	Form of studies:	**full-time**	Year of studies:	**First**	Semesters:	**1st-2nd**
Course status:	**mandatory**	Course group:	**primary**				

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	E	L	EL	S	P	SE	TW	PR	A	E	L	EL	S	P	SE	TW	PR	
First	15	2E	2								30	30								6
2nd	15	1		1							15		15							2
Total during studies											45	30	15							8

Prerequisite knowledge, skills and other competences

1.	Basic knowledge and ability to solve problems in algebra, vector, matrix, differential and integral calculus
2.	Basic knowledge of physics
3.	Basic engineering graphics skills

Course objectives:

1.	Teaching: - basics of classical mechanics, i.e. statics, kinematics and dynamics of mechanical systems treated as perfectly rigid bodies; - basics of the theory of vibrations and dynamics of machines; - methods to minimize vibration and noise
2.	To equip the student with knowledge and skills necessary in teaching, among others strength of materials, basic construction of machines
3.	Teaching the student how to use the acquired knowledge and skills in professional practice

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Correctly describes and analyzes systems of forces acting on real mechanical systems in static equilibrium	EK_W05, EK_U05
EKP2	Correctly describes and determines the basic geometric and mass indices of perfectly rigid bodies	EK_W05, EK_U05
EKP3	Correctly describes and analyzes the motion of real mechanical objects treated as perfectly rigid bodies	EK_W05, EK_U05
EKP4	Correctly models real physical and mathematical mechanical objects	EK_W05, EK_U05
EKP5	Correctly arranges and analyzes the dynamic equations of simple mechanical systems motion	EK_W05, EK_U05
EKP6	Correctly lists and defines ways to minimize mechanical vibrations and noise	EK_W05, EK_U05

EKP7	Properly discusses the measurement system, records and analyzes mechanical vibrations and noise	EK_W05, EK_U05

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		First	
A	EKP1	Division, tasks and basic concepts of general mechanics (including concentrated force). Principles of statics	30
	EKP1	Reduction of the concurrent and parallel system of forces. A pair of forces and its properties; moment of a pair of forces; concentrated force and torque	
	EKP1	Reduction of a planar system of forces; principal vector and principal moment of a system of forces	
	EKP1	Conditions of static equilibrium of a plane system of forces	
	EKP1	Moment of force in relation to axis; static equilibrium conditions of the spatial force system. Center of parallel forces	
	EKP2	Center of gravity of linear, flat and three-dimensional homogeneous bodies	
	EKP2	Static moments, inertia and deviation of material points and bodies with finite dimensions	
	EKP1	Dry sliding friction; Coulomb-Moren laws; practical importance of friction	
	EKP1	Rolling friction, including friction in roller bearings	
	EKP3	Material point kinematics, including track and point equations, and point velocity and acceleration	
	EKP3	Kinematics of a point in a circular motion and kinematics of a point in a harmonic motion	
	EKP3	Translational and rotary motion of a rigid body	
	EKP3	Body kinematics in plane motion; body velocity and acceleration and points; center of velocity and center of acceleration	
	EKP3	Basic concepts of the mechanisms and machines theory	
	EKP3	Kinematic analysis of mechanisms (positions and trajectories, center of rotation, velocity and acceleration of the term and its points)	
	EKP3	Basic concepts, laws and tasks of the dynamics of a material point	
E	EKP1	Vector calculus revision. Moment of force related to a point	30
	EKP1	Examples of the reduction of a concurrent and parallel system of forces	
	EKP1	Description and analysis of force systems containing concentrated forces and pairs of forces	
	EKP1	Determination of the main vector and the main moment of a planar force system; reduction of a planar system of forces only to the resultant or only to a pair of forces	
	EKP1	Solving systems with a plane force system; determination of support reactions and internal forces	
	EKP1	Determination of the moment of force related to an axis. Analysis of the spatial system of forces	
	EKP2	Determination of centers of gravity for linear, flat and three-dimensional homogeneous bodies	
	EKP2	Determination of static moments, inertia and deviation of material points and bodies with finite dimensions	

	EKP1	Description and analysis of the static equilibrium of mechanical systems, taking into account the sliding and rolling friction forces	
	EKP3	Determination of trajectory and movement equations for a point as well as velocity and acceleration.	
	EKP3	Description and analysis of the kinematics of a point in circular motion and in harmonic motion	
	EKP3	Description and analysis of examples of translational and rotational motion of a rigid body	
	EKP3	Determining the speed and acceleration of the body and its points in plane motion; determining the center of velocity and the center of body acceleration	
	EKP3	Application of the laws of dynamics of a material point	
Total in the semester:			60

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	60	6
Self study	60	
Participation in final tests and exams apart from classes	30	
Total	150	

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		2nd	
A	EKP4	Subject, scope and purpose of the foundations of the vibrations theory and dynamics of machines theory. General features of elements of mechanical systems and their dynamic properties	15
	EKP4	The essence, purpose and stages of mechanical systems modeling. Phenomenological-physical modeling; forces of inertia, rigidity and damping	
	EKP4	Mathematical modeling of mechanical systems; constraints, number of degrees of freedom of the system	
	EKP4	Ways of determining the differential equations of motion. Mechanical energy of the system	
	EKP4	Methods for determining the structural parameters of the model	
	EKP5	General form of differential equations of a mechanical system motion	
	EKP5	Random vibrations of a conservative and non-conservative system with one degree of freedom	
	EKP5	Harmonically forced vibrations of a system with one degree of freedom; dynamic compliance and rigidity of the system	
	EKP5	Random vibrations of a linear system with multiple degrees of freedom. Main vibrations of the system; frequencies and forms of natural vibrations	

	EKP6	Minimization of mechanical vibrations in the vibration source	
	EKP6	Minimization of mechanical vibrations along the path of propagation (vibro-insulation)	
	EKP6	Minimization of noise in the source and propagation path	
L	EKP7	Fundamentals of measurements and analysis of mechanical vibrations	15
	EKP7	Fundamentals of acoustic measurements with particular emphasis on noise measurements of mechanical devices	
	EKP7	Investigation of dynamic properties and identification of parameters in a system with one degree of freedom	
	EKP7	Static balancing of a rigid rotor	
	EKP7	Investigation of dynamic properties of a system with multiple degrees of freedom	
	EKP7	Analytical tests of torsional vibrations of drive system shafts	
	EKP7	Measurements of torsional vibrations of shafts using the electrofusion strain gauge method	
Total in the semester:			30

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	30	2
Self study	20	
Participation in final tests and exams apart from classes	5	
Total	55	

Assessment methods and criteria:

Grades	2	3	3.5–4	4.5 – 5
Grading method	Written test. Assessment possible using distance learning methods and techniques			
EKP1	Student does not define the basic concepts of statics	Defines the basic concepts of statics	Correctly analyzes the basic problems of statics	Correctly formulates and analyzes complex problems of statics
EKP2	Student cannot define the basic indices of mass geometry	Defines the basic indices of mass geometry	Correctly determines and determines the geometry indices of masses of linear and flat bodies	Correctly determines and finds indices of mass geometry of linear, flat and spatial bodies
EKP3	Does not define the basic concepts of the kinematics of a material point and a rigid body	Defines the basic concepts of the kinematics of a material point and a rigid body	Correctly formulates and analyzes the basic problems of kinematics of a material point and a rigid body	Correctly formulates and analyzes complex problems of kinematics of a material point and a rigid body
EKP4	Does not define the basic concepts and problems of modeling mechanical systems	Defines the basic concepts and problems of modeling mechanical systems	Correctly builds a discrete physical model of a mechanical system	Correctly builds a discrete mathematical model of a mechanical system

EKP5	Does not create dynamic equations of motion of a discrete mechanical system	Arranges dynamic equations of motion of a discrete mechanical system	Analyzes the vibrations of a system with one degree of freedom	Analyzes vibrations of any discrete mechanical system
EKP6	Does not define ways to minimize mechanical vibration and noise in general sense	Defines ways to minimize mechanical vibrations and noise in general sense	Defines in detail ways to minimize mechanical vibrations and noise	Analyzes methods of minimizing mechanical vibrations and noise
EKP7	Does not define the structure of systems for measuring mechanical vibrations and noise in general sense	Defines the structure of systems for measuring mechanical vibrations and noise in general sense	Defines in detail the system for measuring mechanical vibrations and noise	Analyzes in detail the measurement system and the results of measurements of mechanical vibrations and noise

Teaching tools:

Type	Description
Blackboard, chalk, markers	
Overhead projectors	
System for measuring and analyzing mechanical vibrations	B&K measurement set: piezoelectric sensors 4333, 4343, amplifiers 2625, 2635, calibrator 4291. Eagle PCI-730 A / D converter with WaveView software. Oscilloscope. HP 3575 amplitude and phase level meter
Noise measurement and analysis system	Universal sonometer B&K 2209; octave and third octave filters B&K 1613, 1616
Workbench for testing the dynamic properties of a system with one degree of freedom	Mechanical model of a system with one degree of freedom; system for measuring and analyzing mechanical vibrations
Workbench for testing the dynamic properties of a system with two degrees of freedom	Mechanical model of bending vibrations of a system with two degrees of freedom; electromagnetic inductor, a system for measuring and analyzing mechanical vibrations
Static balancer	Balancing machine for static gravity balancing with rectilinear guides (rotor diameters up to 0.4 m)
Workbench for testing torsional vibrations of shaft lines	Mechanical model of a shaft line with six degrees of freedom; torsional vibration measurement system by electrofusion method: full bridge strain gauge system, B&K measuring amplifier, A / D converter, WaveView software; software for the analysis of vibrations using the FEM method of the NeiNastran type
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature

1. Leyko J.: *Mechanika ogólna. T.1: Statyka i kinematyka*. Wydawnictwo Naukowe PWN, Warszawa 2005.
2. Leyko J.: *Mechanika ogólna. T.2: Dynamika*. Wydawnictwo Naukowe PWN, Warszawa 2006.
3. Leyko J., Szmelter J.: *Zbiór zadań z mechaniki ogólnej. Tom 1. Statyka*. PWN, Warszawa 1972.
4. Leyko J., Szmelter J.: *Zbiór zadań z mechaniki ogólnej. Tom 2. Kinematyka i dynamika*. PWN, Warszawa 1977.
5. Niezgodziński T.: *Mechanika ogólna*. Wydawnictwo Naukowe PWN, Warszawa 2007.

6. Niezgodziński M. E., Niezgodziński T.: *Zbiór zadań z mechaniki ogólnej*. Wydawnictwo Naukowe PWN, Warszawa 2008. 7. Mieszczerski I. W.: *Zbiór zadań z mechaniki*. PWN, Warszawa 1971. 8. Kaczmarek J.: *Podstawy teorii drgań i dynamiki maszyn*. WSM Szczecin 2000. 9. Kaczmarek J.: *Zwalczanie drgań i hałasu. Podstawy teoretyczne*. WSM Szczecin 2002.
Complementary literature
1. Engel Z.: *Ochrona środowiska przed drganiami i hałasem.* PWN, Warszawa 2002. 2. Giergiel J.: *Tłumienie drgań mechanicznych*. PWN, Warszawa 1990. 3. Giergiel J., Uhl T.: *Identyfikacja układów mechanicznych*. PWN, Warszawa 1990. 4. Marchelek K., Berczyński S.: *Drgania mechaniczne. Zbiór zadań z rozwiązaniami*. PSz, Szczecin 2005. 5. Kaczmarek J., Nicewicz G.: *Zwalczanie drgań i hałasu. Ćwiczenia laboratoryjne*. WSM, Szczecin 2002. 6. Osiński Z. *Teoria drgań*. PWN, Warszawa 1980.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Jacek Kaczmarek, PhD Eng.	j.kaczmarek@am.szczecin.pl	WM
Other teachers:		

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	**10**	Course:	**Material strength** *				
Major:	**Mechanical Engineering**	Specialisation:		**Marine Power Plant Operation**			
Studies cycle:	**First**	Form of studies:	**full-time**	Year of studies:	**2nd**	Semesters:	**3rd-4th**
Course status:	**mandatory**	Course group:	**primary**				

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	T	L	E	S	P	SE	IP	PR	A	T	L	E	S	P	SE	IP	PR	
3rd	12	1E	1								12	12								2
4th	15	1	1	2							15	15	30							4
Total during studies											27	27	30							6

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Student demonstrates a thorough knowledge of the principles of mechanics: the principles of statics, basic body models in mechanics, equilibrium conditions for planar and spatial systems, mass geometry
2.	Possesses basic knowledge of mathematics - solving systems of algebraic equations, differential and integral calculus
3.	Possesses basic knowledge of physics
4.	Basic engineering graphics skills

Course objectives:

1.	Preparation for occupations supporting the design of simple engineering tasks, for the selection of engineering materials used for machine elements
2.	Acquisition of skills to assess the strength of individual elements and complex engineering structures under various load states (tension, bending, torsion, shear, buckling)

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Student correctly applies the methods of calculating the strength of simple structural elements	EK_W05, EK_U05
EKP2	Correctly calculates the basic strength of structural elements	EK_W05, EK_U05
EKP3	Correctly applies methods of calculating the composite strength of structural elements	EK_W05, EK_U05
EKP4	Correctly calculates the complex strength of structural elements	EK_W05, EK_U05
EKP5	Correctly determines the basic strength parameters of materials	EK_W05, EK_U05

EKP6	Properly assesses the degree of risk of hazardous stresses or deformations in elements of machines and devices	EK_W05, EK_U05

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		3rd	
A	EKP1, EKP2	**Basic concepts and terms**. External and internal forces. Tensile and compression charts of various materials. Hooke's Law. Poisson's law	12
	EKP1, EKP2	**Stretching and compression**. The basic endurance condition. Allowable stresses. Statically indeterminate tasks, assembly and thermal stresses	
	EKP1, EKP2	**Point stress analysis**, uniaxial stress state, principal stresses, Mohr's circles. Generalized Hooke's law	
	EKP1, EKP2	**Pure shear**, the relationship between the modulus of longitudinal elasticity and the torsional modulus of elasticity. Technical shear. Calculation of welded, pin, key and bolt connections	
	EKP2	**Geometric section indicators**	
	EKP1, EKP2	**Torsion of axially symmetrical and rectangular sections**. Drive shafts calculations	
	EKP1	**Bending, diagrams of shear forces and bending moments**	
E	EKP2	**Basic concepts and terms**. External and internal forces. Tensile and compression charts of various materials. Hooke's Law. Poisson's law	12
	EKP1, EKP2	**Stretching and compression**. The basic endurance condition. Allowable stresses. Statically indeterminate tasks, assembly and thermal stresses.	
	EKP2	**Point stress analysis**, uniaxial stress state, principal stresses, Mohr's circles. Generalized Hooke's law	
	EKP1, EKP2	**Pure shear**, the relationship between the modulus of longitudinal elasticity and the torsional modulus of elasticity. Technical shear. Calculation of welded, pin, key and bolt connections	
	EKP2	**Geometric section indicators**	
	EKP1, EKP2	**Torsion of sections** axially symmetrical and rectangular. Drive shafts calculations	
	EKP1, EKP2	**Bending, diagrams of shear forces and bending moments**	
Total in the semester:			24

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	24	2
Self study	10	
Participation in final tests and exams apart from classes	20	

Total	54	

Programme content:

Form of clas-ses	EKP relation	Implemented content	Num-ber of hours
Semester:		4th	
A	EKP3	**Differential relationships in bending**	15
	EKP3	**Shear with bending, Żurawski formula**	
	EKP4	**Beam calculations**, dimensioning with regard to permissible stresses	
	EKP3,4	**Beams deformation** during pure bending. Integration of the differential equation	
	EKP4	**Clebsch's method of integrating the differential equation of the axis of a deformed beam**	
	EKP3,4	**Buckling**, critical force, rod slenderness, Euler and Tetmayer formulas	
	EKP3,4	**Statically indeterminate beams**, determining the reaction by integrating the differential equation and comparing the strains	
	EKP3	**Endurance hypotheses of Huber, Coulomb, De Saint Venant, Galileo**, complex cases of strength, torsion with bending, eccentric compression	
E	EKP3	**Differential relationships in bending**	15
	EKP3, EKP4	**Shear with bending, Żurawski formula**	
	EKP4	**Beam calculations**, dimensioning with regard to permissible stresses	
	EKP3,4	**Beams deformation** during pure bending. Integration of the differential equation	
	EKP4	**Clebsch's method of integrating the differential equation of the axis of a deformed beam**	
	EKP3,4	**Buckling**, critical force, rod slenderness, Euler and Tetmayer formulas	
	EKP3,4	**Statically indeterminate beams**, determining the reaction by integrating the differential equation and comparing the strains	
	EKP3	**The endurance hypotheses of Huber, Coulomb, De Saint Venant, Galileo**, complex cases of strength, torsion with bending, eccentric compression	
L		Preliminary classes, health and safety, fire protection	30
	EKP5,6	Static regular tensile test of metals	
	EKP5,6	Static regular compression test of metals	
	EKP6	Determination of the modulus of longitudinal elasticity, the limit of proportionality and the proof stress using mechanical extensometers	
	EKP5	Electrofusion tensometry	
	EKP6	Determination of the modulus of elasticity, shear modulus and Piosson number by measuring the deflection arrow and torsion angle	
	EKP5	Bending impact test	
	EKP6	Determination of the beam deflection line	
	EKP4	Determining the reaction of a statically indeterminate beam	

	EKP5	Buckling of an axially compressed bar	
	EKP5,6	Examination of coil springs	
	EKP5,6	Steel ropes testing	
	EKP5,6	Fatigue tests	
	EKP6	Computer solving of trusses	
	EKP6	Computer solving of beams	
Total in the semester:			60

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	60	4
Self study	30	
Participation in final tests and exams apart from classes	10	
Total	100	

Assessment methods and criteria:

Grades	2	3	3.5–4	4.5 – 5
Grading method	Written test, Assessment possible with the use of distance learning methods and techniques.			
EKP1	Student does not define basic simple strength cases	Defines the basic cases of simple strength	Describes the methods of calculating basic simple strength cases	Analyzes the methods of calculating basic simple strength cases
EKP2	Student cannot use basic formulas for simple strength cases	Applies the basic formulas for simple strength cases	Calculates the basic simple strength cases correctly	Analyzes and compares correctly basic cases of simple strength
EKP3	Cannot define basic cases of complex strength	Defines the basic cases of complex strength	Describes the methods of calculating basic cases of complex strength	Analyzes the methods of calculating basic cases of complex strength
EKP4	Cannot use basic formulas for cases of complex strength	Applies basic formulas for cases of complex strength	Correctly calculates basic complex strength cases	Analyzes and compares correctly basic cases of complex strength
EKP5	Student cannot read basic strength parameters from tables and charts	Reads the basic strength parameters from tables and charts	Determines the basic strength parameters from their definition	Analyzes the determined strength parameters
EKP6	Cannot properly apply the basic strength and stiffness conditions	Uses the basic strength and stiffness condition correctly	Calculates, the risk of occurrence of dangerous stresses and deformations based on test results	Uses computer programs to assess the risk of stresses and dangerous deformations

Teaching tools:

Type	Description
Blackboard, markers	
Handwriting projector, multimedia projector	

ZD 100 universal testing machine	Laboratory exercises carried out with use of the universal ZD 100 machine: stretching, compression, bending, mechanical extensometry, electrofusion extensometry
ZD 2500 testing machine	Laboratory exercises carried out on the machine: testing of coil springs, testing of steel ropes,
Charpy type rotary hammer	For carrying out laboratory exercise on metal impact
UBM fatigue test machine	For fatigue testing with symmetrical bending
Workbench for strain gauges in bending	Rigid supporting structure, flat bar with glued strain gauges, strain gauge bridge, oscilloscope
Workbench for determining basic material constants E, G, ν	Rigid frame, round bar, bracket with a bearing, weights, micrometer
Workbench for determining the beam deflection line and determining the reaction of a statically indeterminate beam	Rigid supporting structure, supports, weights, micrometers, flat bar
Computer room with programs for solving grates and beams	Classes on solving grates and beams using computer methods will be conducted in the computer room
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. Mierzejewski J., Grządziel Z., Świeczkowski W.: *Wytrzymałość materiałów. Zadania*. WSM. 2. Mierzejewski J., Grządziel Z., Świeczkowski W.: *Ćwiczenia laboratoryjne z wytrzymałości materiałów*. WSM, Szczecin 1998. 3. Niezgodziński M.E., Niezgodziński T.: *Wytrzymałość materiałów*. PWN, Warszawa 2006. 4. Niezgodziński M.E., Niezgodziński T.: *Wzory, wykresy i tablice wytrzymałościowe*. PWN, Warszawa 2006. 5. Dyląg Z., Jakubowicz A., Orłoś Z.: *Wytrzymałość materiałów*. WNT, 2007. 6. Bąk R., Burczyński T.: *Wytrzymałość materiałów z elementami ujęcia komputerowego*. WNT, 2006. http://dydaktyka.polsl.pl/mes/download.aspx
Complementary literature
1. Gere J.M., Goodno B.J.: *Mechanics of materials*. *Cengage Learning*. Stamford USA, 2009.,

Course instructor:

Degree / title, name, surname, form of classes	**E-mail address**	**Teaching unit**
Course supervisor:		
PhD Eng. Zenon Grządziel	z.grzadziel@am.szczecin.pl	WM
Other teachers:		
M.Sc. Eng. Adam Komorowski	a.komorowski@am.szczecin.pl	WM

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	**11**	Course:	**Engineering graphics** *					
Major:	**Mechanical Engineering**	Specialisation:		**Marine Power Plant Operation**				
Studies cycle:	**First**	Form of studies:	**full-time**	Year of studies:	**First**	Semesters:	**1st, 2nd**	
Course status:	**mandatory**	Course group:	**primary**					

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	E	L	EL	S	P	SE	TW	PR	A	E	L	EL	S	P	SE	TW	PR	
First	15			2									30							2
2nd	15			3									45							3
Total during studies													75							5

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	

Course objectives:

1.	Teaching students the rules of making standardized drawings of machine parts, assembly drawings and the preparation of ship installation diagrams
2.	Teaching students the practical preparation of standardized working drawings of machine parts, assembly drawings and diagrams of ship installations
3.	Teaching students to read standardized working drawings of machine parts, assembly drawings, ship installation diagrams as well as the main dimensions and theoretical lines of the ship's hull

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Draws any machine element in a standardized format, using standardized drawing lines and a properly selected scale, and correctly dimensions the machine element using the information on the tolerance of drawing dimensions and surface roughness	EK_W05, EK_U04
EKP2	Draws the machine connection correctly (threaded, welded, soldered, glued, shrink, spline) and dimensions it	EK_W05, EK_U04
EKP3	Draws and reads the assembly drawing correctly	EK_W05, EK_U04
EKP4	Draws and correctly reads a diagram of any power plant system as well as the main dimensions and theoretical lines of the ship's hull	EK_W05, EK_U04

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		First	
L	EKP1,2,3,4	Standardized elements of a technical drawing: a) sheet formats, b) graduations, c) thicknesses, types and application of drawing lines, d) technical letters, e) viewport layout, f) views, sections, layers, nameplates	30
	EKP2	Threaded connections a) types of threads, b) markings, c) drawing simplifications	
	EKP2	Welded joints: a) shapes of joints, b) drawing simplifications	
	EKP1,3	Toothed wheels and gears - drawing simplifications	
	EKP1,2,3,4	The essence and rules of dimensioning in the technical drawing: a) special dimensioning cases, b) tolerance and fit in the engineering drawing	
	EKP1,2	Designation of tolerances of shape, position and runout	
	EKP1,2,3,4	Designation of surface roughness, additional information on the technical drawing	
	EKP1,2	Principles of drawing up executive drawings of machine parts	
	EKP1,2,3	Drawing and dimensioning of basic machine elements: a) working drawing of machine parts, b) assembly drawing	
	EKP4	Principal dimensions and theoretical lines of the hull	
	EKP4	Ship power plant installation diagrams and rules for drawing them - reading marine power plant installation diagrams	
	EKP4	Principles of drawing up diagrams of hydraulic and pneumatic systems, reading diagrams of hydraulic and pneumatic systems	
	EKP4	Principles of drawing up wiring diagrams, reading wiring diagrams	
	EKP3,4	Reading technical drawings and installation diagrams from the ship's technical documentation	
Total in the semester:			30

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	30	2

Self study	25	
Participation in final tests and exams apart from classes	5	
Total	60	

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		2nd	
	EKP1,2	Designation of tolerances of shape, position and runout	45
	EKP1,2,3,4	Designation of surface roughness, additional information on the technical drawing	
	EKP1,2	Principles of drawing up executive drawings of machine parts	
	EKP1,2,3	Drawing and dimensioning of basic machine elements: a) working drawing of machine parts, b) assembly drawing	
	EKP4	Principal dimensions and theoretical lines of the hull	
	EKP4	Ship power plant installation diagrams and rules for drawing them - reading marine power plant installation diagrams	
	EKP4	Principles of drawing up diagrams of hydraulic and pneumatic systems, reading diagrams of hydraulic and pneumatic systems	
	EKP4	Principles of drawing up wiring diagrams, reading wiring diagrams	
	EKP3,4	Reading technical drawings and installation diagrams from the ship's technical documentation	
Total in the semester:			45

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	45	3
Self study	25	
Participation in final tests and exams apart from classes	5	
Total	75	

Assessment methods and criteria:

Grades	2	3	3.5–4	4.5 – 5
Methods of evaluation	Preparation of a drawing. Assessment possible with the use of distance learning methods and techniques			
EKP1	Student is not able to properly make a workshop drawing of a machine part	Makes the workshop drawing of the machine part correctly	Makes the correct drawing of the machine part using tracing paper and rapidographs	Correctly draws a complex machine part using tracing paper and rapidographs or a computer program such as AutoCAD
EKP2	Is unable to properly make a workshop drawing of a machine connection	Makes the workshop drawing of the machine joint correctly	Draw correctly the machine connection using tracing paper and rapidographs	Draws properly a complex machine connection using tracing paper and rapidographs or a computer program such as AutoCAD
EKP3	Is not able to correctly draw a workshop assembly drawing and correctly read any assembly drawing	Makes workshop assembly drawing correctly and reads any assembly drawing correctly	Makes the assembly drawing correctly using tracing paper and rapidographs and correctly reads any assembly drawing	Makes a complex assembly drawing correctly using tracing paper and rapidographs or a computer program such as AutoCAD and correctly reads any assembly drawing
EKP4	Is unable to properly draw and read a diagram of any power plant system and can replace the main dimensions and theoretical lines of the ship's hull	Draws and reads a diagram of any power plant system and lists the main dimensions and theoretical lines of the ship's hull	Draws a diagram of any ship power plant system using tracing paper and rapidographs, reads any diagram and defines the main dimensions and theoretical lines of the ship's hull	Draws a diagram of any marine engine system using tracing paper and rapidographs or an AutoCAD computer program, analyzes the processes taking place in the system and the system's operation capabilities in the event of damage to its selected components, and defines the main dimensions and theoretical lines of the ship's hull

Teaching tools:

Type	Description
Blackboard, chalk, felt-tip pens	
Laptop, multimedia projector, screen	
Demonstration boards	
Machine parts	Gears; rollers; special screws; threaded connections; welded connections; valve, pump and injector bodies; pistons; valves for heads of internal combustion engines; rolling bearings; plain bearings; sliders; springs; etc.
Simple machines and devices	Gear transmissions; pumps; valves; safety valves; injectors
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. Dobrzański T.: *Rysunek techniczny maszynowy*. WNT, Warszawa 2006. 2. Foley J. i inni: *Wprowadzenie do grafiki komputerowej*. WNT, Warszawa 2001.

3. Michalski R.: *Siłownie okrętowe: obliczenia wstępne oraz ogólne zasady doboru mechanizmów i urządzeń pomocniczych instalacji siłowni motorowych*. Wydawnictwo Uczelniane Politechniki Szczecińskiej, Szczecin 1997.
Complementary literature
1. Grzybowski L.: *Geometria wykreślna*. Skrypt WSM, Szczecin 2002. 2. Otto F., Otto E.: *Podręcznik geometrii wykreślnej*. PWN, Warszawa 1975.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Zenon Grząiel; NS, PhD Eng.	z.grzadziel@am.szczecin.pl	WM
Other teachers:		
PhD Eng. Jacek Kaczmarek	j.kaczmarek@am.szczecin.pl	WM
Adam Komorowski; L, M.Sc. Eng.	a.komorowski@am.szcze-cin.pl	WM

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	12	Course:	**Introduction to applied computer science**				
Major:	**Mechanical Engineering**		Specialisation:	**Marine Power Plant Operation**			
Studies cycle:	**First**	Form of studies:	**full-time**	Year of studies:	**First**	Semesters:	**First**
Course status:	**elective**	Course group:	**primary**				

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	T	L	E	S	P	SE	IP	PR	A	T	L	E	S	P	SE	IP	PR	
First	15			1									15							1
Total during studies													15							1

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	

Course objectives:

1.	Getting to know the functioning of the computer, its peripherals and computer networks
2.	Acquiring the ability to use software for calculations, data processing, data presentation, text composition

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Student can use the software to work with databases	EK_W02, EK_U01, EK_K02
EKP2	Is able to use text editing software	EK_W02, EK_U10
EKP3	Is able to use software for calculations and data processing	EK_W02, EK_U01
EKP4	Can use software for data presentation, text composition	EK_W02, EK_U07

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		First	
L	EKP2	Text formatting with styles using a text editor	15
	EKP2	Embedding and formatting various objects in a text	
	EKP2, EKP4	Lists, indexes, captions, links in a text editor	
	EKP3, EKP4	Denoting and calculating arithmetic expressions, creating charts in a spreadsheet	
	EKP1	Application of embedded spreadsheet functions	
	EKP1	Table and queries creation in a database	
	EKP1	Forms creation in a database	
Total in the semester:			15

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	15	1
Self study	8	
Participation in final tests and exams apart from classes	2	
Total	25	

Assessment methods and criteria:

Grades	**2**	**3**	**3.5–4**	**4.5 – 5**
Methods of evaluation	Written or oral and practical tests during laboratory classes, Assessment possible with the use of distance learning methods and techniques			
EKP1	Student cannot use MySQL software	Applies methods of searching and processing information in a relational database (SQL language	Is able to process information stored in databases using appropriate tools	Creates a database application that uses the language of queries and reports; ensures data integrity at the level of fields, tables, relationships
EKP2	Cannot use text editor software	Knows the rules of operating in a long document, ordering paragraphs, converting text into a table.	Student is able to apply styles and create a table of contents	Can prepare documents with extensive structure, uses styles, templates, creates table of contents
EKP3	Cannot use Excel software for calculations	Can perform arithmetic calculations in Excel	Can draw charts in Excel	Can perform calculations on symbols in Excel
EKP4	Cannot use software to create multimedia presentations	Knows the possibilities of programs for creating presentations	Has the ability to create a multimedia presentation.	Has the ability to save presentations in others formats and is able to deliver a presentation to the public

Teaching tools:

Type	Description
Projector	Auditorium classes in the form of multimedia presentations and films
Computer stations	A PC connected to the Internet and running in the Windows operating system
Software	MS Office (Word, Excel, Access, Front Page),
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature

1. Walkenbach J.: *Excel. Najlepsze sztuczki i chwyty*. Helion SA, 2006.
2. Simon Jinjer: *Excel. Profesjonalna analiza i prezentacja danych*. Helion SA, 2006.
3. Liengme B.V.: *Microsoft Excel w nauce i technice*. Oficyna Wydawnicza READ ME, 2002.
4. Groszek M.: *OpenOffice.ux.pl Calc 2.0. Funkcje arkusza kalkulacyjnego*. Helion, 2007.
5. Wróblewski P.: *MS Office 2007 PL w biurze i nie tylko*. Helion SA, 2007.
6. Grover Ch.: *Word 2007 PL. Nieoficjalny podręcznik*. Helion, 2007.
7. Jaronicki A.: *122 sposoby na OpenOffice.ux.pl 2.0*. Helion, 2006.

8. Dziewoński M.: *OpenOffice 2.0 PL. Oficjalny podręcznik*. Helion, 2006. 9. Elmasri R., Navathe S.B.: *Wprowadzenie do systemów baz danych*. Helion SA, 2005. 10. Schwartz S.: *Po prostu Access 2003 PL*. Helion SA, 2004. 11. Całka L.: *Poczta elektroniczna. Ćwiczenia praktyczne*. Helion, 2003.
Complementary literature

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Łukasz Nozdrzykowski, PhD Eng.	l.nozrzykowski@am.szczecin.pl	WiITT
Other teachers:		

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,

E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	**13**	Course:	**Fundamentals of machine construction**				
Major:	**Mechanical Engineering**	Specialisation:	**Marine Power Plant Operation**				
Studies cycle:	**First**	Form of studies:	**full-time**	Year of studies:	**2nd 3rd**	Semesters:	**3rd-4th 5th**
Course status:	**mandatory**	Course group:	**field-specific course**				

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	T	L	E	S	P	SE	IP	PR	A	T	L	E	S	P	SE	IP	PR	
3rd	12	2									24									2
4th	15	2E		2							30		30							5
5th	12			2									24							1
Total during studies											54		54							8

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Prior participation in the classes and obtaining credit in the following courses: mathematics, physics, mechanics and strength of materials, engineering graphics, and completion of the professional practice provided for in the study plan.

Course objectives:

1.	Developing the ability to use standards and unification studies
2.	Master the rules of developing construction documentation
3.	Teaching the implementation of the necessary strength calculations for basic construction nodes of machines and devices (during construction)
4.	Acquainting with the functional features of typical mechanisms used in the construction of machines

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Applies the issues of standardization, tolerances and fits as well as the technological efficiency of structures	EK_W02, EK_U05, EK_U04
EKP2	Selects materials based on properties and strength	EK_W02, EK_U05, EK_U10, EK_U03, EK_U04
EKP3	Designs and constructs machine elements	EK_W02, EK_U05, EK_U10, EK_U03, EK_U04, EK_K01, EK_K03
EKP4	Designs and constructs basic types of connections and mechanisms, taking into account their functional features	EK_W02, EK_U05, EK_U10, EK_U03, EK_U04, EK_K01, EK_K03

EKP5	Characterizes the working conditions of connections and mechanisms	EK_W02 , EK_U05, EK_U02
EKP6	Prepares the technical drawing with the use of Auto CAD computer aid	EK_W02, EK_U11, EK_U03

Programme content:

Form of clas-ses	EKP relation	Implemented content	Num-ber of hours
Semester:		3rd	
A	EKP1,2,3	Principles of machine construction: standardization, resistance of ma-chine parts, construction materials, technological design, tolerances and fits	24
	EKP1–5	Connections: a) riveted: types of rivets and riveted joints, design rules for riveted joints; b) bonded: performance and characteristics of bonded joints; c) push-in: calculation and design of press-fit and shrink connections; d) shape: calculation and design of bushings, wedges, pin and spline con-nections; e) threaded: structure, parameters and types of threads, forces in threaded connections, design of threaded connections; f) flexible (elastic): coil springs, characteristics and calculation rules	
Total in the semester:			24

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	24	2
Self study	16	
Participation in final tests and exams apart from classes	5	
Total	45	

Programme content:

Form of classes	EKP relation	Implemented content	Num-ber of hours
Semester:		4th	
A	EKP1–5	**Axles and shafts**: static and fatigue limit; rigidity; structure; design of axes and straight and cranked shafts	30
	EKP1–5	**Bearings**: slide bearings; rolling bearings	

	EKP1–5	**Gears**: gears (types of gears and gears, basic terms, gear cooperation, gear machining, displacement of the profile in gears, gear strength, gear structure, worm gears, planetary and compound gears); friction (principles of construction and calculation of friction gears, regular gears, continuously variable gears); tie rods (belt transmission systems, belts and pulleys, design of belt transmissions, construction and design of chain transmissions)	
	EKP1–5	**Clutches**: a) types of clutches; b) standardization and selection; c) calculations; d) application	
	EKP1–5	**Brakes**: classification and characteristics; calculation of block and cable brakes	
	EKP1–5	**Mechanisms**: a) structure of mechanisms; b) classification of kinematic pairs and chains; c) lever mechanisms; d) crank and yoke mechanisms; e) cam mechanisms	
L	EKP1–6	Introduction (general information on CAD / CAM computer assistance). Basic information on drawing editors, modern software, introduction to Auto CAD 2000 (editor's capabilities, starting the program, basic commands). Autocad drawing space, global and local coordinate systems, object picking, units, paper scale and size, help system, disk operations	30
	EKP1–6	Basic drawing elements (line, point, circle, arc, area, polyline, ellipse, rectangle, polygon). Basic drawing elements (ring, wide line, sketch, spline, multilines, construction lines, regions). Features of drawing objects (color, line types, scale factor, lines with symbols), viewing the drawing	
	EKP1–6	Drawing modifications (deleting, copying, moving, rotating, resizing objects), handles, precision of editing. Text fields, hatching, precise drawing. Creating layers and blocks, grouping objects, prototype drawing	
	EKP1–6	Dimensioning of drawings, references, shape tolerances, editing dimensions, dimension styles. Printout (drawing plotting)	
	EKP1-5	Calculation and design of a welded bolt-thread connection	
	EKP1-6	Preparation of drawings: assembly and executive parts of the designed connection	
	EKP1-5	Calculation and design of a screw lift	
	EKP1-6	Preparation of assembly and executive drawings of the designed lift	
Total in the semester:			24

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	60	5
Self study	60	
Participation in final tests and exams apart from classes	30	
Total	150	

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		5th	
L	EKP4.5	Drawing in space - general information	24
	EKP1–6	Using polylines in solid modeling. Create solids using an extrude, revolve around any axis, and a handlebar extrude. Modeling using the "solids" function	
	EKP4.5	Modification of 3D objects: intersection, addition, subtraction. 3D operations: shift, rotation, mirror, array	
	EKP1–6	Rounding and chamfering corners in 3D objects. Drawing exercises	
	EKP1–6	Calculation and design of the stepped reduction gearbox: selection of gear ratios and the number of teeth of interlocking gears, calculation of modules and strength conditions; shaft strength calculation; bearing selection and key calculations	
	EKP1–6	Preparation of assembly and executive drawings of the designed reduction gear with toothed wheels	
	EKP1–5	Identification and measurements of gears. Meshing characteristics	
	EKP1–5	Tooth clearance adjustment in gears	
	EKP1–5	Hydrodynamic pressure testing in slide bearings	
	EKP1–5	Measurements of geometrical errors of the crankshaft	
	EKP1–5	Measurements of geometrical errors of openings in bearing seats	
	EKP1–5	Testing the stresses in coupled shafts	
	EKP1–5	Examination of selected characteristics of the friction clutch	
	EKP1–5	Slip test in a belt transmission	
Total in the semester:			24

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	24	1
Self study	12	
Participation in final tests and exams apart from classes	4	
Total	40	

Assessment methods and criteria:

Grades	2	3	3.5–4	4.5 – 5
Grading method	Written or oral and practical credit during laboratory classes. Assessment possible using distance learning methods and techniques			
EKP1	Student is unable to correctly apply and implement the principles of standardization. Does not know the concepts and principles of selecting tolerances and fits. Does not know or is unable to correctly apply the principles of the technological design	Can apply and implement the principles of standardization. Knows the concepts and rules of selecting tolerances and fits. Knows and is able to apply the principles of the technological design	Can correctly apply and implement the principles of standardization. Knows the concepts and rules of selecting tolerances and fits. Knows and is able to correctly apply the principles of the technological design	Can correctly apply and implement the principles of standardization. Knows the concepts and principles of selecting tolerances and fits, and is able to combine these issues with the issues of standardization. Knows and is able to correctly apply the principles of the technological design. Can predict the effects of errors in the selection of tolerances and fits, and the effects of not applying the principles of technology when designing
EKP2	Is not able to select materials for the designed machine elements. Does not know the issues linking the material and strength properties of the designed machine elements with the nature of their work and load	Can select materials for the designed machine elements depending on the nature of their work and load	Is able to properly select materials for the designed machine elements, taking into account the nature of work and the load on these elements	Can independently select materials for the designed machine elements in an appropriate manner. Analyzes the nature of work and the load of these elements. Knows the consequences of wrong selection of materials for the designed machine elements
EKP3	Is not able to properly design and construct specific elements of machines. Does not know the rules of construction	Can design and construct selected machine elements	Can design and construct any elements of machines	Independently designs and constructs any elements of machines, analyzing their working conditions and purpose beforehand
EKP4	Cannot design and construct basic types of connections and mechanisms. Does not distinguish between typical connections and does not know the rules of their design	Can design and construct selected types of connections and mechanisms. Distinguishes between types of connections, knows the principles of their design and construction	Can design and construct selected types of connections and mechanisms. Distinguishes and classifies connections, knows the principles of their design and construction. Performs appropriate structural and strength calculations necessary for the correct design of the selected type of connection	Can design and construct any type of connection or mechanism. Distinguishes between types of connections, knows the principles of their design and construction Independently performs appropriate structural and strength calculations necessary for the proper design of any connection or mechanism

EKP5	Cannot characterize the working conditions of the selected connection or mechanism	Can characterize the working conditions of the selected connection or mechanism	Can characterize the working conditions of the selected connection or mechanism	Can independently characterize the working conditions of any connection or mechanism. Knows their functional features and purpose
EKP6	Cannot save a technical drawing with the use of Auto CAD 2D and 3D	Is able to prepare a technical drawing with the use of Auto CAD 2D and 3D	Is able to prepare a technical drawing with the use of Auto CAD 2D and 3D. Knows the broad functionalities of the program	Is able to prepare a technical drawing with the use of Auto CAD 2D and 3D. Knows the broad functionalities of the program. Accurately prepares construction documentation

Teaching tools:

Type	Description
Multimedia projector, screen, laptop	Auditorium classes in the form of a multimedia presentation and computer animation
Laboratory workbenches, computers with Auto-Cad software	Laboratory classes in the form of laboratory and project exercises. Laboratory exercises include classes lead in groups with use of specially made laboratory workstations, 2D and 3D CAD design tools and individual design tools for every student.
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. Rutkowski: *Części Maszyn, cz.I i II*. Wydawnictwo Szkolne i Pedagogiczne, 2007. 2. Ciszewski, Radomski T.: *Materiały konstrukcyjne w budowie maszyn*. PWN, Warszawa 1999. 3. Jezierski J.: *Analiza tolerancji i niedokładności pomiarów budowie maszyn*. WNT, Warszawa 1983. 4. Feld M.: *Podstawy projektowania procesów technologicznych typowych części maszyn*. WNT, Warszawa 2009. 5. Korewa W., Zygmunt K.: *Postawy Konstrukcji Maszyn, część II*. WNT, Warszawa 1975. 6. Dietrich M.: *Postawy Konstrukcji Maszyn, część III.* WNT, Warszawa 2008.
Complementary literature
1. Praca zbiorowa: *Mały poradnik mechanika, tom 2*. WNT, 1994 . 2. Flis J.: *Zapis i Podstawy Konstrukcji Materiały Konstrukcyjne*. 3. Chwastek P.: *Podstawy projektowania inżynierskiego*. www.chwastyk.po.opole.pl 4. www.wbss.pg.gda.pl 5. www.kuryjanski.pl 6. Mitutoyo: advertising materials. 7. SKF sp. z o.o. advertising materials 8. Timken advertising materials

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Krzysztof Nozdrzykowski, PhD Eng.	l.nozrzykowski@am.szczecin.pl	WM
Other teachers:		
Waldemar Kostrzewa, PhD Eng.	w.kostrzewa@am.szczecin.pl	WM
Marek Pijanowski, PhD Eng.	m.pijanowski@am.szczecin.pl	WM

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	14	Course:	**Marine materials science***				
Major:	**Mechanical Engineering**	Specialisation:		**Marine Power Plant Operation**			
Studies cycle:	**First**	Form of studies:	**full-time**	Year of studies:	**First**	Semesters:	**First**
Course status:	**mandatory**	Course group:	**field-specific course**				

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	E	L	EL	S	P	SE	TW	PR	A	E	L	EL	S	P	SE	TW	PR	
First	15	2E		2							30		30							5
Total during studies											30		30							5

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Chemistry
2.	Physics
3.	Fundamentals of machine construction
4.	Strength of materials
5.	Advanced IT systems

Course objectives:

1.	Developing the ability to distinguish between basic types of materials
2.	Developing the ability to determine the properties of materials with relation to their structure
3.	Developing the ability to select materials for specific applications

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Student characterizes and distinguishes basic laws, dependencies, mechanisms and connections concerning the structure and properties of construction materials	EK_W05, EK_W02, EK_W03, EK_U10, EK_U04
EKP2	Distinguishes and conducts basic research on the structure and properties of materials	EK_W05, EK_W03, EK_W01, EK_U10, EK_U01, EK_U04
EKP3	Distinguishes the essential features and properties of basic structural and auxiliary materials used in shipbuilding	EK_W05, EK_W02, EK_W03, EK_U10, EK_U04
EKP4	Distinguishes the mechanisms of materials destruction	EK_W05, EK_W03, EK_W02, EK_U04, EK_U10
EKP5	Distinguishes and properly selects structural or auxiliary material	EK_W05, EK_W03, EK_W01, EK_U10, EK_U01, EK_U04

Programme content:

Form of clas-ses	EKP relation	Implemented content	Num-ber of hours
Semester:		First	
A	EKP1,2,3,4	**Basic concepts of materials science**: kind, form, technological condition, quality, functional features. Fundamentals of solids structure: crystalline and amorphous structures, lattice types, defects. The influence of physical structure on the properties of materials. Fundamentals of the structural form of metal alloys: types of equilibrium systems, phase components of alloys	30
	EKP2,4	**Fundamentals of materials research**: optical microscopy, basics of metallographic preparation, macroscopic examinations, measurements of metal hardness, technological tests. Mechanisms of material destruction: brittle fracture, fatigue, wear, corrosion, erosion	
	EKP1,3,4	**Iron-carbon balance system**. Technical iron alloys: steels and cast steels, cast irons, special iron alloys, foreign elements in iron alloys and their influence on properties, marking of iron alloys, selected properties and examples of applications. Ferrous alloys metallurgy: iron-carbon diagram, alloy additives, mechanical properties of individual metals, heat treatment. Use of metals and their alloys in shipbuilding	
	EKP1,4,5	**Technical non-ferrous metal alloys**: alloys of copper, aluminum, titanium, nickel, magnesium, tin, lead; marking of non-ferrous alloys; selected properties and application examples. Metallurgy of non-ferrous metals: aluminum alloys, bronze and brass, properties and application of non-ferrous metals	
	EKP1,2,3	**The influence of heat treatment processes on the properties of metals**: basics of heat treatment processes, study of the influence of hardening and tempering processes on the mechanical properties of steel, microscopic observations of heat-treated and thermo-chemically treated steel structures, heat treatment of alloy steels, observations of microstructures of high-alloy steels, heat treatment of non-ferrous alloys	
	EKP1,3,4,5	**Non-metallic materials**. Natural materials: technical ceramics, polymer materials; auxiliary materials: adhesives, sealants, insulation, paints, varnishes, abrasive pastes. The use of natural materials, ceramics and polymers in shipbuilding. The use of adhesives, sealants and other auxiliary materials for the regeneration of machine parts and the operation of the power plant	
	EKP1,3,4,5	**Composite materials**: basic mechanics of composites, polymer- and metal-based composites, technical examples of applications. Use of polymer- and metal-based composites in shipbuilding	
	EKP1,3,4,5	**Principles of selection of engineering materials**: performance criteria, technological criteria, economic criteria, ecological criteria. Regulations of classification societies related to shipbuilding materials. Computer-aided design, testing and selection of CAMD materials	
L	EKP1,2,3,4	Study of crystalline structures of selected metal alloys	30
	EKP1,2,3,4	Examination of material destruction mechanisms	
	EKP1,2,3,4	Testing influence of alloy additives on the properties of metal alloys	
	EKP1,2,3,4	Testing of selected metal alloys	
	EKP1,2,3,4	Heat treatment of metal alloys	

	EKP1,2,3,4	Testing of non-metal materials	
	EKP1,2,3,4,5	Testing properties of composite materials	
	EKP1,2,3,4,5	Use of computer research and selection of materials	
Total in the semester:			60

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	60	5
Self study	40	
Participation in final tests and exams apart from classes	30	
Total	130	

Assessment methods and criteria:

Grades	**2**	**3**	**3.5–4**	**4.5 – 5**
Grading method	Written or oral and practical credit during laboratory classes. Assessment possible using distance learning methods and techniques			
EKP1	Student is unable to characterize and distinguish correctly the basic laws, dependencies and mechanisms concerning the structure of construction materials	Can characterize and distinguish correctly the basic laws, dependencies and mechanisms regarding the structure of construction materials	Can characterize and distinguish correctly the basic laws, relationships, mechanisms and relationships concerning the structure and properties of construction materials. Can present arguments in favor of selecting the appropriate construction material for its intended use	Can characterize and distinguish correctly the basic laws, relationships, mechanisms and relationships concerning the structure and properties of construction materials. Can present arguments in favor of selecting the appropriate construction material for its intended use, can propose an accurate replacement of construction material with derivative construction material
EKP2	Student is unable to carry out basic research on the structure and properties of materials	Performs basic research on the structure and properties of materials to a satisfactory degree	Can distinguish and evaluate the usefulness of research on the structure and properties of materials. Can carry them out and indicate the most optimal research methods according to a specific criterion	Can distinguish and evaluate the usefulness of research on the structure and properties of materials. Can carry them out and indicate the most optimal research methods according to a specific criterion. Can define an alternative method of examining the structure and properties of basic construction materials
EKP3	Is unable to distinguish the features and properties of basic construction materials in shipbuilding	Can distinguish the features and properties of basic construction materials used in shipbuilding	Can correctly distinguish and evaluate the essential features and properties of construction materials used in shipbuilding	Can correctly distinguish and evaluate the essential features and properties of structural and auxiliary materials used in shipbuilding. Can indicate the benefits of changing the structure and determine their impact on these properties of materials
EKP4	Cannot distinguish the mechanisms of material destruction	Can distinguish the mechanisms of the destruction of materials	Can correctly distinguish and assess the mechanisms of destruction of materials	Can correctly distinguish and assess the mechanisms of destruction of materials. Can indicate the causes of the destructive influence of factors on the material

EKP5	Cannot distinguish and choose the construction material	Can distinguish and select construction or auxiliary material	Can distinguish and properly select construction or auxiliary material. Can replace construction or auxiliary material with another	Can distinguish and properly select construction or auxiliary material. Can replace construction or auxiliary material with another. Can identify the differences resulting from the change of the starting material to a substitute and define the consequences of this change. Can propose the most desirable type of structure in terms of the indicated design properties

Teaching tools:

Type	Description
Projector	Auditorium classes in the form of multimedia presentations and films
Microscopes	Metallography microscopes
Auxiliary materials	Carbon and alloy steels, cast irons, copper alloys, aluminum, plastics, fiberglass, resins, hardeners, adhesives, etc.
Laboratory	ovens and dryers
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature

1. Prowans S.: *Materiałoznawstwo*. PWN, Warszawa 1984.
2. Dobrzański L.A.: *Podstawy nauki o materiałach i metaloznawstwo.* WNT, Warszawa 2002.
3. Cicholska M., Czechowski M.: *Materiałoznawstwo okrętowe*. WNT, Gdynia 1999.
4. Mazurkiewicz A.: *Obróbka plastyczna. Laboratorium*. Ed. Politechniki Radomskiej, 2006.
5. Own notes from lectures.

Complementary literature

1. Laboratory instructions from "Materials Science" available on the ZIMO website www.am.szczecin.zimo.pl
2. Górny Z.: *Metale nieżelazne i ich stopy odlewnicze, topienie, odlewanie, struktury i właściwości*. Instytut Odlewnictwa, Kraków 1992.
3. Gawdzińska K., Nagolska D., Szweycer M.: *Technologia materiałów*. Fundacja Rozwoju Wyższej Szkoły Morskiej w Szczecinie, 2002.
4. Łybacki W., Modrzyński A., Szweycer M.: *Technologia topienia metali*. Wydawnictwo Politechniki Poznańskiej, 1986.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Katarzyna Gawdzińska, PhD Eng.	k.gawdzinska@am.szczecin.pl	WM
Other teachers:		
Robert Jasionowski, PhD Eng.	r.jasionowski@am.szczecin.pl	WM

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	15	Course:	**Engineering of manufacturing I** *					
Major:	**Mechanical Engineering**	Specialisation:			**Marine Power Plant Operation**			
Studies cycle:	**First**	Form of studies:	**full-time**	Year of studies:	**2nd**	Semesters:	**3rd**	
Course status:	**mandatory**	Course group:	**field-specific course**					

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	T	L	E	S	P	SE	IP	PR	A	T	L	E	S	P	SE	IP	PR	
3rd	12	1		2							12		24							3
Total during studies											12		24							3

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Basics of materials science and strength of materials
2.	Strength of materials
3.	Fundamentals of machine construction
4.	Technical drawing
5.	Advanced IT systems

Course objectives:

1.	Developing the ability to distinguish between the processes of materials manufacturing, forming and joining
2.	Developing the ability to distinguish the influence of plastic, heat and surface processing on the properties of materials
3.	Developing the ability to combine materials

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Distinguishes between the production processes of basic constructional and auxiliary materials	EK_W05, EK_W03, EK_U10
EKP2	Distinguishes and properly selects the processes of manufacturing, forming and joining basic construction materials	EK_W05, EK_W03, EK_U10
EKP3	Distinguishes between changes in structure and changes in properties in the material resulting from manufacturing, forming and joining	EK_W05, EK_W03, EK_U10

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		3rd	
A	EKP1,2	Metallurgical and foundry processes and their influence on metal properties: the basics of metallurgy and foundry	12
	EKP3	Influence of plastic working processes on the properties of metals: plastic deformation, crushing and recrystallization; plastic forming processes	
	EKP1	Fundamentals of technology and research on polymers: processes for obtaining polymer materials, research on polymer materials, adhesives and bonding	
	EKP1,2	Basics of ceramics technology	
	EKP1,2,3	Composite materials technologies: polymer and metallic composite materials; manufacturing technologies; testing of selected properties of composite materials	
	EKP1	Technological characteristics of construction materials	
	EKP2	Welding and cutting metals, argon arc welding	
	EKP1	Computer aided manufacturing process	
L	EKP1,2	Metallurgical and foundry processes and their influence on metal properties: the basics of metallurgy and foundry	24
	EKP1,2	Influence of plastic working processes on the properties of metals: plastic deformation, crushing and recrystallization; plastic forming processes	
	EKP1,2	Basics of plastic working and its influence on metal properties , plastic deformation, crushing and recrystallization	
	EKP1,2,3	Fundamentals of technology and research on polymers: processes for obtaining polymer materials, research on polymer materials, adhesives and bonding	
	EKP1	Basics of ceramics technology	
	EKP1,2	Composite materials technologies: polymer and metallic composite materials; manufacturing technologies; testing of selected properties of composite materials	
	EKP1	Technological characteristics of construction materials	
	EKP1	Computer aided manufacturing process	
Total in the semester:			36

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	36	3
Self study	20	
Participation in final tests and exams apart from classes	8	
Total	68	

Assessment methods and criteria:

Grades	2	3	3.5–4	4.5 – 5
Methods of evaluation	Written or oral and practical credit during laboratory classes. Assessment possible using distance learning methods and techniques			
EKP1	Student is unable to correctly distinguish between the manufacturing processes of basic construction materials	Student distinguishes between the production processes of basic constructional and auxiliary materials	Can correctly distinguish between the processes of manufacturing basic constructional and auxiliary materials. Can present arguments in favor of selecting the appropriate construction material for its intended use, can propose an accurate replacement of construction material with derivative construction material	Can correctly distinguish between the processes of manufacturing basic constructional and auxiliary materials. Can present arguments in favor of selecting the appropriate construction material (and auxiliary materials) for its intended use, can propose an accurate replacement of construction (and auxiliary) material with derivative construction (and auxiliary) material
EKP2	Student is unable to distinguish and properly select the processes of manufacturing, forming and joining basic construction materials	Correctly identifies and selects the processes of manufacturing, forming and joining basic construction materials	Can distinguish and evaluate the usefulness of manufacturing processes, select the most effective joining and forming processes (can perform them satisfactorily) in relation to basic construction materials	Can distinguish and evaluate the usefulness of manufacturing processes, select the most effective joining and forming processes in relation to basic construction materials (knows how to make them correctly). Can identify an alternative method of forming or joining basic construction materials
EKP3	Student is unable to distinguish between changes in structure and changes in properties taking place in the material as a result of manufacturing and forming	Can distinguish between changes in structure and changes in properties of the material as a result of manufacturing, forming and joining it	Is able to correctly distinguish and assess changes in the structure and changes in properties occurring in the material as a result of its production, forming and joining. Can indicate the benefits of changing the structure and their impact on the properties of materials	Can correctly distinguish and assess changes in the structure and changes in properties occurring in the material as a result of its production, forming and joining. Student can indicate the benefits of changing the structure and their impact on the properties of materials. Can propose the most desirable type of structure for the presented design properties

Teaching tools:

Type	Description
Projector	Auditorium classes in the form of multimedia presentations and films
Auxiliary materials	Metal alloys, crucibles, molding boxes, molding sand, quartz sand, plastics, fiberglass, resins, hardeners, adhesives, etc.
Ovens	Laboratory and induction
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. Gawdzińska K., Nagolska D., Szweycer M.: *Technologia materiałów*. Fundacja Rozwoju Wyższej Szkoły Morskiej w Szczecinie, 2002. 2. Szweycer M., Nagolska D.: *Technologia materiałów. Metalurgia i odlewnictwo*. Wydawnictwo Politechniki Poznańskiej, Poznań 2001. 3. Prowans S.: *Materiałoznawstwo.* PWN, Warszawa 1984. 4. Dobrzański L.A.: *Podstawy nauki o materiałach i metaloznawstwo.* WNT, Warszawa 2002. 5. Klimpel A.: *Spawanie, zgrzewanie i cięcie metali*. WNT, 1999. 6. Mazurkiewicz A.: *Obróbka plastyczna. Laboratorium*. Ed. Politechniki Radomskiej, 2006. 7. Own notes from lectures.
Complementary literature
1. Laboratory instructions from "Manufacturing Techniques I" available on the ZIMO website www.am.zimo.szczecin.pl 2. Górny Z.: *Metale nieżelazne i ich stopy odlewnicze, topienie, odlewanie, struktury i właściwości*. Instytut Odlewnictwa, Kraków 1992. 3. Łybacki W., Modrzyński A., Szweycer M.: *Technologia topienia metali*. Wydawnictwo Politechniki Poznańskiej, 1986. 4. Cicholska M., Czechowski M.: *Materiałoznawstwo okrętowe*. WNT, Gdynia 1999.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Katarzyna Gawdzińska, PhD Eng.	k.gawdzinska@am.szczecin.pl	WM
Other teachers:		
Robert Jasionowski, PhD Eng.	r.jasionowski@am.szczecin.pl	WM
Prof. Janusz Grabian, PhD Eng.	j.grabian@am.szczecin.pl	WM

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	16	Course:	**Engineering of manufacturing II – workshop practice** *				
Major:	**Mechanical Engineering**	Specialisation:		**Marine Power Plant Operation**			
Studies cycle:	**First**	Form of studies:	**full-time**	Year of studies:	**2nd**	Semesters:	**3rd, 4th**
Course status:	**mandatory**	Course group:	**field-specific course**				

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	E	L	EL	S	P	SE	TW	PR	A	E	L	EL	S	P	SE	TW	PR	
3rd	12			2									24							2
4th	15			3									45							3
Total during studies													69							5

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Engineering graphics
2.	Mechanics, strength of materials
3.	Basics of materials science and strength of materials

Course objectives:

1.	Mastering the ability to use tools for manual metal processing
2.	Mastering the ability to work and implement technological processes on metal-working machine tools
3.	Teaching the basics of workshop metrology

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Produces the desired spatial shape of details with the use of machining tools	EK_W02, EK_U05, EK_U10, EK_U03, EK_U04, EK_K01, EK_K03
EKP2	Student can work with machining tools and operate them	EK_W02, EK_U05, EK_U10, EK_U03, EK_U04, EK_K01, EK_K03
EKP3	Can use universal measuring equipment	EK_W02, EK_U05, EK_U01, EK_U04, EK_U10,

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		3rd	
L	EKP1,2	**Basic locksmithing operations**: sawing, cutting, parting off, scraping, tool sharpening	24

	EKP1,2	**Routing rules**: marking methods, tracing devices, bricklaying (steel, copper, PE pipes)	
	EKP1,2	**Power tools - operating principles**: drills, saws, grinders, basic operations	
	EKP3	**Measuring tools** a) review of basic measuring devices, b) rules of using universal equipment, c) methods of measuring linear and angular dimensions with universal equipment, d) types of patterns and their application, e) spirit levels - rules of operation and measurement, f) error calculation, error estimation rules	
Total in the semester:			24

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	24	2
Self study	20	
Participation in final tests and exams apart from classes	10	
Total	54	

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		4th	
L	EKP1,2,3	**Lathes**: a) types of lathes and their operation b) types of tools c) basic operations, OSN - programming principles and systems, technological processes	45
	EKP1,2,3	**Drills**: a) types and handling b) tools c) drilling operations	
	EKP1,2,3	**Planers**: a) types and handling b) tools c) operations	
	EKP1,2,3	**Milling machines**: a) basic types, b) milling operations: milling of planes and grooves	
Total in the semester:			45

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	45	3
Self study	30	
Participation in final tests and exams apart from classes	10	
Total	70	

Assessment methods and criteria:

Grades	2	3	3.5–4	4.5 – 5
Grading method	Practical credit during laboratory classes. Assessment possible using distance learning methods and techniques			
EKP1	Student is unable to produce the desired specific spatial shape of details with the use of machining processes	Student is able to produce the desired specific spatial shape of a selected detail with the use of machining processes	Is able to produce the desired specific spatial shape of any detail with the use of machining processes	Student is able to produce the desired specific spatial shape of a selected detail with the use of machining processes on their own
EKP2	Student cannot demonstrate the ability to work with machining tools and operate machine tools	Can demonstrate the ability to work with selected tools and to operate selected machining tools	Can demonstrate the ability to work with any tools and operate any machining tools	Can demonstrate the ability to work with selected tools and to operate selected machining tools Independently selects tools and equipment. Independently develops and implements the technological process of processing details
EKP3	Cannot handle basic universal measuring equipment	Can operate basic universal measuring equipment	Can operate basic universal measuring equipment. Independently selects measuring equipment for a specific task	Can operate basic universal measuring equipment. Independently selects measuring equipment for a specific task. Independently formulates and interprets the measurement results

Teaching tools:

Type	Description
Manual processing tools	Center punch, stylus, hacksaws, files, drills, reamers, taps, dies, grinding wheels
Machining tools	Lathes - Quantum, FWD 25 universal milling machines, column drill, table drills, surface grinders, cylindrical grinders
Auxiliary materials	Sheet metal, rods, sleeves, pipes
Universal measuring tools	Standards, templates, gauges, calipers, micrometers, inside micrometers, bore gauges, spirit levels
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. Jakubiec W., Malinowski J.: *Metrologia wielkości geometrycznych*. WNT, Warszawa 1996. 2. Praca zbiorowa: *Ślusarstwo*. WNT, Warszawa 2004. 3. Feld M.: *Podstawy projektowania procesów technologicznych typowych części maszyn*. WNT, Warszawa 2000. 4. Burek J.: *Maszyny technologiczne*. Politechnika Rzeszowska, 1999. 5. Praca zbiorowa: *Obrabiarki do skrawania metali*. WNT, Warszawa 1974. 6. Dietrich M.: *Podstawy konstrukcji maszyn tom I, II, III*. WNT, Warszawa 1999. 7. Bartosiewicz J.: *Obróbka plastyczna*. Fundacja Rozwoju Wyższej Szkoły Morskiej w Gdyni, 2000.
Complementary literature
1. O&MM for Quantum lathe 2. O&MM for FWD 25 JAFO mill 3. Poradnik inżyniera *Obróbka skrawaniem tom I – III*. WNT, Warszawa 1993. 4. Kornberger Z.: *Technologia obróbki skrawaniem i montażu*. WNT, Warszawa 1974.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Krzysztof Nozdrzykowski, PhD Eng.	l.nozrzykowski@am.szczecin.pl	WM
Marek Pijanowski, PhD Eng.	m.pijanowski@am.szczecin.pl	WM

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	17	Course:	**Engineering of manufacturing III – welding** *				
Major:		**Mechanical Engineering**	Specialisation:		**Marine Power Plant Operation**		
Studies cycle:		**First**	Form of studies:	**full-time**	Year of studies:	**3rd**	Semesters: **5th**
Course status:		**mandatory**	Course group:	**field-specific course**			

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	T	L	E	S	P	SE	IP	PR	A	T	L	E	S	P	SE	IP	PR	
5th	12			3									36							2
Total during studies													36							2

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Elementary knowledge of the structure and properties of basic construction materials
2.	Knowledge of the basics of heat treatment of iron alloys

Course objectives:

1.	Developing the ability to select the appropriate welding method, cutting, joining and surfacing, as well as soldering and welding depending on the material, shape, dimensions and technological condition of the element
2.	Acquiring the ability to prepare elements for cutting, welding and surfacing, as well as soldering and welding, and to ensure appropriate safety conditions
3.	Acquiring the ability to carry out cutting, joining and surfacing with welding methods as well as soldering and welding
4.	Developing the ability to assess the quality of joints and welds made

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Student can choose the right method, perform welding, surfacing and cutting, as well as soldering and fusing basic construction materials. Knows the rules of safe use of welding equipment and applies them to the use of this equipment	EK_W05, EK_W01, EK_U04, EK_U06
EKP2	Can recognize defects (welding imperfections) of welded joints and explain the reasons for their occurrence	EK_W05

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		5th	
L	EKP1,2	**Basics of welding processes**: basic concepts; welding materials (0.5 h); the use of welding materials in shipbuilding (2 hours); the mechanism of the formation of the welded joint; construction of a welded joint; heat affected zone; heat sources in welding processes; welding, surfacing and cutting technologies	36
	EKP1,2	**Welding and gas cutting**: principles of health and safety and fire protection with gas welding; properties of technical gases; storage and transport of technical gases; structure and types of flame; types and construction of welding and cutting torches; gas welding consumables; practical operation of welding equipment; types of joints, welds and welding positions; preparation of material for welding and cutting; cutting (burning) of steel in the form of sheets, profiles and pipes; surfacing in uphill and vertical position; welding of butt joints in the downhill, wall and vertical position	
	EKP1,2	**Electric welding and cutting**: principles of health and safety and fire protection in electric welding and cutting; construction and principles of electric welding and cutting devices; consumables for electric welding: electrodes, technical gases (argon, CO_2, mixtures), ceramic washers; practical operation of electric welding and cutting devices; types of joints, welds and welding positions; preparation of material for welding and cutting; welding with bare wire and coated electrode; welding of T-joints in the side and vertical position; welding of butt joints prepared for "I", "V" and "Y" in the horizontal and vertical position; electric cutting of steel in the form of sheets, profiles and pipes	
	EKP1,2	Disadvantages of welded joints. Testing of welded joints	
	EKP1,2	**Soldering and welding**. Preparation of elements, auxiliary materials, station, used device along with the selection of technological parameters of the process, assessment of the existing hazards for the operator and the environment, determination of ways to eliminate safety hazards and conducting the planned soldering and welding process. Conducting a quality assessment of the work performed	
Total in the semester:			36

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	36	2
Self study	15	
Participation in final tests and exams apart from classes	5	
Total	56	

Assessment methods and criteria:

Grades	2	3	3.5–4	4.5 – 5
Methods of evaluation	Oral or written credit and practical credit during laboratory classes. Assessment possible using distance learning methods and techniques			
EKP1	Student cannot discuss the safety rules for welding methods and does not know the principles of basic welding methods (as well as soldering and welding)	Can discuss the principles of cutting, welding and surfacing safety, as well as soldering and fusing, and can discuss the activities necessary to be performed within individual processes. Student can carry out welding and surfacing with the use of a coated electrode	Can carry out cutting, welding and surfacing as well as soldering and welding and prepare elements for these processes	Can choose the method of bonding and justify this choice. Is able to assess the correctness of the bonding processes carried out on the basis of the external characteristics of welds and padding welds, radiographs and samples cut out for macroscopic examinations
EKP2	Cannot describe the structure of a welded joint on welding samples. Cannot provide the rules for assessing the quality of the welded joint	Can name and discuss welding imperfections occurring in welded joints	Can identify welding imperfections on the basis of radiographs and welding samples	Can assess the quality of welded joints

Teaching tools:

Type	Description
Basic welding equipment	acetylene welding and cutting sets, TIG welding equipment, MIG / MAG welding equipment, inverter welding machines for coated electrode welding, plasma cutters, resistance spot welding machine, propane-butane soldering torches
Auxiliary equipment	welding tables, negatoscope, calipers
Materials	auxiliary materials, elements prepared for cutting, welding, surfacing, gluing, welding
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature

1. Klimpel: *Technologia spawania i cięcia metali*. Wydawnictwo Politechniki Śląskiej, Gliwice 1997.
2. Klimpel: *Napawanie i natryskiwanie cieplne*. WNT, Warszawa 2000.
3. Dobaj E.: *Maszyny i urządzenia spawalnicze*. WNT, 1994, 1998.
4. Halamus L.: *Spawalnictwo – laboratorium*. Skrypt nr 7. Politechnika Radomska, 2000.
5. Gourd L.M.: *Podstawy technologii spawalniczych*. WNT, Warszawa 1997.
6. Mistur L.: *Spawanie gazowe i elektryczne*. Państwowe Wydawnictwa Szkolnictwa Zawodowego.
7. Dobrowolski Z.: *Podręcznik spawalnictwa*. WNT.
8. *Konstrukcje metalowe. Przewodnik do ćwiczeń laboratoryjnych ze spawalnictwa*. WSM, Szczecin.

Complementary literature

1. Klimpel: *Technologie zgrzewania metali i tworzyw termoplastycznych*. Wydawnictwo Politechniki Śląskiej, Gliwice 1999.
2. Marcolla K.: *Gazy techniczne w spawalnictwie*. Wydawnictwo Uczelniane Politechniki Poznańskiej, Poznań.
3. Butnicki S.: *Spawalność i kruchość stali*. WNT, Warszawa.
4. Tasak E.: *Metalurgia i metaloznawstwo połączeń spawanych*. Skrypty uczelniane nr 945 AGH w Krakowie.

5. Auxiliary materials for selected laboratory exercises prepared at the Department of Ship Materials Engineering.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Prof. Janusz Grabian, PhD Eng.	j.grabian@am.szczecin.pl	WM
Other teachers:		

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	18	Course:	**Repair technology** *				
Major:	**Mechanical Engineering**	Specialisation:		**Marine Power Plant Operation**			
Studies cycle:	**First**	Form of studies:	**full-time**	Year of studies:	**3rd-4th**	Semesters:	**5th, 7th**
Course status:	**mandatory**	Course group:	**field-specific course**				

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	E	L	EL	S	P	SE	TW	PR	A	E	L	EL	S	P	SE	TW	PR	
5th	12	2		2							24		24							3
7th	15	2		2							30		30							4
Total during studies											54		54							7

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Ship machinery and equipment
2.	Reciprocating internal combustion engines and their control systems
3.	Metrology and measurement systems

Course objectives:

1.	Developing the ability to assess the quality of machine elements by means of visual inspection, workshop measurements and non-destructive testing
2.	Developing the skills to carry out repairs of ship machinery, taking into account, supervision and verification of the correctness of the assembly and disassembly processes of elements, systems, assemblies with the use of various methods of connection implementation
3.	Developing the ability to assess the degree of wear and qualify an element for repair or regeneration as well as the implementation of repairs and regeneration of selected machine elements

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Student knows and applies the methods of assessing the quality of machine elements	EK_W01, EK_W02, EK_U04, EK_U10
EKP2	Knows and applies the methods of connection in the process of assembly / disassembly of the machine, its subassemblies and elements. Is able to manage and share responsibilities while working in a team. Can plan and safely carry out repairs of ship machinery	EK_W02, EK_W04, EK_U05
EKP3	Knows and correctly chooses the right method of repair or regeneration, and knows how to repair / regenerate a machine element with the selected method. Can estimate the costs and profitability of repair or regeneration	EK_W03, EK_U06

Programme content:

Form of clas-ses	EKP rela-tion	Implemented content	Num-ber of hours
Semester:		5th	
A	EKP2	The phases of the technological process and the renovation phases	24
	EKP2	Types of tools used in device disassembly and assembly	
	EKP1,2	Rules for disassembling devices, subassemblies and elements in the marine power plant: - methods of removing impurities, - replacement of elements and subassemblies, - assembly rules and tightness tests	
L	EKP1	Checking the straightness, flatness and perpendicularity of planes	24
	EKP1	Checking the concentricity, perpendicularity and parallelism of the axes of the holes	
	EKP1	Measurements of interference in cylindrical press-fit connections. Measurements of cone angles and diameters in press-fit conical connections	
	EKP1	Measurements of shape deviations and roughness of shafts (including crankshaft journals). Measurement of runout and detection of the causes of runout	
	EKP1	Measurements of shape deviations and roughness of holes (cylinder liners, bushing bearing holes)	
	EKP1	Measurement of position deviations (piston, connecting rod, crankshaft etc.)	
	EKP1	Measurements of layer thickness and wall thickness	
	EKP1	Measurements of mechanical properties. Measurements of elasticity of elements. Element stress measurements Modal analysis	
	EKP1	Study of the macrostructure. Detection of discontinuities with penetration methods	
	EKP1	Detection of discontinuities by magnetic-particle methods	
	EKP1	Detection of discontinuities by ultrasonic methods	
	EKP1	Detection of discontinuities by radiological methods	
	EKP1	Tightness testing. Endoscopy	
	EKP1	Unbalance measurements	
	EKP2,3	Implementation of cylindrical interference joints (by pressing, heating, cooling). Implementation of conical press-fit connections (by pressing in, hydraulic hub expansion, heating, cooling). Assembly inspection. Repairs by inserting elements: bushing, pinning, sewing	
Total in the semester:			48

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	**Estimated number of hours to complete the activity**	**ECTS points**
Total hours	48	3
Self study	20	
Participation in final tests and exams apart from classes	6	
Total	74	

Programme content:

Form of classes	**EKP relation**	**Implemented content**	**Number of hours**
Semester:		7th	
A	EKP2	Safety rules for disassembly and assembly works	30
	EKP1	Basics of workshop metrology: - measuring instruments used in the repair of machines and devices and their purpose	
	EKP3	Regeneration of elements with the use of plastic composites, technology of applying protective coatings	
	EKP2	Technology of repair of steam and gas turbines, renovation of turbochargers	
	EKP1,2,3	Repair technology for marine reciprocating internal combustion engines: preparation and organization of engine overhaul, measurements before disassembly, disassembly of basic engine assemblies, verification and repair of engine components, engine tests after overhaul	
	EKP1,2,3	Technology of repairing machines and auxiliary devices: pumps, compressors, fans, filters, heat exchangers, centrifuges, hydraulic devices, devices for the protection of the marine environment	
	EKP2	Technology of repair of ship pipelines and fittings: cutting pipes, threading pipes, immediate removal of pipe leaks, sealing pipeline sections with flanged connections, pipe disassembly, making new sections of pipes with flanges (straight and profiled), flange fitting, valve repair	
	EKP2,3	Repairs and acceptance of: hulls, tanks, boilers and pressure vessels, gears, shaft lines and thrusters, on-board equipment, marine environment protection devices, automation and control devices	
	EKP2,3	Repairs management on ships: processes of physical aging of the hull and ship's equipment, organization of ship repair (types of repairs: emergency, scheduled), repair planning, spare parts management	
L	EKP2,3	Making bolted connections: checking the position of the bolts, checking the initial tension, assembly of push-in connections, assembly of resting seals	30
	EKP2,3	Implementation of wedge and key connections	
	EKP2,3	Assembly of rotors and inspection of assembly of rotors. Rolling bearings installation	

	EKP2,3	Installation of multi-support shafts: control of the alignment of holes for bearings, mounting of plain bearings, measurement of clearances	
	EKP2,3	Installation of multi-support shafts: checking the smooth and crankshaft alignment (measurement of shaft springback and fall)	
	EKP2,3	Installation of movement seals	
	EKP2,3	Assembly of piston-crank systems	
	EKP2,3	Installing the valve train	
	EKP2,3	Coaxial setting of the aggregate shafts. Mounting the machine on the foundation	
	EKP2,3	Checking the alignment of the shafts	
	EKP2,3	Repairs with the use of adhesives and chemically set masses	
	EKP2,3	Repairs with the use of subtractive methods	
	EKP1,2	Vibroacoustic diagnostics of rotating and reciprocating machines	
	EKP2,3	New technical diagnostics systems presented with samples from the following companies: CoCos-MAN B&W, MAPEK-PR, SIPWA-TP, WARTSILA	
	EKP1,3	Endoscopy in marine use	
	EKP2,3	Coaxial alignment of the shafts of the aggregates and checking the alignment of the shafts	
Total in the semester:			60

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	60	4
Self study	30	
Participation in final tests and exams apart from classes	5	
Total	95	

Assessment methods and criteria:

Grades	**2**	**3**	**3.5–4**	**4.5 – 5**
Grading method	Written or oral credit after lecture block, practical credit during laboratory classes. Assessment possible using distance learning methods and techniques			
EKP1	Due to insufficient knowledge of the methods of assessing the quality of machine elements, student is not able to correctly perform basic micrometric measurements and non-destructive tests of selected machine elements and to evaluate them	With some help, student can correctly use their knowledge about the methods of assessing the quality of machine elements and perform basic micrometric measurements and non-destructive testing of selected machine elements and perform basic assessment	Is able to properly use the knowledge about machine and its elements quality assessment methods and correctly perform basic micrometric measurements and non-destructive testing of selected machine elements and assess the tests	Is able to properly use their knowledge about machine elements quality assessment and proficiently perform micrometric measurements and non-destructive tests for any machine elements and make their in-depth analysis

EKP2	Does not know and is not able to use the methods of making connections in the process of assembling / disassembling the machine, its subassemblies and elements. Is unable to manage and distribute responsibilities in the team	Has knowledge of the methods of connecting elements in the process of assembling / disassembling the machine, its subassemblies and elements, and their implementation is satisfactory with the support of the teacher. Has the ability to manage and divide duties while working in a team	Is able to properly perform connections in the process of assembly / disassembly of the machine, its subassemblies and elements using various methods. Has the ability to manage and divide duties while working in a team and planning the repair of ship machinery	Is able to correctly, independently and very efficiently perform the implementation of connections in the process of assembly / disassembly of the machine, its subassemblies and elements using various methods. Has the ability to manage and divide duties while working in a team as well as planning and safe implementation of ship machinery repairs
EKP3	Student cannot correctly identify the problem related to the repair of a given item. Does not know the procedure and cannot proceed during the repair or regeneration of the selected element. Is not able to determine whether a given element is suitable for repair and is not able to estimate the profitability and costs of repair	Is able to determine the scope of activities when repairing a selected element and correctly apply at least one of the repair methods selected by themselves. Can, with the help of instructions, qualify an element for repair and with a certain probability estimate the repair costs	Can correctly assess and define the problem related to the repair of a selected element and justify the choice of the repair or regeneration method. Can correctly classify an element for repair or regeneration, assess its profitability and repair a selected element	Can correctly assess and define the problem related to the repair of a selected element as well as justify and present arguments for the selected method of repair or regeneration. Can correctly classify an element for repair or regeneration, assess its profitability and repair a selected element. Can predict the effects of improperly performed repairs. Has the ability to analyze the entirety of costs and assess the optimal solution and select a corrective method

Teaching tools:

Type	Description
Auditorium classes	
Projector	Auditorium classes in the form of multimedia presentations and films
Laboratory classes	
Tightness testing	– The ALCATEL ASM 120 * helium leak detector – Helium gas bottle – APV plate heat exchanger – A hydrostatic device for leak testing of own design – Shell and tube marine heat exchanger – Ship's steam boiler safety valve. – Ship plate type heat exchangers – LUKAS hydraulic press
Measurements of interference in cylindrical and conical press-fit connections	– Calipers, micrometers, dial gauges and micrometers – Microscopes – Gauge blocks and control rollers – Sine ruler and dial indicators
Measurements of deviations in shape, position and roughness of machine elements	– Calipers, micrometers, dial gauges and micrometers – Roughness measuring device - Perthometer M2
Layer thickness, wall thickness and crack depth measurements	– Thickness Gauge 545 H – Echometer 1074

	– 4LDS10H transmitter-receiver ultrasound head (range 2 ÷ 50 mm) and 4LDL 10H (range 5 ÷ 150 mm), accuracy ±0.1 mm, resolution 0.1 mm – Karl Deutsch 2001 leptoscope with instrumentation (laminator) – Leptoscope 2040 – RMG 4015 crack depth measuring kit
Detection of discontinuities by ultrasound and radiological methods	– Ultrasonic flaw detector type DI-22 – Ultrasonic flaw detector type DI-3T – Ultrasonic flaw detector type DI-22 – USN-50 digital ultrasonic flaw detector * – LILIPUT 200 X-ray machine – IRA 20 X-ray machine – Negatoscope
Unbalance measurements	– Schenck H3 N / 1 * balancing machine – CAB 590 measuring device – Voltage inverter
Detection of discontinuities with the use of magnetic particle methods and penetration methods	– HD 400* magnetic flaw detector – UV light lamp – Reagents for magnetic particle testing
Visual research	– 9×405 M multiscope / 25 (endoscope) – Videoendoscope with 1 m probe
Implementation of press-fit connections, cylindrical and conical (by pressing, heating, cooling)	– BETEX 38 ESD induction heater – Hydraulic press – Device for cooling shrinkage connections
Dismantling, verification and assembly of marine piston pumps	– Piston marine bilge pump type 10TKF – Universal measuring tools – Assembly tool kit
Coaxial alignment of shafts	– Shaft line – SHAFT 200 * laser device made by the Swedish company FIXTUR-LASER with accessories – 2 pairs of anvils and 4 dial gauges – Feeler gauge, ruler, gauge
Disassembly, verification and assembly of reciprocating air compressors	– SE-160 A marine start-up air compressor – Universal measuring tools – Assembly tool kit – Set of flat shims – Shaft 200 laser measuring device made by FIXTUR-LASER – Emergency marine two-stage manual air compressor
Disassembly, verification and assembly of a four-stroke marine engine	– Mockup of the 6AL25 / 30 marine engine – Hydraulic presses for tightening bolts: main and crank bearings, cylinder heads, tie rods – A set of universal measuring tools – Assembly tool kit – Instruments for measuring the crankshaft * springback: with digital readout, with dial gauge
Assembly of rotors and inspection of rotor assembly.	– Turbo-compressors – Rotodynamic pumps – Schenck H3 N / 1 balancing machine

	– CAB 590 measuring device
Repairs using chemosetting compounds and industrial adhesives	– Metal and ceramic chemically hardening pastes and elastomers from Chester Molecular, Belzona and Unitor – Industrial anaerobic and cyanoacrylate adhesives from Chester Molecular and Loctitle
Bushing and sewing	– Machine body elements – Insoles: METALOCK, HELI-COIL
Repair of cylinder liners of four-stroke marine engines by honing	– Honing machine type S *, diameter range of the repaired sleeves 170 ÷ 410 mm – Cylinder sleeve – Roughness measuring device - Perthometer M2
Repair of valve sockets by use of machining	– VSL type portable lathe, range of diameters of repaired sockets 50 ÷ 230 mm – WR 3G rack (up to 300 kg) – 4-stroke cylinder marine engine head
Repair of intake and exhaust valves of four-stroke marine engines with grinding	– BSP-3 * stationary grinder, valve head diameter range: 40 ÷ 300 mm – Valves for four-stroke marine engines
Grinding repair of fuel injection valves	– BSP-3 stationary grinder – BFG-type attachment with accessories – Fuel injection valves
Diagnostics of rotating machines: general evaluation of the machine and diagnosis of unbalance using the analyzer - tracking filter	– ATR 2M tracking analyzer – CS 110 electrodynamic vibration sensor – CFR 22 photoelectric reflective sensor – Electric motor with a measuring disc
Diagnostics of rotating machines: assessment of the condition of rolling bearings, gears and shaft alignment	– DMG 1A demonstration gear – Schenck's portable two-channel vibration analyzer VIBOPORT 41 *
Diagnostics of the rotor machine based on the trajectory of the center of the shaft journal	– Rotary machine laboratory stand with jamming device and plain bearing lubrication system – TDS 210 digital oscilloscope – Schenck's portable two-channel vibration analyzer VIBOPORT 41 *
Platforms for e-Learning	– A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. Bielawski P.: *Ocena jakości elementów maszyn*. Fundacja Rozwoju Wyższej Szkoły Morskiej w Szczecinie, Szczecin 1999. 2. Bielawski P.: *Promieniowanie elektromagnetyczne w badaniach nieniszczących*. TEMPUS S-JEP-07495-94 internal materials Szczecin 1997. 3. Bielawski P.: *Diagnostyka drganiowa mechanizmów tłokowo-korbowych maszyn okrętowych*. Monografia WSM, Szczecin 2002. 4. Doerffer J.: *Technologia wyposażania statków*. Wydawnictwo Morskie, Gdańsk 1975. 5. Grudziński K., Jaroszewicz W.: *Posadowienie maszyn i urządzeń na podkładkach fundamentowych odlewanych z tworzywa EPY*. Zapol, Szczecin 2005. 6. Jakubiec W., Malinowski J.: *Metrologia wielkości geometrycznych*. WNT, Warszawa 1996.

7. Jezierski J.: *Technologia tłokowych silników spalinowych*. WNT, Warszawa 1999. 8. Kowalski A., Zaczek Z.: *Technologia remontu siłowni okrętowych*. Wydawnictwo Morskie. Gdańsk 1973. 9. Lewińska-Romińska A.: *Badania nieniszczące. Podstawy defektoskopii*. WNT, Warszawa 2001. 10. Piaseczny L.: *Technologia naprawy okrętowych silników spalinowych*. Wydawnictwo Morskie, Gdańsk 1992. 11. Raunmiagi Z.: Naprawy *wybranych okrętowych elementów maszyn za pomocą obróbki ubytkowej*. Wydawnictwo Naukowe Akademii Morskiej, Szczecin 2010. 12. Żółtowski B.: *Podstawy diagnostyki maszyn*. Ed. ATR, Bydgoszcz 1996.
Complementary literature
1. Arendarski J. i inni: *Sprawdzanie przyrządów do pomiarów długości i kąta*. Politechnika Warszawska, Warszawa 2009. 2. Brodowicz W.: *Technologia silników spalinowych*. WSiP, Warszawa 1984. 3. Jezierski J.: *Analiza tolerancji i niedokładności pomiarów w budowie maszyn*. WNT, Warszawa 1994. 4. Chris Marine - information materials. 5. MAN B&W 6S90MC-C engine operation and maintenance documentation. 6. Technical and operational documentation of the MAN B&W S28L engine. 7. Operation and maintenance manual of the DU-SULZER 7RTA84T engine. 8. Diesel Marine International - repair and regeneration catalogs. 9. Gourd L.: *Podstawy technologii spawalniczych*. WNT, Warszawa 1995. 10. Hikima T.: *The best seamanship – A guide to engine skills*. IMMAJ, Japan 2005. 11. Jezierski G.: *Radiografia przemysłowa*. WNT. Warszawa 1993. 12. Jędrzejowski J.: *Obliczanie tłokowych silników spalinowych*. WNT, Warszawa 1988. 13. Kemel Air Seal – instruction materials. 14. Kozaczewski W.: *Konstrukcja grupy tłokowo-cylindrowej silników spalinowych*. WKiŁ, Warszawa 2004. 15. Krukowski A., Tutaj J.: *Połączenia odkształceniowe.* PWN, Warszawa 1987. 16. Lipnicki M., Szulwach Z.: *Podstawy badań ultradźwiękowych*. Koli Sp. z o.o. w Gdańsku, Gdańsk 1995. 17. Łukomski: *Technologia spalinowych silników kolejowych i okrętowych*. WKiŁ, Warszawa 1972. 18. Advertising and information materials from companies - Unitor, Belzona, Devcon, Loctitle and Chester Molecular. 19. MAN B&W: The Intelligent Engine. Development Status and Prospects. Cylinder pressure measuring system. Copenhagen 11.2000. 20. MAPEX PR - Monitoring and Maintenance Performance Enhancement with Expert Knowledge - Piston-running Reliability. New Sulzer Diesel catalog. 21. Induction heaters - company information materials. 22. NK-100 - Diesel Engine Condition Monitoring System. Maritime Instrumentation – Autronica, Oct 1997. 23. Nowikow M.P.: *Podstawy Technologii Montażu Maszyn i Mechanizmów*. WNT, Warszawa 1972. 24. Piotrowski I.: *Okrętowe silniki spalinowe. Zasady budowy i działania*. Wydawnictwo Morskie, Gdańsk 1983. 25. Praca zbiorowa: *Poradnik Metrologa warsztatowego*. WNT, Warszawa 1994. 26. Sadowski A.: *Metrologia długości i kąta*. WNT, Warszawa 1988. 27. Śliwiński A.: *Ultradźwięki i ich zastosowania*. WNT, Warszawa 1993. 28. Wajand J., Wajand T.: *Tłokowe silniki spalinowe średnio i szybkoobrotowe*. WNT, Warszawa 2000.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Jan Drzewaniecki, PhD Eng. Chief Marine Engineer	j.drzewaniecki@am.szczecin.pl	WM
Other teachers:		

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Abbreviations:
A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	19	Course:	**Technical thermodynamics***				
Major:	**Mechanical Engineering**	Specialisation:		**Marine Power Plant Operation**			
Studies cycle:	**First**	Form of studies:	**full-time**	Year of studies:	**1st-2nd**	Semesters:	**2nd-3rd**
Course status:	**mandatory**	Course group:	**field-specific course**				

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	T	L	E	S	P	SE	IP	PR	A	T	L	E	S	P	SE	IP	PR	
2nd	15	2E	1								30	15								4
3rd	12			2									24							2
Total during studies											30	15	24							6

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	

Course objectives:

1.	Developing the ability to use basic knowledge of thermodynamic and climatic processes, heat transfer, energy device cycles and combustion processes
2.	Developing the ability to solve problems related to the determination of basic physical quantities while solving thermodynamic and climatic problems, heat transfer, energy device cycles and combustion processes
3.	Developing the ability to work in a team during the measurements of thermodynamic quantities and their development
4.	Developing the ability to use basic laboratory and technical devices for measuring thermodynamic quantities

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Student recognizes and applies the basic laws and principles of thermodynamic and climatic processes, heat transfer, energy device cycles and combustion processes in a proper way	EK_W05, EK_W02, EK_U05, EK_U11
EKP2	Is able to calculate basic thermodynamic parameters in thermodynamic and climatic processes, heat transfer, energy device cycles and combustion processes	EK_W05, EK_W02, EK_U05, EK_U11, EK_U01
EKP3	Is able to select laboratory and measuring devices and instruments for measuring basic thermodynamic quantities in thermodynamic and climatic processes, heat transfer, energy device cycles and combustion processes	EK_W05, EK_W02, EK_U05, EK_U11, EK_U01

EKP4	Is able to clearly and illustratively present the measured and developed measurement results of basic thermodynamic quantities in thermodynamic and climatic processes, heat transfer, energy device cycles and combustion processes	EK_W05, EK_W02, EK_U05, EK_U11, EK_U01

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		2nd	
A E	EKP 1,2,3,4	Basic concepts of thermodynamics. Physical quantities, units, pressure, temperature, mass, energy, heat, work. Thermodynamic system, parameters, thermodynamic equilibrium	30 + 15
	EKP 1,2,3,4	System energy. Perfect gas laws Perfect gas, semi-perfect gas, real gas. Boyle-Mariotte law, Gay-Lusac law, Charles law. Equation of gas state (Clapeyron)	
	EKP 1,2,3,4	Heat capacity Entalphy Gas mixtures. Entropy	
	EKP 1.2	First law of thermodynamics. Absolute, useful and technical work. Formulation and equations of the first law of thermodynamics	
	EKP 1.2	Thermodynamic transformations of gases. Isochoric, isothermal, isobaric, adiabatic and polytropic transformation. Poisson equations	
	EKP 1,2,3,4	Second law of thermodynamics. Formulations of the second law of thermodynamics. Thermodynamic cycles. Carnot cycle	
	EKP 1,2,3,4	Comparative cycles of internal combustion reciprocating engines. Otto, Diesel, Sabathe cycle. Operation diagrams of single and multi-stage compressors	
	EKP 1.2	Steam thermodynamics. Steam production, wet and superheated steam, steam parameters	
	EKP 1.2	Chart *p*-*v* and *and*-*p* for the water. Steam entropy graphs: graph *T.*-*s* and *and*-*s*. Damping the steam	
	EKP 1.2	Theoretical cycles of steam power plants. Carnot cycle of a steam power plant, Clausius-Rankine cycle. Ways to increase the efficiency of steam power plants. Cooling systems	
	EKP 1,2,3,4	Moist gases. Humid air parameters. Enthalpy of humid air. Chart i_{1+x}-x for humid air. Isobaric transformations of humid air	
	EKP 1,2,3,4	Heat transfer. Characteristics of heat transfer types: conduction, acquisition, penetration	
	EKP 1,2,3,4	Heat exchangers. Types of heat exchangers. Characteristics of co-current and countercurrent heat exchangers	
	EKP 1,2,3,4	Basic information on petroleum products in marine power plants. Theoretical basis of combustion processes. Types of combustion	
	EKP 1,2,3,4	Composition of exhaust gases. Exhaust gas analysis. Exhaust gas analyzers. Charts characterizing the combustion process	
Total in the semester:			45

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	45	4
Self study	20	
Participation in final tests and exams apart from classes	30	
Total	95	

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		3rd	
L	EKP1-4	Fundamentals of measuring parameters in thermodynamic processes. Determining the basic parameters of thermodynamic factors: density, viscosity, pressure, temperature	24
	EKP1-4	Checking of technical thermometers; characteristics of resistance thermometers	
	EKP1-4	Calibration of a thermoelectric thermometer (thermocouples)	
	EKP1-4	Checking technical pressure gauges	
	EKP1-4	Testing the flow resistance in pneumatic and hydraulic installations	
	EKP1-4	Power measurement based on the indicator diagram	
	EKP1-4	Measurement of the mass flow and gas volume	
	EKP1-4	Determination of the thermal conductivity coefficient	
	EKP1-4	Determination of the calorific value of liquid fuels	
	EKP1-4	Determination of the calorific value of gas fuels	
	EKP1-4	Determining the basic parameters of water vapor and humid air	
	EKP1-4	Technical analysis of exhaust gases	
Total in the semester:			24

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	24	2
Self study	20	
Participation in final tests and exams apart from classes	5	
Total	51	

Assessment methods and criteria:

Grades	2	3	3.5–4	4.5 – 5
Methods for evaluation	Written credit, exam. Assessment possible using distance learning methods and techniques			
EKP1	Student is unable to properly recognize and apply the laws of thermodynamics to solve problems. Student is not able to apply the appropriate dependencies for the calculation of thermodynamic parameters. Lacks knowledge of the units used and applied for describing thermodynamic quantities	Can recognize and apply the laws of thermodynamics to solve problems in a basic, minimal way. Does not always use the correct relationships and does not always obtain correct results of thermodynamic parameters calculations. Possesses minimal knowledge of units used and applied in describing thermodynamic quantities	Can properly recognize and apply the laws of thermodynamics to solve problems. Applies the appropriate relations, but the results of calculations of thermodynamic parameters are not always correct. Possesses partial knowledge of units used and applied in describing thermodynamic quantities	Student properly recognizes and applies the laws of thermodynamics to solve problems. Applies the appropriate relations, the results of calculations of thermodynamic parameters are correct. Possesses complete knowledge of the units used and applied for describing thermodynamic quantities
Methods for evaluation	Written test, exam and practical test during laboratory classes based on prepared laboratory reports. Assessment possible using distance learning methods and techniques			
EKP2	Student is not able to properly use the appropriate dependencies to calculate thermodynamic parameters. Lacks knowledge of the units used and applied for describing thermodynamic quantities. Student is not able to properly perform simple transformations of units describing thermodynamic quantities. Is unable to perform complex calculations of thermodynamic quantities	Can use appropriate relationships to obtain correct results of thermodynamic parameters calculations to a minimum extent. Possesses minimal, basic knowledge of units used and applied in describing thermodynamic quantities. Student is able to properly perform only simple transformations of units describing thermodynamic quantities. Performs complex calculations of thermodynamic quantities and makes errors.	Is able to properly apply the appropriate dependencies, sometimes obtaining incorrect results of calculations of thermodynamic parameters. Possesses partial knowledge of units used and applied in describing thermodynamic quantities. Can perform complex transformations of units describing thermodynamic quantities with minor errors. Makes minor errors in calculating complex thermodynamic quantities	Is able to properly apply the appropriate dependencies, obtaining correct results of calculations of thermodynamic parameters. Possesses complete knowledge of units used and applied in describing thermodynamic quantities Student is able to properly perform complex transformations of units describing thermodynamic quantities. Flawlessly performs complex calculations of thermodynamic quantities

EKP3	Is unable to independently select instruments for the measurements of thermodynamic values. Is not able, even with the help of the teacher, to measure thermodynamic quantities taking into account the class of measuring instruments and their accuracy. Has no knowledge of the operation of the measuring instruments used during the measurement of thermodynamic parameters	Sometimes i unable to independently select instruments for the measurements of thermodynamic values. With the help of the teacher, student can measure thermodynamic quantities, taking into account the class of measuring instruments and their accuracy. Possesses minimal knowledge of the operation of the measuring instruments used during the measurement of thermodynamic parameters	In most cases is able to independently select the instruments for the measurements of thermodynamic values. With minor help of the teacher, student can measure thermodynamic quantities, taking into account the class of measuring instruments and their accuracy. Possesses broad, but not complete knowledge of the operation of the measuring instruments used during the measurement of thermodynamic parameters	Independently selects instruments for the measurements of thermodynamic values. Can measure thermodynamic quantities taking into account the class of measuring instruments and their accuracy. Possesses complete knowledge of the operation of the measuring instruments used during the measurement of thermodynamic parameters
EKP4	Student is not able to present the obtained (measured) thermodynamic values in a descriptive and graphic manner. Is not able discuss possible errors of measurement both in a computational and graphical manner	Can present the results of the obtained (measured) thermodynamic values in a descriptive and graphic manner to a minimum extent. Is able to present a discussion on possible errors of measurement, both in a computational and graphical manner in a minimal way, using only the simplest methods	Can present the obtained (measured) thermodynamic values in a descriptive and graphic manner with slight errors. When presenting a discussion on possible errors of measurement, both in an accounting and graphical manner, commits minor errors	Student can present the results of the obtained (measured) thermodynamic values in a descriptive and graphic manner in a fully comprehensible and legible way. Is able to present a discussion on possible errors of measurement in a proper and error-free way, both in computational and graphical manner

Teaching tools:

Type	Description
Projector	Auditorium classes in the form of multimedia presentations and films
Laboratory workbenches	A set of laboratory workbenches for conducting laboratory exercises
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. Balcerski A.: *Siłownie okrętowe*. Ed. PG, Gdańsk 1990. 2. Szargut J.: *Termodynamika.* PWN, Warszawa 2000. 3. Wiśniewski S.: *Termodynamika techniczna*. WNT, Warszawa 1980. 4. Gąsiorowski J., Radwański E., Zagórski J., Zgorzelski M.: *Zbiór zadań z teorii maszyn cieplnych.* WNT, Warszawa 1978. 5. Szargut J., Guzik A., Górniak H.: *Programowany zbiór zadań z termodynamiki technicznej*. PWN, Warszawa 1979.
Complementary literature

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		

Zbigniew Matuszak, PhD Eng.	z.matuszak@am.szczecin.pl	WM
Other teachers:		
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Jan Monieta, PhD Eng.	j.monieta@am.szczecin.pl	WM

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	20	Course:	Fluid mechanics*				
Major:		Mechanical Engineering	Specialisation:		Marine Power Plant Operation		
Studies cycle:		First	Form of studies:	full-time	Year of studies:	First	Semesters: 2nd
Course status:		mandatory	Course group:	field-specific course			

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	E	L	EL	S	P	SE	TW	PR	A	E	L	EL	S	P	SE	TW	PR	
2nd	15	1	1								15	15								2
Total during studies											15	15								2

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	

Course objectives:

1.	Developing the ability to use basic knowledge about processes related to fluids, i.e. gases and liquids, about their statics, kinematics and dynamics
2.	Developing the ability to solve problems related to the determination of basic physical quantities while solving problems of fluid mechanics, especially related to the calculation of technical problems modeled for tasks

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Student recognizes and applies the basic laws and principles of fluid mechanics concerning gases and liquids in a proper way	EK_W05, EK_W02, EK_U05, EK_U11
EKP2	Has the ability to calculate basic physical parameters when solving problems of fluid mechanics (gases and liquids)	EK_W05, EK_W02, EK_U05, EK_U11

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		2nd	
A E	EKP1,2	Basic concepts of fluid mechanics, the concept of fluid, fluid properties	15 + 15
	EKP1,2	Forces acting in fluids, fluid models. State of stress in a fluid; Euler equation	
	EKP1,2	Pressure against flat and curved walls immersed in a liquid. Buoyancy of bodies immersed in a liquid	
	EKP1,2	Stability of floating bodies	

	EKP1	Description of fluid kinematics. Equations of fluid flow continuity and mass conservation. Notion of fluid kinematics using the Lagrange and Euler methods	
	EKP1,2	Bernoulli's equation and its applications	
	EKP1	Description of the rotationary motion of a fluid. Plane potential flows	
	EKP1	Description of the dynamics of a perfect fluid; Euler equations. Description of real fluid dynamics; Navier-Stokes equations	
	EKP1,2	Hydrodynamic reactions during fluid flow; principle of operation of flow machines. Water hammer in the lines	
	EKP1	Similarities of flows	
	EKP1,2	The boundary layer theory; Prandtl's law; Reynolds experiment	
	EKP1,2	Laminar and turbulent boundary layer; Nikuradse experiment. Ancona chart	
	EKP1	Basic concepts related to the resistance and propulsion of a ship. Basic information about ship propellers, their types and principles of operation	
Total in the semester:			30

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	30	2
Self study	30	
Participation in final tests and exams apart from classes	10	
Total	70	

Assessment methods and criteria:

Grades	**2**	**3**	**3.5–4**	**4.5 – 5**
Methods of evaluation	Written credit, exam. Assessment possible using distance learning methods and techniques			
EKP1	Student is unable to properly recognize and apply the laws of fluid mechanics to solve problems. Student is not able to apply the appropriate dependencies in calculating physical parameters in the problems of fluid mechanics. Lacks knowledge of units used and applied for describing physical quantities in fluid mechanics	Can properly recognize and apply the laws of fluid mechanics to solve problems in a basic scope. Does not always use the correct relationships and does not always obtain correct results of thermodynamic parameters calculations. Possesses minimal knowledge of units used and applied for describing physical quantities in fluid mechanics	Can properly recognize and apply the laws of fluid mechanics to solve problems in a basic scope. Applies the appropriate relations, but the results of calculations of thermodynamic parameters are not always correct. Possesses partial knowledge of units used and applied for describing physical quantities in fluid mechanics	Can properly recognize and apply the laws of fluid mechanics to solve technical problems. After applying the appropriate relations, obtains correct results of calculations of physical parameters in the problems of fluid mechanics. Possesses complete knowledge of units used and applied for describing physical quantities in fluid mechanics

EKP2	Student is not able to properly apply dependencies to calculate thermodynamic parameters. Lacks knowledge of the units used and applied for describing physical quantities. Student is not able to properly perform simple transformations of units describing physical quantities. Is unable to perform complex calculations of physical quantities	Can use appropriate relationships to obtain correct results of physical parameters calculations to a minimum extent. Possesses minimal, basic knowledge of units used and applied in describing physical quantities. Student is able to properly perform only simple transformations of units describing physical quantities. Performs complex calculations of physical quantities and makes errors.	Is able to properly apply the appropriate dependencies, sometimes obtaining incorrect results of calculations of physical parameters. Possesses partial knowledge of units used and applied for describing physical quantities. Can perform complex transformations of units describing physical quantities with minor errors. Makes minor errors in calculating complex physical quantities	Is able to properly apply appropriate dependencies, obtaining correct results of calculations of physical parameters used in fluid mechanics. Possesses complete knowledge of the units used and applied for describing physical quantities. Student is able to properly perform complex transformations of units describing physical quantities. Flawlessly performs complex calculations of physical quantities

Teaching tools:

Type	Description
Projector	Auditorium classes in the form of multimedia presentations and films
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. Kirkiewicz J.: *Mechanika płynów.* Ed. WSM Szczecin, Szczecin 1987. 2. Tuliszka E.: *Mechanika płynów.* Ed. PP, Poznań 1976. 3. Dudziak J.: *Teoria okrętu.* Ed. Morskie, Gdańsk 1988. 4. Gryboś R.: *Zbiór zadań z technicznej mechaniki płynów*. PWN, Warszawa 2002.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Zbigniew Matuszak, PhD Eng.	z.matuszak@am.szczecin.pl	WM
Other teachers:		
Jan Monieta, PhD Eng.	j.monieta@am.szczecin.pl	WM

Abbreviations:
A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	21	Course:	Introduction to electrotechnics and electronics *					
Major:	**Mechanical Engineering**	Specialisation:		**Marine Power Plant Operation**				
Studies cycle:	**First**	Form of studies:	**full-time**	Year of studies:	**1st-2nd**	Semesters:	**2nd-3rd**	
Course status:	**mandatory**	Course group:	**field-specific course**					

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	T	L	E	S	P	SE	IP	PR	A	T	L	E	S	P	SE	IP	PR	
2nd	15	1	1								15	15								2
3rd	12	2E		1							24		12							4
Total during studies											39	15	12							6

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Math
2.	Physic

Course objectives:

1.	Understanding the basic phenomena and dependencies in direct and alternating electric current circuits
2.	Mastering the performance of basic calculations of linear and non-linear direct and sinusoidal electric currents circuits
3.	Understanding the operation and construction of basic semiconductor devices
4.	Acquiring the ability to use basic semiconductor devices in simple electrical circuits

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Student knows and understands the basic equations of the theory of electric and magnetic circuits and the methods of their calculations. Understands phenomena related to electric and magnetic fields. Knows the basic concepts of electromagnetism and spatial rules. Can estimate and define parameters of circuits as well as electric and magnetic units and quantities. Can present and calculate sinusoidal current circuits. Is able to use the concepts and equations of power in electric circuits	EK_W05, EK_U05, EK_U07
EKP2	Is able to measure electrical quantities in AC and DC circuits. Is able to select measuring instruments used in the measurement of electronic components	EK_U11, EK_U09 EK_U07
EKP3	Can set up and check simple electric and electronic circuits containing RLC elements, diodes, stabilizers and transistors	EK_U10, EK_U01

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		2nd	
A	EKP1	Electric current circuits	15
	EKP1	Electromagnetism	
	EKP1,2	Sinusoidal alternating current	
	EKP1,2	Measurements of electrical quantities	
	EKP1,2	Transitional processes in electrical circuits	
	EKP1,2	Electronics	
E	EKP1	Electric current circuits	15
	EKP1	Electromagnetism	
	EKP1,2	Sinusoidal alternating current	
	EKP1,2	Measurements of electrical quantities	
	EKP1,2	Transitional processes in electrical circuits	
	EKP1,2	Electronics	
Total in the semester:			30

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	30	2
Self study	15	
Participation in final tests and exams apart from classes	10	
Total	55	

Programme content:

Form of clas-ses	EKP relation	Implemented content	Num-ber of hours
Semester:		3rd	
A	EKP1	Electric current circuits	24
	EKP1	Electromagnetism	
	EKP1,2	Sinusoidal alternating current	
	EKP1,2	Measurements of electrical quantities	
	EKP1,2	Transitional processes in electrical circuits	
	EKP1,2	Electronics	
L	EKP1,2,3	Basic measurements	12
	EKP1,2,3	Power measurements in single-phase and three-phase circuits	
	EKP1,2,3	Study of RLC circuits	
	EKP1,2,3	Uncontrolled diodes and rectifiers	

	EKP1,2,3	Transistors and thyristors	
Total in the semester:			36

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	36	3
Self study	15	
Participation in final tests and exams apart from classes	25	
Total	76	

Assessment methods and criteria:

Grades	2	3	3.5–4	4.5 – 5
Grad-ing method	Written or oral and practical tests during laboratory classes, Assessment possible with the use of distance learning methods and techniques			
EKP1	Student does not know or understand the basic equations of the theory of electric and magnetic circuits and their calculation methods. Student does not understand phenomena related to electric and magnetic fields. Has no skills in the presentation and calculation of sinusoidal currents. Does not know the concepts and cannot use equations to calculate power in electrical circuits	Student knows and understands the basic equations of the theory of electric and magnetic circuits and the methods of their calculations. Understands basic phenomena related to electric and magnetic fields. Has the ability to present and calculate simple sinusoidal current circuits. Knows the concepts and can use the equations to calculate power in simple electrical circuits	Knows and understands the equations of the theory of electric and magnetic circuits and the methods of their calculations. Understands phenomena related to electric and magnetic fields. Has the ability to present and calculate sinusoidal current circuits. Knows the concepts and can use the equations to calculate power in complex electrical circuits	Knows and understands the equations of the theory of complex electric and magnetic circuits and the methods of their calculations. Understands phenomena related to electric and magnetic fields. Has the ability to present and calculate complex sinusoidal current circuits using various methods, e.g. symbolic. Knows the concepts and can use the equations to calculate power in complex electrical circuits
EKP2	Is unable to carry out measurements of electrical quantities in AC and DC circuits. Does not have the ability to select measuring instruments used in electrical measurements	Is able to measure electrical quantities in AC and DC circuits. Has the ability to correctly select measuring instruments used in electrical measurements	Is able to carry out measurements of electrical quantities in DC and AC circuits using various types of meters. Has the ability to correctly select measuring instruments used in electrical measurements and is able to correctly select (set) measuring ranges	Is able to carry out measurements of electrical quantities in DC and AC circuits with the use of various types of meters by means of direct and indirect methods. Has the ability to correctly select measuring instruments used in electrical measurements and is able to correctly select (set and explain) measuring ranges independently
EKP3	Student cannot set up and check simple electric and electronic circuits containing RLC elements, diodes, stabilizers and transistors	Can set up and check simple electric and electronic circuits containing RLC elements, diodes, stabilizers and transistors	Can independently set up and check simple electric and electronic circuits containing RLC elements, diodes, stabilizers and transistors (based on a diagram)	Can independently (based on a diagram) set up and check branched electric and electronic circuits containing RLC elements, diodes, stabilizers and transistors

Teaching tools:

Type	Description
Projector	Auditorium classes in the form of multimedia presentations and films
References	Guides for laboratory exercises and sets of tasks for auditorium exercises
Laboratory equipment	Analog and digital meters, electrical and electronic components adapted to conduct research, connection cables, power supplies, oscilloscopes
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. Gnat K.: *Elektrotechnika dla studentów Wydziału Mechanicznego WSM*. Szczecin 2000. 2. Gnat K., Żełudziewicz R., Tarnapowicz D.: *Podstawy elektrotechniki i elektroniki dla studentów Wydziału Mechanicznego WSM*. Szczecin 2002. 3. Praca zbiorowa: *Poradnik elektryka*. WSiP, Warszawa 1995. 4. Pazdro K., Poniński M.: *Miernictwo Elektryczne w pytaniach i odpowiedziach*. WNT, Warszawa 1986. 5. Chwaleba A., Moeschke B., Płoszajski G.: *Elektronika*. WSiP, Warszawa 1996. 6. Koziej E., Sochoń B.: *Elektrotechnika i elektronika*. Warszawa 1986. 7. Praca zbiorowa pod redakcją Pawła Hempowicza: *Elektrotechnika i elektronika dla nieelektryków*. PWN, Warszawa 1995.
Complementary literature
1. Jabłoński W.: *Elektrotechnika z automatyką*. WSiP, Warszawa 1996. 2. Norman Lurch E.: *Podstawy techniki elektronicznej*. PWN, Warszawa 1990. Opracował: prof. dr inż. Mieczysław Wierzejski.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Dariusz Tarnapowicz, PhD Eng.	d.tarnapowicz@am.szczecin.pl	WMiE
Other teachers:		
Maciej Kozak, PhD Eng.	m.kozak@am.szczecin.pl	WMiE

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	22	Course:	Electrical machines and propulsion *				
Major:	**Mechanical Engineering**	Specialisation:		**Marine Power Plant Operation**			
Studies cycle:	**First**	Form of studies:	**full-time**	Year of studies:	**2nd**	Semesters:	**4th**
Course status:	**mandatory**	Course group:	**field-specific course**				

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	E	L	EL	S	P	SE	TW	PR	A	E	L	EL	S	P	SE	TW	PR	
4th	15	3E		2							45		30							7
Total during studies											45		30							7

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Math
2.	Physic
3.	Basics of electrotechnics and electronics

Course objectives:

1.	Understanding the basic phenomena occurring in direct and alternating current electric machines
2.	Learning and understanding the principles of work and control methods of marine electric machines
3.	Understanding the principles of operation and properties of basic power electronic converters of electricity
4.	Understanding the structures and principles of operation and control of marine electric drives

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Student knows and understands the structure and operation principle of the main types of electric machines	EK_W05, EK_W02, EK_W03, EK_U09, EK_U07, EK_U01, EK_U02
EKP2	Correctly carries out control activities in marine power systems	EK_U10, EK_U01, EK_U02
EKP3	Performs simple diagnostic activities in marine electromechanical systems and simple repairs of malfunctions	EK_U02

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		4th	
A	EKP1,2	General information about electric machines, electromagnetic moment	45
	EKP1,2	Synchronous generator	
	EKP1	Asynchronous squirrel-cage motor	
	EKP1	DC commutator machine	
	EKP1	Transformers	
	EKP1,2	Power electronics	
L	EKP1,2	Marine electric drives	30
	EKP1,2,3	DC motor	
	EKP1,2,3	Transformers	
	EKP1,2,3	Examination of a three-phase asynchronous ring motor	
	EKP1,2,3	Study of a three-phase asynchronous squirrel-cage motor with an inverter	
Total in the semester:			75

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	75	7
Self study	115	
Participation in final tests and exams apart from classes	10	
Total	200	

Assessment methods and criteria:

Grades	2	3	3.5–4	4.5 – 5
Grading method	Written or oral and practical credit during laboratory classes. Assessment possible using distance learning methods and techniques			

EKP1	Student does not distinguish between types of electric machines and does not understand the phenomena related to the generation of electromagnetic moment in machines. Does not have the ability to determine the methods of rotational speed control in machines and does not know the issues related to the methods of limiting the inrush currents. Does not know the basic elements and power electronic systems. Cannot name uses of individual types of machines in drive applications. Does not know the basic equations describing electrical machines	Knows the basic types of electric machines and understands the basic phenomena related to the generation of electromagnetic moment in machines. On a very general level, knows the methods of speed control in machines and knows the methods of limiting the inrush currents. Distinguishes between basic elements of systems and power electronic systems. Can identify different types of machines used for propulsion Knows simple, basic equations describing electric machines	Knows and distinguishes the basic types of electrical machines and understands the phenomena related to the generation of electromagnetic moment in machines. Can note appropriate analytical relationships. Knows the methods of rotational speed control in machines and is able to present analytical relationships. Knows the methods of limiting inrush currents and is able to point out the advantages and disadvantages of each of them. Distinguishes between elements and power electronic systems and is able to present the basic analytical relationships describing the phenomena in these systems. Can identify various types of machines used for propulsion and propose specific types for specific applications. Knows simple, basic equations describing electric machines and is able to correctly interpret them	Knows and distinguishes all the discussed types of electrical machines and thoroughly understands the phenomena related to the generation of electromagnetic moment in machines. Can denote appropriate analytical relationships and transform them freely and properly interpret them. Knows the methods of rotational speed control in machines and is able to present analytical and graphical relationships describing the methods of regulation. Knows the methods of limiting inrush currents and is able to point out the advantages and disadvantages of each of them. Is fluent in distinguishing between elements and power electronic systems and is able to present analytical relationships describing the phenomena occurring in these systems. Can present and properly justify the advantages and disadvantages of specific types of systems. Can identify various types of machines used for propulsion and propose their appropriate types for specific applications. Knows simple and complex equations describing electric machines and is able to correctly interpret them
EKP2	Does not know and does not understand the control activities for the proper operation of marine electrical power equipment	Knows and understands the control activities for the proper operation of marine electrical power equipment. Can determine the operating states of the power system, at which appropriate control activities should be used	Knows and understands the control activities for the proper operation of marine electrical power equipment Can determine the operating states of the power system, at which appropriate control activities should be used. Can apply appropriate control methods in simple power systems in practice	Knows and understands the control activities for the proper operation of marine electrical power equipment Can, on their own, determine the operating states of the power system, at which appropriate control activities should be used. Can practically apply appropriate control methods in complex electric power systems
EKP3	Does not know simple methods and diagnostic activities in marine electromechanical systems and is not able to indicate methods of carrying out simple repairs of malfunctions	Knows simple methods and diagnostic activities carried out in marine electromechanical systems and is able to indicate the appropriate methods for carrying out simple repairs of malfunctions	Knows simple and complex methods and diagnostic activities in marine electromechanical systems and is able to indicate the appropriate methods of carrying out simple and complex repair of malfunctions. Can perform simple repairs and malfunctions of electric power systems under supervision	Knows simple and complex methods and diagnostic activities in marine electromechanical systems and is able to indicate the appropriate methods of carrying out simple and complex repair of malfunctions. Can perform simple repairs and malfunctions of electric power systems and select the necessary tools

Teaching tools:

Type	Description
Projector	Auditorium classes in the form of multimedia presentations and films
References	Guides for laboratory exercises and sets of tasks for auditorium exercises
Laboratory equipment	Analog and digital meters, power electronic components and systems adapted to conduct research, connection cables, power supplies, oscilloscopes, real electrical machines, simulation programs, power electronic converters

Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. Przeździecki F.: *Elektrotechnika i elektronika*. PWN, 1980. 2. Plamitzer A.: *Maszyny elektryczne*. WNT, Warszawa 1982. 3. Latek W., *Teoria maszyn elektrycznych*, WNT, Warszawa 1987. 4. Latek W.: *Badania maszyn elektrycznych w przemyśle*. WNT, Warszawa 1979. 5. Bajorek Z.: *Maszyny elektryczne*. WNT, 1980.
Complementary literature
1. Henig T.: *Maszyny i napęd elektryczny*. WSiP.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Maciej Kozak, PhD Eng.	m.kozak@am.szczecin.pl	WMiE
Other teachers:		

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	23	Course:	**Marine electrical engineering** *					
Major:		**Mechanical Engineering**	Specialisation:		**Marine Power Plant Operation**			
Studies cycle:		**First**	Form of studies:	**full-time**	Year of studies:	**3rd**	Semesters:	**5th**
Course status:		**mandatory**	Course group:	**field-specific course**				

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	T	L	E	S	P	SE	IP	PR	A	T	L	E	S	P	SE	IP	PR	
5th	12	2		2							24		24							3
Total during studies											24		24							3

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Physic
2.	Basics of electrotechnics and electronics
3.	Electric machines and drives
4.	Fundamentals of automation and robotics

Course objectives:

1.	The course is meant to prepare the future graduate to perform activities related to the use of marine power systems (STCW operational level) and supervision over the use of marine power systems (STCW management level)

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Can explain the operation of individual elements of the marine power system	EK_W02, EK_W04, EK_U05, EK_U11, EK_U09, EK_U01
EKP2	Can operate ship power systems in various operating states	EK_W02, EK_W04, EK_U05, EK_U11, EK_U09, EK_U01
EKP3	Knows the methods and systems of protecting people against electric shock	EK_W03, EK_W02, EK_W04, EK_U01, EK_U04, EK_U10, EK_U02, EK_U05
EKP4	Knows the properties of marine electricity receivers and the principles of their protection	EK_W03, EK_W01, EK_W02, EK_U07, EK_U01, EK_U04
EKP5	Understands the principles of operation of marine fire protection systems. and connectivity	EK_W03, EK_W04, EK_U04

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		5th	
A	EKP1	**Electricity generation on the ship** Synchronous generators, diesel generators, turbogenerators, parameters and characteristics, excitation systems (general classification). Excitation systems for marine synchronous generators, excitation systems for brush machines (composite and shunt), structures of control systems, short-circuit properties, excitation systems for brushless machines. Ship shaft generators with synchronous machines, principles of active and reactive power regulation. Parallel operation of synchronous generators, principles and apparatus of synchronization, load control with active and reactive power. Emergency power sources, batteries and their operation. Emergency aggregates and emergency power supply boards	24
	EKP2	**Distribution of electricity on the ship** The role and content of the rules of classification societies in the construction of the ship's power system, PRS rules. Ship electricity distribution systems, power supply requirements for certain receivers, rated voltage, AC and DC networks. Electricity balance of the ship, determination of the installed capacity of the power plant and the type of energy sources, division of the installed capacity into units. Commutation apparatus in marine power engineering, short-circuit breakers, fuses, contactors, relays, apparatus characteristics. Principles of short-circuit, overload and voltage protection in the network, protection in the power plant and in the network, protection of motors	
	EKP4	**Ship electrical installations** Ship lighting devices, incandescent lamps, ion lamps and their equipment, emergency lighting, lighting power supply (voltage, power lines), navigation lighting. Communication installations on the ship, telephones and sound systems. Ship fire protection installations, sensors and their operation, fire extinguishing installations, signaling and alarm control. Electric heating on marine units. Electromagnetic compatibility in the ship's network	
	EKP5	**Electric propeller drive** Characteristics and requirements of electric main propulsion, primary energy sources, applications of electric main propulsion, basic propulsion systems. DC motor drives, speed control, reversing, power return. Drives with an AC motor, types of power supply and control, high power converters and inverters	
	EKP3	**Principles of protection against electric shock in the ship's network** Human sensitivity to electric current, safe currents and voltages, isolated and earthed networks, network leakage control systems, principles of earthing	
L	EKP1,2	Determining the connection group of three-phase transformers;	24

		Characterization of a three-phase synchronous generator in the case of individual work on the load of R and RL type for various cosφ; Parallel cooperation of synchronous generators; Synchronization methods of synchronous generators; Power distribution between cooperating synchronous generators; Study of the properties of a thermobimetallic relay; Protection for synchronous generators; Protection of AC motors; The role of contactors and relays in power and control systems; Connecting simple control systems with the use of time relays and electrical interlocks; Protection against electric shock in electric networks of various types; The use of computer programs to record the actual operating parameters of electrical systems on the example of the DasyLab program, e.g. Asynchronous motor soft start; Voltage and current changes in controlled rectifiers and inverters Characteristics of chemicals used in the repair and maintenance of electrical devices, MSDS cards	
Total in the semester:			48

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	48	3
Self study	20	
Participation in final tests and exams apart from classes	5	
Total	71	

Assessment methods and criteria:

Grades	2	3	3.5–4	4.5 – 5
Grading method	Written or oral credit, Assessment possible with the use of distance learning methods and techniques.			
EKP1	Cannot describe the basic methods of generating electricity on a ship. Cannot explain the operation of individual elements of the marine power system	Can describe the basic methods of generating electricity on board a ship. Can explain the operation of the basic elements of the marine power system	Can describe and explain in detail the methods of generating electricity on the ship. Can explain the operation of all elements of the marine power system. Knows the methods used to diagnose power systems	Has extensive knowledge of the methods of generating electricity on the ship. Can explain the operation of all elements of the marine power system in detail. Knows the methods used to diagnose marine power systems. Fluently uses power system diagrams
EKP2	Has no skills in handling marine power systems in various operating states	Has a basic knowledge of the operation of marine power systems in various operating states	Has extensive knowledge of the operation of marine power systems in various operating states. Can accurately explain the phenomena occurring in various states of the ship's power system	Has extensive knowledge of the operation of marine power systems in various operating states Can accurately explain the phenomena occurring in various states of the ship's power system. Is able to propose alternative solutions in case of failure of system elements. Has detailed knowledge of the construction of circuits used in practice

EKP3	Does not know the methods and systems of protecting people against electric shock	Knows the methods and systems of protecting people against electric shock Can explain the operation of the basic elements of the system of protection of people against electric shock	Knows the methods and systems of protecting people against electric shock Can accurately explain the operation of all elements of the system of protecting people from electric shock	Knows the methods and systems of protecting people against electric shock Can accurately explain the operation of all elements of the system of protecting people from electric shock Can accurately explain the phenomena occurring during an electric shock. Has detailed and extensive knowledge of methods and systems for protecting people against electric shock
EKP4	Does not know the properties of marine electricity receivers and the principles of their protection	Knows the properties of marine electricity receivers and the principles of their protection	Knows the properties of marine electricity receivers and the principles of their protection Can describe and explain in detail the properties of marine electricity receivers and the principles of their protection. Knows the methods used to diagnose the security of ship electric energy receivers	Knows the properties of marine electricity receivers and the principles of their protection Can describe and explain in detail the properties of marine electricity receivers and the principles of their protection. Knows the methods used to diagnose the protection devices of ship electric energy receivers Can accurately explain the phenomena occurring during overload and short circuit. Has detailed and extensive knowledge of the properties of marine electricity receivers and the principles of their protection
EKP5	Does not understand the rules of operation of marine fire protection systems. and connectivity	Understands the principles of operation of marine fire protection systems and their connectivity	Understands the rules of operation of marine fire protection systems. and connectivity Can describe and explain in detail the principles of operation of marine fire protection systems and their connectivity. Can explain the operation of all elements of marine fire protection systems and their connectivity. Knows the methods used to diagnose the ship's fire protection systems and their connectivity	Understands the principles of operation of marine fire protection systems and their connectivity Can describe and explain in detail the principles of operation of marine fire protection systems and their connectivity. Can explain the operation of all elements of marine fire protection systems and their connectivity. Knows the methods used to diagnose the ship's fire protection systems and their connectivity Has extensive knowledge of the principles of operation of marine fire protection systems and their connectivity

Teaching tools:

Type	Description
Projector	Auditorium classes in the form of multimedia presentations and films
References	Laboratory exercise guides
Laboratory equipment	Test workbenches for power electronic components, real test systems of power electronic systems. Analog and digital meters, oscilloscopes and computer measurement and visualization stations
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. Wyszkowski S.: *Elektrotechnika okrętowa*. WM, Gdańsk 1971. 2. Wyszkowski S.: *Elektrotechnika okrętowa tom 1*. WM, Gdańsk 1991. 3. Wyszkowski J.,Wyszkowski S.: *Elektrotechnika okrętowa. Napędy elektryczne*. Wydawnictwo Fundacji Rozwoju Akademii Morskiej w Gdyni, Gdynia 2002. 4. Gnat K., Hrynkiewicz J., Sojka J.: *Elektrotechnika okrętowa*. Skrypt WSM, Szczecin 1991.

5. Zatorski W., Figwer J.: *Układy wzbudzenia okrętowych prądnic synchronicznych*. Wydawnictwo Morskie, Gdańsk 1978. 6. Wyszkowski S.: *Energoelektronika na statkach*. Ed. Morskie, Gdańsk 1981. 7. Sołdek J.: *Automatyzacja statków*. Wydawnictwo Morskie, Gdańsk 1985. 8. Śmierzchalski R.: *Automatyzacja systemu elektroenergetycznego statku*. Wydawnictwo Gryf, Gdańsk 2004. 9. Białek R.: *Elektroenergetyka okrętowa*. Gdynia 1997. 10. Markiewicz H.: *Bezpieczeństwo w elektroenergetyce*. WNT, Warszawa 1999. 11. Jabłoński W.: *Ochrona przeciwporażeniowa w urządzeniach elektroenergetycznych niskiego i wysokiego napięcia*. WNT, Warszawa 2005.
Complementary literature
1. Białek R., Gnat K.: *Elektrotechnika dla studentow Wydziału Nawigacyjnego*. WSM, Szczecin 2000. 2. Białek R.: *Elektryczne urządzenia okrętowe*. Skrypt OSZGM, Gdynia 1998. 3. Lipski T. [red.]: *Elektryczne aparaty okrętowe*. wyd. WSM, Gdynia 1971. 4. Markiewicz H.: *Instalacje elektryczne*. WNT, Warszawa 1996. 5. Gnat K., Sojka J.: *Maszyny elektryczne*. Skrypt WSM, Wyd. II, Szczecin 1990. 6. PN-IEC 60092-101:2001. *Instalacje elektryczne na statkach. Part 101: Definitions and general requirements*. 7. *Przepisy Klasyfikacji i Budowy Statków Morskich. Część VIII: Instalacje Elektryczne i Systemy Sterowania*. Polski Rejestr Statków, Gdańsk 2007.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Maciej Kozak, PhD, Eng.	m.kozak@am.szczecin.pl	WMiE
Other teachers:		

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	24	Course:	Fundamentals of automation and robotics*				
Major:		Mechanical Engineering	Specialisation:		Marine Power Plant Operation		
Studies cycle:		First	Form of studies:	full-time	Year of studies:	2nd	Semesters: 4th
Course status:		mandatory	Course group:	field-specific course			

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	E	L	EL	S	P	SE	TW	PR	A	E	L	EL	S	P	SE	TW	PR	
4th	15	1E	1	1							15	15	15							4
Total during studies											15	15	15							4

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Mathematics, physics, electrical engineering, mechanics

Course objectives:

1.	Getting to know the properties, functions and mathematical description of the basic elements of automation and adjustment systems
2.	Getting to know the methods of operation of control and adjustment systems
3.	Carrying out the process of analyzing the operation of the control system and the adjustment system
4.	Learning about the construction, ownership and application of robots

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Knows the principle of work, structure and properties of typical linear and nonlinear elements as well as automatic adjustment systems and their components	EK_W05, EK_W03, EK_U05, EK_U01
EKP2	Is able to perform basic calculations in the adjustment / control system	EK_W05, EK_W01, EK_U07, EK_U01
EKP3	Is able to set the adjustment system to the desired requirements (quality)	EK_W02, EK_U01, EK_U05, EK_U06
EKP4	Knows the construction, properties and application of robots	EK_W03, EK_U01

Programme content:

Form of clas-ses	EKP relation	Implemented content	Num-ber of hours
Semester:		4th	
A	EKP1	Basic concepts, including division into linear and nonlinear elements and systems. Automation systems (stabilization, programming, follow-up, extreme, adaptive, cascade, set point and disturbance feedback); examples. Control systems and adjustment systems	15
	EKP1,2,3	Static and dynamic characteristics. Description of static and dynamic properties of control objects	
	EKP1,2	Automation elements (proportional, inertial, oscillating, differentiating, integrating). Characteristics of linear continuous controllers (P, I, PI, PD, PID)	
	EKP2,3	Selection of controller settings. Quality of regulation. Analysis of automatic control system operation - Nyquist and Hurwitz stability criteria	
	EKP1	Two-position adjustment: structure, quality indicators of the control process, selection of settings	
	EKP1	Three-position and step-by-step adjustment: system structures, selection of settings, control quality evaluation parameters	
	EKP1	Automation of complex systems. Logic systems	
	EKP4	Types of robots - their characteristics and main components	
	EKP4	Description and structure, kinematics and dynamics of manipulators and robots; drives, position and position-force control; servomechanisms. Basics of robot programming	
E	EKP1	Basic concepts, including division into linear and nonlinear elements and systems. Automation systems (stabilization, programming, follow-up, extreme, adaptive, cascade, set point and disturbance feedback); examples. Control systems and adjustment systems	15
	EKP1,2	Static and dynamic characteristics.	
	EKP1,2	Description of static and dynamic properties of control objects	
	EKP1,2	Automation elements (proportional, inertial, oscillating, differentiating, integrating)	
	EKP3	Characteristics of linear continuous controllers (P, I, PI, PD, PID)	
	EKP3	Selection of controller settings. Quality of adjustment.	
	EKP2	Analysis of automatic adjustment system operation - Nyquist and Hurwitz stability criteria	
L	EKP3	Modeling of automatic adjustment systems	15
	EKP3	Determining the characteristics of continuous controllers (P, I, PI, PD, PID)	
	EKP3	Setting continuous controllers (P, I, PI, PD, PID)	
	EKP1	Study of combinational logic circuits	
	EKP1	Investigation of sequential logic circuits	
Total in the semester:			45

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	45	4
Self study	20	
Participation in final tests and exams apart from classes	30	
Total	95	

Assessment methods and criteria:

Grades	2	3	3.5–4	4.5 – 5
Grading method	continuous assessment (preparation for classes and activity throughout the semester); mid-term written tests, mid-term oral tests, final written test, final oral test, written exam, oral exam, attendance, Assessment possible with the use of distance learning methods and techniques			
EKP1	Does not know the structure of a linear / non-linear automatic adjustment and control system	Knows the structure and its components and understands the operation of linear and non-linear automatic adjustment (URA) and control systems	Knows the structure, components and their properties and is able to explain the principle of operation of the linear and non-linear automatic adjustment and control system	Analyzes the functioning of linear and non-linear automatic adjustment and control systems
EKP2	Cannot solve the simplest task for the automatic adjustment system	Is able to solve a simple task for URA (control) following teacher's suggestions	Can independently solve an uncomplicated task for URA or control	Can solve a difficult task for URA or control on their own and analyze the obtained results
EKP3	Cannot list and describe the methods of adjusting regulators	Can list and describe the methods of adjusting regulators	Can choose the controller settings in URA for a given object (process) according to the given method	Can choose and analyze the method of selecting the controller settings for described requirements
EKP4	Cannot name the main components of the robot, does not know uses for robots on ships	Can list the main components of a robot, knows the uses for robots on ships	Knows the elements of the robot's structure and is able to explain the principle of operation of the mechanical elements of the robot's equipment	Can explain the principle of operation and properties of each robot element; knows and understands the meaning of the robot's working parameters

Teaching tools:

Type	Description
Computers	PC computers with Windows operating system
Software	MATLAB with libraries
Laboratory workbenches	UNILOG - a set for exercises with logical elements
Laboratory station.	Laboratory pneumatic control system
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. Brzózka J.: *Regulatory cyfrowe w automatyce*. MIKOM, Warszawa 2002. 2. Brzózka J.: *Regulatory i układy automatyki*. MIKOM, Warszawa 2004.

3. Brzózka J.: (redakcja), *Ćwiczenia laboratoryjne z automatyki*, cz. I. *Podstawy automatyki*, cz. II *Układy automatyzacji*. Ed. AM, Szczecin 2008. 4. Bohdanowicz J., Kostecki M.: *Podstawy automatyki dla oficerów statków morskich*. Ed. Morskie, Gdańsk 1980. 5. Honczarenko J.: *Roboty przemysłowe. Budowa i zastosowanie*. WNT, Warszawa 2004.
Complementary literature
1. Urbaniak A.: *Podstawy automatyki*. Ed. PP, Poznań 2001. 2. Mazurek J. i inni: *Podstawy automatyki*. Oficyna Wyd. PW, Warszawa 2002.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Mariusz Sosnowski, PhD Eng.	m.sosnowski@am.szczecin.pl	WMiE
Other teachers:		

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	25	Course:	**Marine automation and metrology** *				
Major:		**Mechanical Engineering**	Specialisation:		**Marine Power Plant Operation**		
Studies cycle:		**First**	Form of studies:	**full-time**	Year of studies:	**4th**	Semesters: **7th**
Course status:		**mandatory**	Course group:	**field-specific course**			

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	T	L	E	S	P	SE	IP	PR	A	T	L	E	S	P	SE	IP	PR	
7th	15	2E		3		0.4					30		45		6					6
Total during studies											30		45		6					6

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Possesses elementary knowledge of the basics of automation and digital technology
2.	Student can retrieve information from literature and documentation
3.	Student can work with computers and computer networks

Course objectives:

1.	Getting to know the structure of systems and automation devices of a ship power plant
2.	Developing the ability to operate the automation systems found in the ship's power plant
3.	Developing the ability to correctly diagnose failures in automation systems and to solve emergency situations

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Describes the essential structures of automation systems in a marine power plant	EK_W05, EK_U04
EKP2	Can supervise and operate an automated marine power plant	EK_W03, EK_U02, EK_U06
EKP3	Assesses and selects essential parameters for controlling the subsystems of an automated power plant	EK_U01
EKP4	Recognizes and adequately reacts to emergency states in automation systems	EK_U04, EK_U10, EK_U10
EKP5	Finds information in order to maintain the technical efficiency of power plant equipment	EK_U05, EK_U07
EKP6	Uses technical documentation	EK_U07, EK_U11, EK_U04

Programme content:

Form of clas-ses	EKP relation	Implemented content	Num-ber of hours
Semester:		7th	
A	EKP1,4,5	Control systems for internal combustion reciprocating engines driving fixed-pitch marine propellers	30
	EKP1,4,5	Control systems for internal combustion reciprocating engines driving adjustable-pitch marine propellers	
	EKP3,5	Measuring transducers of non-electrical quantities found in a marine power plant, signal processing and normalization systems, digital signal form, A / D and D / A converters, remote signal transmission	
	EKP2,5	Selected marine regulators of non-electric quantities: construction, principle of operation, maintenance; structure of control systems, selection of controller settings	
	EKP1,5,6	Ship power plant automatics systems: automatics of generator sets, automated power plants. Integrated control systems for the production and distribution of electricity on the ship, cogeneration systems	
	EKP1,2,3,5	Principle of operation, construction and operation of automation systems of mechanisms and auxiliary devices: auxiliary boilers, air compressors, centrifuges and fuel filters, steering devices, on-board and reloading devices. Control and regulation systems of the main marine boilers	
	EKP1,2,3,5,6	Ship information systems: alarm, dispatch, operational, warning, diagnostics and statistical-record keeping. Application of computer systems in ship automation	
L	EKP1,4,5	Control systems for internal combustion reciprocating engines driving fixed-pitch marine propellers	45
	EKP1,4,5	Control systems for internal combustion reciprocating engines driving adjustable-pitch marine propellers	
	EKP3,5	Examination of analog measuring transducers	
	EKP3,5	Studying automation system with intelligent measuring transducers	
	EKP2,5	Marine pneumatic and electronic regulators: construction, principle of operation, maintenance; structure of control systems, selection of controller settings	
	EKP1,5,6	Operating ship power plant automation systems	
	EKP2,3,5	Operating selected automation systems: auxiliary boilers, air compressors, centrifuges and fuel filters, steering devices, on-board and cargo handling devices	
	EKP1,2,3,5,6	Ship information systems: alarm, dispatch, operational, warning, diagnostics and statistical-record keeping.	
S	EKP3,5	Operating ship power plant automation systems	6
	EKP2,5	Operating selected automation systems: auxiliary boilers, air compressors, centrifuges and fuel filters, steering devices, on-board and cargo handling devices	
Total in the semester:			81

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	81	6
Self study	30	
Participation in final tests and exams apart from classes	30	
Total	141	

Assessment methods and criteria:

Grades	2	3	3.5–4	4.5 – 5
Grading method	Exam, written test. Assessment possible using distance learning methods and techniques			
EKP1	Student cannot describe the structure of their own choice	Can describe the structure of their own choice	Can describe the structure chosen by the teacher	Can explain connections and interdependencies between structures
EKP2	Cannot choose, run and operate the selected system	Runs the selected automation system in power plant simulator	Changes the control types and stations on the simulator (car, semi-auto, remote, local), operates systems	Fluently operates and supervises ship automation systems on the simulator
EKP3	Cannot define and evaluate parameters characterizing the system operation	Defines the essential parameters characterizing the operation of the automation system	Correctly evaluates and selects control parameter settings	Assesses the impact of interactions in automation systems
EKP4	Cannot recognize a threat in the system	Adequately responds to alarm signals	Understands the algorithm of threats and alarms detection	Knows the methods of recognizing threats and alarm states
EKP5	Cannot recognize automation devices	Recognizes individual devices	Finds information about the recommended operating conditions of automation devices	Can choose replacement elements and devices
EKP6	Does not understand technical documentation	Understands the vocabulary used in technical documentation	Can search for the necessary information	Is fluent in technical documentation in Polish and English

Teaching tools:

Type	Description
Computer hardware	PCs with two monitors, multimedia projectors
Simulation software	Computer simulation programs, e.g. by Unitest
Regulators, converters	Laboratory workbenches with transducers and pneumatic and electric regulators from Siemens, Aplisens, Omron, Foxboro, Festo
Technical documentation	Technical documentation of automation systems and elements of the selected vessel
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. Szcześniak J.: *Zdalne sterowanie silnikiem głównym na statkach ze śrubą stałą.* Fundacja Rozwoju Wyższej Szkoły Morskiej w Szczecinie, Szczecin 2001. 2. Szcześniak J., Stępniak A.: *Sterowanie i eksploatacja układu napędowego statku ze śrubą nastawną.* Fundacja Rozwoju Wyższej Szkoły Morskiej w Szczecinie, Szczecin 2001. 3. Szcześniak J.: *Cyfrowe regulatory prędkości obrotowej silników okrętowych.* Fundacja Rozwoju Wyższej Szkoły Morskiej w Szczecinie, Szczecin 2001. 4. Brzózka J. i inni: *Podstawy automatyki*. Wydawnictwo Naukowe Akademii Morskiej w Szczecinie, Szczecin 2008. 5. Brzózka J. i inni: *Układy automatyzacji*. Wydawnictwo Naukowe Akademii Morskiej w Szczecinie, Szczecin 2008. 6. Śmierzchalski R.: *Automatyzacja systemu elektroenergetycznego statku*. Gdynia 2004. 7. Kowalski Z., Tittenbrun S., Łastowski W.F.: *Regulacja prędkości obrotowej okrętowych silników spalinowych*. Wydawnictwo Morskie, Gdańsk 1988. 8. Miłek M.: *Pomiary wielkości nieelektrycznych metodami elektrycznymi.* Wydawnictwo Pol. Zielonogórskiej, 1998. 9. Piotrowski J.: *Podstawy miernictwa.* WNT, Warszawa 2007. 10. Tumański S.: *Technika pomiarowa.* WNT, Warszawa 2007. 11. Przepisy klasyfikacji i budowy statków morskich. PRS, Gdańsk 2007.
Complementary literature
1. MAN B&W company documentation; Wartsila-Sulzer 2. Description of Unitest simulation programs 3. Company documentation of ship automation devices and systems

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Mariusz Sosnowski, PhD Eng.	m.sosnowski@am.szczecin.pl	WMiE
Other teachers:		

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	26	Course:	**Technical Chemistry**				
Major:	**Mechanical Engineering**	Specialisation:		**Marine Power Plant Operation**			
Studies cycle:	**First**	Form of studies:	**full-time**	Year of studies:	**First**	Semesters:	**2nd**
Course status:	**mandatory**	Course group:	**vocational**				

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	E	L	EL	S	P	SE	TW	PR	A	E	L	EL	S	P	SE	TW	PR	
2nd	15	1		2							15		30							3
Total during studies											15		30							3

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Basic knowledge of mathematics, physics and chemistry at secondary school level

Course objectives:

1.	Acquiring the knowledge and developing the ability to apply chemical knowledge to formulate and solve tasks and problems related to mechanics and the construction and operation of machines and devices
2.	Developing self-education skills
3.	Developing the ability to observe and analyze data leading to a qualitative and quantitative assessment of chemical and physicochemical phenomena
4.	Teaching basic laboratory activities, measurement methods, interpretation of experimental results and preparation of reports

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Possesses chemistry knowledge and skills useful for formulating and solving tasks and problems related to mechanics and the construction and operation of machines, energy devices and industrial installations	EK_W05, EK_U11
EKP2	Student can conduct experiments, interpret the obtained results and draw conclusions, and prepare research reports	EK_U01

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		2nd	

A	EKP1	Structure of matter; elements, chemical compounds, mixtures; classification and characterization of basic groups of chemical compounds, current nomenclature of inorganic and organic compounds	15
	EKP1	Structure of the atom and molecules; quantum numbers, electronic configuration of elements and valence shells; types of chemical bonds; valency and degree of oxidation of elements in chemical compounds	
	EKP1,2	Using the periodic table of elements in macro- and microscopic terms; metals, non-metals, semi-metals; cations and anions; s, p, d, f block elements	
	EKP1,2	Solutions; concentration types, dissolution process, solubility product, dissociation, pH of acid and base solutions and buffer solutions	
	EKP1	Basic types of colloids, defines sols and gels, liquid and solid emulsions, solid foams and dispersions, characterizes lipophilic and lipophobic colloids, as well as hydrophilic and hydrophobic colloids, as well as gels, describes properties, preparation and application	
	EKP1,2	Types of chemical reactions; neutralization reactions, hydrolysis, precipitation, redox reactions, equilibrium constant, defiance rule	
	EKP1,2	Basic concepts related to the pace of chemical reactions and catalysis, catalysts and inhibitors, homo- and heterogeneous catalysis, graphs of energy dependence on the reaction progress	
	EKP1,2	Elements of electrochemistry; basic concepts - half-cell, cathode, anode, cell, standard half-cell potential, EMF cell, electrochemical series, electrode reactions, diagrams of half-cells and cells; corrosion; types, mechanism of formation, methods of protection against corrosion	
	EKP1	Phase equilibria, diagrams of phase equilibria of single and multicomponent systems; analysis using the Gibbs rule	
	EKP1	Dangerous substances, characteristics and classification, symbols of hazard and danger and safe procedures, safety data sheets and numerical codes of dangerous substances	
L	EKP2	Health and safety in a chemical laboratory	30
	EKP1,2	Performing characteristic reactions for selected elements of the s and p blocks	
	EKP1,2	Investigation of the physicochemical properties of water solutions, types of concentration, solubility, temperature, common ion	
	EKP1,2	Study of electrolytic dissociation, dissociation equations, dissociation constant and degree, effect of dilution and common ion	
	EKP1,2	Determination of the pH of aqueous solutions, pH scale, indicators, pH of aqueous solutions of salts, acids and bases in terms of corrosive action	
	EKP1,2	Performing the neutralization and hydrolysis reactions, studying the influence of factors on the chemical equilibrium	
	EKP1,2	Examination of the rate of chemical reactions and the influence of temperature, concentration, catalyst addition	
	EKP1,2	Execution and balancing of redox reactions and testing of the electrochemical corrosion process	
Total in the semester:			45

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	45	3
Self study	20	
Participation in final tests and exams apart from classes	5	
Total	70	

Assessment methods and criteria:

Grades	2	3	3.5–4	4.5 – 5
Grading method	tasks for self-study, self-education with the use of the WL package, control works, Assessment possible with the use of distance learning methods and techniques			
EKP1	Student does not have basic chemical knowledge, shows no ability to solve simple tasks	Has basic chemical knowledge and the ability to solve simple tasks	Has extensive chemical knowledge and the ability to solve complex tasks	Has the ability to apply complex chemical knowledge to solve interdisciplinary problems
Methods for evaluation	self-education with the use of E-learning, reports, control works. Assessment possible using distance learning methods and techniques			
EKP2	Demonstrates lack of ability to analyze results and draw conclusions	Has the ability to analyze results, interpret phenomena and laws, transform formulas, and interpret charts and tables	Has the ability to perform an extended analysis of results, apply laws, and construct charts	Has the ability to perform a complementary analysis of results, generalization, detection of cause-effect relationships, equations to describe the results

Teaching tools:

Type	Description
Multimedia	PP presentations and educational videos covering general knowledge of the subject and examples of practical use of knowledge to master the ability to solve simple and complex tasks and problems
Own work / WL package	WL Package - Chemistry for 1st year students of MU; material including extended and complementary chemical knowledge, examples of complex tasks and interdisciplinary problems as well as sets of questions and tasks for self-completion available at the MU website Guide to the preparation of safety data sheets for hazardous substances, REACH 2004
Laboratory exercises	Instructions for laboratory exercises, containing the practical purpose of the exercises, methodology of measurements and preparation of results and reports, as well as sets of questions and tasks for self-completion
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. Jones L., Atkins P.: *Chemia ogólna*. PWN, Warszawa 2004. 2. Pajdowski L.: *Chemia ogólna*. PWN, Warszawa 2002. 3. Stundis H., Trześniowski W., Żmijewska S.: *Ćwiczenia laboratoryjne z chemii nieorganicznej*. WSM, Szczecin 1995.

4. Szaniawska D., Ćwirko K.: *Pakiet E-learning Chemia techniczna dla kierunku kształcenia Mechanika i Budowa Maszyn*. Szczecin 2011. 5. Guide for preparing REACH 2004 material safety data sheets.
Complementary literature
1. Lautenschlager K.H., Schroter W., Wanninger A.: *Nowoczesne Kompendium Chemii*. PWN, Warszawa 2007; czytelnia internetowa ibuk.pl. 2. vanLoon G.W., Duffy S.J.: *Chemia środowiska*. PWN, Warszawa 2008.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Agnieszka Kalbarczyk-Jedynak, PhD Eng.	a.kalbarczyk@am.szczecin.pl	IMFiCh / ZCh
Other teachers:		
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Konrad Ćwirko, PhD Eng.	k.cwirko@am.szczecin.pl	IMFiCh / ZCh

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	27	Course:	Chemistry of water, fuel and lubricants *				
Major:		**Mechanical Engineering**	Specialisation:		**Marine Power Plant Operation**		
Studies cycle:		**First**	Form of studies:	**full-time**	Year of studies:	**3rd 4th**	Semesters: **5th 8th**
Course status:		**mandatory**	Course group:	**vocational**			

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	T	L	E	S	P	SE	IP	PR	A	T	L	E	S	P	SE	IP	PR	
5th	12	0.5		1.3							6		15							1
8th	15	0.6		1							9		15							2
Total during studies											15		30							3

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Completed subjects - mathematics, physics, technical chemistry, ship materials science, ship power plants, hydraulic drives, environmental protection

Course objectives:

1.	Acquiring knowledge in the field of water chemistry of fuels and lubricants, including the characteristics of operational parameters, analysis methodology, normative requirements and operational significance
2.	Developing the ability to apply chemical knowledge to solve problems related to water and wastewater management and the use of fuels and lubricants
3.	Developing practical skills in the field of methodology of chemical analyzes of technical water, fuels and lubricants, evaluation of usable quality and making diagnostic and repair decisions

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Has knowledge of operating media necessary to manage water and sewage, and the use of marine fuels and lubricants	EK_W05, EK_W03, EK_W01, EK_W02
EKP2	Has the ability to apply knowledge in the field of operating media for the effective management of water and sewage, as well as the use of fuels and lubricants	EK_U05, EK_U07, EK_U11, EK_U01, EK_U04; EK_K01, EK_K03
EKP3	Is skilled in taking samples, performing normative and test examinations of operational factors as well as qualitative assessment of operational parameters of operational factors and taking corrective actions	EK_U01, EK_U02, EK_U05

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		5th	
A	EKP1,2	Natural and industrial waters, pollution, quality indicators, basic treatment methods	6
	EKP1,2	Types, properties and requirements of water on ships	
	EKP1,2	Indicators of the quality of water used on board ships; methodology and chemistry of determination, standards, operational importance; expressing the values of indicators in various units used in practice	
	EKP1,2	The influence of water pollution on the operation of devices; sediments and boiler scale, corrosion, foaming, methods and preparations used for technical water treatment	
L	EKP3	Health and safety and fire protection in the water laboratory; film - technical water quality testing with portable laboratory kits	15
	EKP3	Measurement of pH and alkalinity in boiler and cooling water	
	EKP3	Determination of chloride ion content and conductivity of technical water	
	EKP3	Determination of total, calcium and magnesium hardness of boiler water	
	EKP3	Determination of oxygen and ammoniacal nitrogen content in technical water	
	EKP3	Determination of corrosion inhibitors in technical water	
	EKP3	Determination of water oxidisability and testing of suspensions	
Total in the semester:			21
Semester:		8th	
A	EKP1,2	Petroleum; composition, obtaining liquid fuels and lubricating products, the influence of the composition of petroleum products on functional properties	9
	EKP1,2	Liquid fuels; characteristics and classification, basic physicochemical properties and quality parameters, methodology and chemistry of determination, standards and operational significance of fuel performance parameters; ennobling additives	
	EKP1,2	Lubricating oils; composition, types, characteristics and classification, basic functional parameters, normative methods for determining quality indicators, analysis of relationships between parameters; ennobling additives	
	EKP1,2	Plastic lubricants; composition, types, characteristics and classification; basic functional parameters, additives, application	
	EKP1,2	Work safety with petroleum products; criteria for classification of hazardous substances, symbols of hazard, danger and safe procedures, material safety data sheets	
L	EKP3	Health and safety and fire protection in the fuel laboratory.	15
	EKP3	Fuel distillation and calculation of the cetane index	
	EKP3	Density measurement and determination of the temperature coefficient of density of petroleum products	

	EKP3	Viscosity measurement and determination of the viscosity index of lubricating oils	
	EKP3	Measurement of the flash point of fresh and used oil	
	EKP3	Determination of water content in petroleum products	
	EKP3	Determination of the reaction of water extract, acid or base number of petroleum products	
	EKP3	Measurement and evaluation of operational parameters of plastic greases, measurement of penetration and dropping point of lubricants	
	EKP3	Quality testing of used lubricating oils with portable laboratory kits	
Total in the semester:			24
Total during studies:			45

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	45	3
Self study	20	
Participation in final tests and exams apart from classes	6	
Total	70	

Assessment methods and criteria:

Grades	**2**	**3**	**3.5–4**	**4.5 – 5**
Methods of evaluation	tasks for independent completion, control works, Assessment possible using distance learning methods and techniques			
EKP1 EKP2	Has no basic knowledge and lacks the ability to solve simple tasks in the field of water chemistry, fuels and lubricants	Student has basic knowledge and the ability to solve simple tasks	Has extensive chemical knowledge and the ability to solve complex tasks	Has the ability to apply complex chemical knowledge to solve interdisciplinary problems
Methods for evaluation	lab reports, control works. Assessment possible using distance learning methods and techniques			
EKP3	Lacks the ability to analyze and evaluate the results and draw conclusions	Has the ability to analyze results, interpret phenomena and laws, transform formulas, and interpret charts and tables	Has the ability to perform an extended analysis of results, apply laws, and construct charts	Has the ability to perform a complementary analysis of results, generalization, detection of cause-effect relationships, equations to describe the results

Teaching tools:

Type	Description
Multimedia	PP presentations and educational videos covering general knowledge of the subject and examples of practical use of knowledge to master the ability to solve simple and complex tasks and problems
Own work / homework	Przemysłowe środki smarne. Poradnik. Total, Warszawa 2003. Guide for the compilation of safety data sheets, REACH. A set of tasks and sample questions and questions for own work

Instructions for laboratory exercises	Instructions for laboratory exercises, containing the practical purpose of the exercises, methodology of measurements and preparation of results and reports, as well as sets of questions and tasks for self-completion
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. Podniało A.: *Paliwa oleje i smary w ekologicznej eksploatacji*. WNT, Warszawa 2002. 2. *Przemysłowe środki smarne. Poradnik*. TOTAL Polska Sp. z o.o., Warszawa 2003. 3. Czarny R.: *Smary plastyczne*. WNT, Warszawa 2004. 4. Stańda J.: *Woda do kotłów parowych i obiegów chłodzących siłowni cieplnych*. WNT, Warszawa 1999. 5. Urbański P.: *Paliwa i smary*. Ed. FRWSzM w Gdyni, Gdańsk 1999. 6. Barcewicz K.: *Ćwiczenia laboratoryjne z chemii wody, paliw i smarów*. Ed. AM w Gdyni, 2006. 7. Żmijewska S., Trześniowski W.: *Badania jakości wody stosowanej na statkach*. Ed. AM w Szczecinie, 2005.
Complementary literature
1. Mizielińska K., Olszak J.: *Parowe źródła ciepła.* WNT, Warszawa 2009. 2. Kowal A.L., Świderka-Bróż M.: *Oczyszczanie wody*. PWN, Warszawa 2009.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
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Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	28	Course:	Use of fuels and lubricants*				
Major:	**Mechanical Engineering**	Specialisation:		**Marine Power Plant Operation**			
Studies cycle:	**First**	Form of studies:	**full-time**	Year of studies:	**4th**	Semesters:	**7th**
Course status:	**mandatory**	Course group:	**vocational**				

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	T	L	E	S	P	SE	IP	PR	A	T	L	E	S	P	SE	IP	PR	
7th	15	2									30									2
Total during studies											30									2

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Basic knowledge of: structure, classification, physicochemical properties of hydrocarbons and hetero compounds occurring in petroleum products

Course objectives:

1.	The aim of the course is to prepare the future graduate to perform activities related to the use of fuels and lubricants (STCW operational level) and to supervise the use of fuels and lubricants (STCW management level) in a marine power plant. The term "use" is understood as determining the demand, ordering, collecting, storing, transporting, maintaining and combustion

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Is able to analyze data and make correct decisions in operations related to the use of lubricants and knows the rules of supervision over the use of lubricants in a ship's power plant	EK_W03, EK_W04, EK_U10
EKP2	Is able to analyze data and make correct decisions in operations related to the use of fuels and knows the principles of supervision over the use of fuels in a ship's power plant	EK_W03, EK_W04, EK_U10

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		7th	
A	EKP1,2	**Density**: a) definition of density; b) dependence of the of petroleum products density on temperature and pressure;	30

		c) use of oil product density knowledge in shipboard practice	
	EKP1,2	**Viscosity**: viscosity as a measure of internal friction in fluids, general definitions of dynamic and kinematic viscosity, SI units, cgs and the most common conventional and relative viscosity units, methods of converting viscosity expressed in different units at the same temperature; (a) the concept of nominal viscosity of fuels and the resulting viscosity classification of fuels; b) dependence of the viscosity of petroleum products on temperature; c) fuel mixture viscosity, fuel mixing purpose, fuel mixing graph; d) importance of viscosity for: lubrication of slide bearings, resistance to fuel flow in pipelines, gravity sedimentation, efficiency of centrifuges and fuel spraying in the combustion chamber of a diesel engine	
	EKP1	**Friction and lubrication** a) importance of friction in technology (mechanical efficiency of devices, heat release, surface wear), methods of reducing the coefficient of friction between cooperating surfaces, hydrodynamic lubrication, dependence of the load capacity of a sliding bearing and its coefficient of friction on various design and operational factors; b) viscosity of the bearing lubricating oil - the relationship between the minimum and maximum limit values on the complexity level and the load of the lubricated device	
	EKP1	**Viscosity classifications of lubricating oils** a) ISO viscosity classification (applies to all non-engine oils); b) viscosity classification of SAE engine oils - reasons for using a separate classification, classification requirements	
	EKP1	**Functions of lubricating oil in an internal combustion engine and the possibility of filling them with oils** a) highly loaded anhydrous motor as a device that places the highest demands on lubricating oils; b) oil functions in an anhydrous engine: lubrication (reduction of friction and wear of lubricated elements), heat dissipation, keeping lubricated elements clean, sealing and acid neutralization and the resulting oil requirements: nominal viscosity, viscosity index (detailed description), lubricity resistance to oxidation and high temperature (detailed discussion of oxidative and thermal stability), washing and dispersing properties, alkalinity	
	EKP1	**Manufacturing of lubricating oils** a) obtaining base oils from refined crude oil distillates, properties of the base oil resulting from the oil refining method: viscosity index, oxidation stability, thermal stability - no possibility to meet all the requirements for engine oils, synthetic oils - much better viscosity index, oxidative and thermal stability - also does not meet all the requirements; b) additives added to the base oil - discussion of various types of additives used (viscosifiers, depressants, detergents, dispersants, anti-emulsifiers, alkaline additives, lubricating and EP additives, corrosion inhibitors, anti-foam additives, antioxidants); c) specific requirements for other (except engine) oils used on ships (turbine, gear, hydraulic, compressor oils - for air, gases and refrigerants, propeller shaft tubes, heating oils, for fish processing machines)	
	EKP1	**Engine lubricating oil in operation - operational contamination of engine oil**	

		a) alkaline additives - a specific type of additives quantified in the oil, the definition of the base number (BN), the importance of its value for the operation of the engine (phenomena in the oil film of the cylinder liner), fresh oil selection BN, changes in BN during engine oil operation, factors influencing the rate of decline of BN and the level of stabilization of BN, the limit value of the decline of BN; b) oxidation of oil (aging) - increase in viscosity, formation of organic acids, resins and asphalts, oil darkening; c) oil evaporation - oil losses in the lubrication system (significant share in the oil consumption by the engine), increase in viscosity; d) oil contamination - types of contamination, their sources and effects of presence (in particular water and fuel contamination); e) the necessity to test oil properties in order to assess its suitability for further operation; f) procedure for taking oil samples for testing; g) interpretation of the results of the physico-chemical analyzes of oil, the limit values of the determined parameters, the interpretation of the results of the spectral analysis of the oil; h) oil care during its operation: filtering, centrifuging and refreshing - selection of appropriate devices when designing the power plant and recommendations as to what to do when using them - typical errors	
	EKP1	**Viscosity classifications of lubricating oils** a) quality classification of lubricating oils as a result of operating experience - general quality classification requirements; b) quality classifications of engine oils: API, ACEA, MIL-L, classifications of engine manufacturers	
	EKP1	**Plastic lubricants** a) definition of plastic lubricant, advantages of plastic lubricant, its structure and composition; b) the most important properties of plastic lubricants: consistency (penetration), dropping point, lubricity, resistance to water washout, corrosion protection, impact on non-ferrous metals, paint coatings and seal materials; c) influence of the thickener type on the properties of plastic lubricants, ISO plastic lubricants classification; d) principles of selecting lubricants for a given application, methods of applying lubricants to various friction nodes; e) identification of plastic lubricants and detection of mechanical contamination, assortment of lubricants used in shipping, synthetic lubricants	
	EKP2	**Influence of the fuel production method for diesel engines on their most important operational properties** a) crude oil as a mixture of hydrocarbons and non-hydrocarbons, conservative and destructive processing of crude oil, the influence of crude oil composition and processing method on the hydrocarbon group composition of fuel fractions as well as distillation and post-cracking residues, production (composition) of distillate and residual fuels; b) the importance of the group composition of hydrocarbons for the auto-ignition properties of fuels, the importance of ignition retardation for the proper operation and durability of the engine, determination of the auto-ignition properties of distillate and residual fuels: cetane number, cetane index, diesel index, CCAI, CII;	

		c) the case of using the catalytic cracking residue to compose residual fuels: catalyst particles contained in such fuel - their composition, size and hardness, effects on the engine, difficulties in cleaning the fuel from them - new designs of centrifuges and filters, permissible share in the fuel, determination Al + Si; d) structure of residual fuels - colloidal solution and suspension, stability of residual fuels - causes and effects of instability (for the fuel system and for the engine), prevention of instability, stability margin, determination of TSE and TSP, method for determining fuel stability on a ship using ASTM paper method	
	EKP2	**Marine fuel contamination and other important parameters of fuel properties** a) flash point: no relation to self-ignition properties of fuel, fire safety requirements, permissible deviations - causes and conditions; b) pour point, pumpability temperature, cloud point, cold filter block temperature; c) water content: sources of water origin from fuel, why was the water content of the residual bunkered fuel limited to max. 1%, the effects of the presence of water in the fuel (for the fuel system and the engine), purification of water from fuels, fuel-water emulsions for fueling engines (benefits, conditions of use); d) sulfur content: sulfur content in fuels depending on the origin of the oil and the method of its processing, formation of SO_2 during fuel combustion, factors influencing the degree of SO conversion$_2$ to SO_3, the influence of sulfur compounds in exhaust gas on the dew point temperature - sulfuric corrosion (low-temperature) and its effects on the engine, methods of sulfur corrosion prevention (TBN of oils only signaling the problem); e) vanadium content: the origin of vanadium compounds in the fuel, the inability to remove them from the fuel on board, after burning the fuel, the vanadium oxides remain in the ash, melting point and ash adhesion temperature - low-melting sodium sulphate alloys, vanadium (high-temperature) corrosion and its effects for the engine, ways to prevent this corrosion; f) residue after fuel ash: its impact on the wear rate of engine components - the need to limit the amount of generated ash; g) residue after coking the fuel: the need to determine the propensity of fuels to form carbon deposits in the engine, Conradson number and MCR - good compliance with engine tests for distillate fuels and poor for residual fuels (discussion of the reasons)	
	EKP1,2	**Fuel classification and quality standards - fuel quality tests** a) previous classification: division into diesel oils (light fuels) and heating oils (heavy fuels), viscosity classification of heating oils and the lack of its relation to quality, reasons for introducing the new ISO international fuel classification; b) basics and principles of ISO marine fuel classification and specification; c) marine fuel quality tests by organizations established by Det Norske Veritas and Lloyd, their impact on the development of ISO standards, fuel sampling procedure, fuel parameters determined, use of on-board test results and as statistical data on fuel quality in the world	
	EKP1,2	**Safety of work with petroleum products**	
	EKP1,2	**Selection of substitutes for selected operating fluids:**	

		a) fuel, b) grease oils, c) hydraulic fluids, d) plastic lubricants, e) thermal oils.	
Total in the semester:			30

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	30	2
Self study	20	
Participation in final tests and exams apart from classes	2	
Total	52	

Assessment methods and criteria:

Grades	2	3	3.5–4	4.5 – 5
Methods of evaluation	Written multiple or single choice test, Assessment possible using distance learning methods and techniques			
EKP1	Does not know the rules of safe work with lubricants or does not know the functions of lubricants or does not know the main physico-chemical parameters of lubricants that determine the ability to fulfill these functions	Interprets and makes correct operational decisions on the basis of available data, characterizes the conditions of sampling oils for analysis	Characterizes the phenomena of friction and lubrication, operating conditions of various friction nodes and the influence of handling on wear	Characterizes the types of lubricants, conditions and principles of selection as a structural element of the friction junction
EKP2	Does not know the rules of safe work with lubricants or does not know the functions of lubricants or does not know the main physico-chemical parameters of lubricants that determine the ability to fulfill these functions	Interprets and makes correct operational decisions on the basis of available data, characterizes the conditions of sampling oils for analysis	Characterizes the impact of fuel quality on the operation of engines and boilers	Student describes the possibility of reducing the harmful effects of fuel reduced quality in the operation of a marine power plant

Teaching tools:

Type	Description
Projector, screen and computer	Typical for multimedia presentations
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. Urbański P.: *Paliwa i smary*. Fundacja Rozwoju Wyższej Szkoły Morskiej w Gdyni, 1999. 2. Czarny R.: *Smary plastyczne*. WNT, Warszawa 2004. 3. Podniało A.: *Paliwa oleje i smary w ekologicznej eksploatacji*. WNT, Warszawa 2002.

Complementary literature
1. Dudek A.: *Oleje smarowe Rafinerii Gdańskiej*. Met-Press, Gdańsk 1997. 2. Zwierzycki W.: *Paliwa silnikowe i oleje opałowe*. Rafineria Nafty Glimar SA, 1997. 3. Zwierzycki W.: *Paliwa, oleje, motoryzacyjne płyny eksploatacyjne*. Rafineria Nafty Glimar SA, 1998. 4. Zwierzycki W.: *Oleje smarowe: dobór i użytkowanie*. Rafineria Nafty Glimar SA, 1998.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Paweł Krause, PhD Eng.	p.krause@am.szczecin.pl	WM
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Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	29	Course:	Marine reciprocating engines*				
Major:		**Mechanics and Machine Building**	Specialisation:		**Marine Power Plant Operation**		
Studies cycle:		**First**	Form of studies:	**full-time**	Year of studies:	**3rd 4th**	Semesters:	**5th, 7th-8th**
Course status:		**mandatory**	Course group:	**vocational**			

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	E	L	EL	S	P	SE	TW	PR	A	E	L	EL	S	P	SE	TW	PR	
5th	12	2E		2							24		24							4
7th	15	2									30									2
8th	15	1E		2							15		30							4
Total during studies											69		54							10

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Basic knowledge of thermodynamics
2.	Basics of machine construction
3.	Materials engineering

Course objectives:

1.	Mastering the knowledge about operation principles of marine internal combustion engines
2.	Mastering the knowledge about the construction of reciprocating engines
3.	Getting to know the properties of work and characteristics of internal combustion engines
4.	Getting to know the principles of cooperation of internal combustion engines with an energy receiver
5.	Understanding destructive processes during the operation of an internal combustion engine
6.	Getting to know the principles of safe use of an internal combustion engine in various conditions

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Student can use the basic knowledge to solve the current operational problems of internal combustion engines	EK_W02, EK_U10, EK_K02
EKP2	Student can measure indicators of internal combustion engines and use them for operation	EK_W02, EK_U01, EK_U05
EKP3	Is able to ensure the supply of consumables necessary for the operation of marine engines	EK_U01, EK_U05, EK_K03

Programme content:

Form of clas-ses	EKP relation	Implemented content	Number of hours
Semester:		5th	
A	EKP1	Division of internal combustion engines. The principle of operation of two- and four-stroke internal combustion engines.	24
	EKP2	Recharging, the thermodynamic basis of the charging process, purpose and methods of implementation, impulse and constant pressure system, charging air parameters, cooling, water vapor condensation, influence of operating factors on the operating parameters of the charging system.	
	EKP2	Construction, workmanship and materials of the basic elements of the hull: base, crankcase, cylinder block, cylinder liner, head, tie bolts, foundation bolts	
	EKP2	Construction, workmanship and materials of basic elements of the crank-piston system: piston, piston pin, piston rings, piston rod, cross-head, connecting rod, crankshaft, crank system bearings.	
	EKP2	Construction and operation of the valve train: timing system components: cam, pusher, pusher rod, valve lever, poppet valve assembly with a spring, valve spring characteristics, hydraulic exhaust valve drive system, the concept of valve clearance and its adjustment.	
	EKP2	Fuel supply installation: required properties of marine fuel at the inlet to the engine, construction of a mechanically driven system and the principle of fuel dose control, construction and operation of injection pumps, construction of injectors, construction of the storage system and the principle of fuel dose control, high-pressure fuel lines, the principle of fuel dose control in dual fuel engines.	
	EKP2	Engine cooling system: purpose of cooling and the purpose of the cooling agent, parameters of cooling agents.	
	EKP2	Engine lubrication installation: engine lubricating oil functions, engine lubrication installation.	
	EKP1	Engine start-up and control system: principles of generating a driving torque during pneumatic start-up, operation of elements in the start-up installation - distributor and start-up valve, principles of crankshaft override during start-up in two directions of engine rotation (reversibility), protection in the engine control system, operation control system when maneuvering the engine.	
	EKP1	Service activities of the internal combustion engine (main and auxiliary propulsion: preparation for movement, supervision during operation, supervision during maneuvers, engine stoppage).	
	EKP1	Basic operational issues of marine internal combustion reciprocating engine: piston and crank system, injection system, lubrication system, cylinder liner bearing lubrication system, starting and reversing system, engine supercharging system. Operating limits for minimum and maximum engine loads.	
	EKP1	Procedures for dealing with emergency states of marine engine operation	
L	EKP1	Construction and workmanship of basic structural elements of the hull: identification of hull elements on selected objects of marine engines, characteristics of technological processes and material structural elements of the hull.	24
	EKP2	Construction and workmanship of the basic elements of the crank-piston system: identification of structural elements of the crank-piston system on selected objects of marine engines, characteristics of technological processes and material structural elements of the crank-piston system.	
	EKP2	Construction and operation of the valve train: poppet valve - design, technology and materials, valve lash - adjustment activities of the valve lash.	

	EKP2	Construction and operation of the injection system: injection pump with an overflow valve, injection pump with a rotary piston, marine engine injector - the technical solution of the atomiser.	
	EKP1	Construction and operation of cooling, lubrication and start-up installations: construction of subassemblies of individual installations, operating parameters of individual installations, evaluation of the operation of individual installations.	
	EKP1	Adjustment of injection pumps settings	
	EKP1	Assessment of injectors technical condition: visual assessment, assessment based on a testing bench sampling	
	EKP1	Basic maintenance of a piston internal combustion engine: preparation of installations supporting the engine for movement, starting the engine, adjustment of engine operating parameters, supervision during operation, parameter readings and interpretation, engine stops.	
Total in the semester:			48

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	48	4
Self study	20	
Participation in final tests and exams apart from classes	30	
Total	98	

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		7th	
A	EKP1	Work process theory: comparative circuits, actual circuits	30
	EKP1	Charge exchange process, indicators describing the quality of the charge exchange process	
	EKP1	Generation, ignition and combustion of the fuel-air mixture: thermodynamic foundations of the combustion process, fuel injection process, optimization of the fuel atomization process, formation of the fuel-air mixture, macro- and microstructure of the stream, fuel atomization parameters, the course of the combustion process, the impact of the injection and combustion process on engine efficiency, the impact of the injection and combustion process on the exhaust gas composition, toxic exhaust gas components, the impact of fuel parameters on the process of fuel-air mixture formation and combustion, the impact of operating parameters on the formation process fuel-air mixture and combustion.	
	EKP1	Energy indicators of engine operation: torque, rotational speed, average indicated and useful pressure, indicated and useful power, indicated, mechanical and general efficiency, specific fuel consumption, methods of measuring the engine energy indicators on the ship, heat balance and Sankey diagram of the ship engine	

	EKP1	Characteristics of marine engines: characteristics as a function of rotational speed, characteristics as a function of load, control characteristics, special characteristics, cooperation of the main drive motor with the propeller.	
	EKP1	The rotational speed control system of the internal combustion reciprocating engine: purpose of application, types, principle of operation and construction of rotational speed regulators, operation of the engine rotational speed control system under operating conditions,	
	EKP1	Charge air installation: examples of installation construction and components, types and construction of turbochargers, cooperation of the turbocharger with the charge air installation, conditions of the turbocharger pumping phenomenon, methods of preventing and removing the causes, engine operation with a disconnected turbocharger.	
	EKP1	Mechanics of the crank system: equations of crank system elements motion, inertia forces and the principle of their balancing, examples of balancing inertia forces and moments in multi-cylinder engines, uneven running of the engine, engine unbalance, structure and operation of the flywheel, torsional vibrations of the crankshaft - determination of the degree of safety of a specific case torsional resonance, torsional vibration dampers - structure, operation and operational recommendations.	
Total in the semester:			30

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	30	2
Self study	15	
Participation in final tests and exams apart from classes	5	
Total	60	

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		8th	
A	EKP1	Marine engine diagnostics: diagnostics of the supercharging process, diagnostics of the injection and combustion process	15
	EKP1,3	Safety installations: oil mist, under-piston space extinguishing	
	EKP3	Engine thermal loads: the essence of the thermal load, combustion chamber elements thermal loads, the effects of thermal loads, properties of materials used to manufacture thermally loaded elements.	
	EKP3	Emergency operating states of the marine engine: emergency maneuver, engine operation in a storm, engine operation with the a deactivated cylinder, engine operation with an inefficient supercharging system	

	EKP3	Dual-fuel engines: dual-fuel engines principle of operation, construction and operation of gas supply systems, operating properties of dual-fuel engines	
	EKP3	Exhaust gas toxicity: properties of toxic components of exhaust exhaust gases, methods of limiting the emission of toxic components of exhaust exhaust gases, international regulations for the protection of the marine environment against the effects of toxic components of exhaust gases.	
	EKP1	Foundation of marine engines: principles of mounting engines on the foundation, transverse vibrations of the engine hull - side bonds, forces and moments acting on the engine hull during operation	
	EKP1	Development trends of marine reciprocating engines	
L	EKP3	Indication and analysis of indicator charts	30
	EKP3	Rotational speed regulators: settings of main drive and generating sets regulators, regulator repairs	
	EKP3	Turbocharging unit testing: identification of faults and malfunctions, methods of cleaning contaminated components	
	EKP3	Preparation of the characteristics of the marine engine	
	EKP1,3	Research and measurements of torsional vibrations of the ship's propulsion system	
	EKP3	Testing of safety installations: methods of oil mist detection in the crankcase and the degree of explosion risk, methods of extinguishing a fire in the piston space of a crosshead engine	
Total in the semester:			45

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	45	4
Self study	25	
Participation in final tests and exams apart from classes	30	
Total	100	

Assessment methods and criteria:

Grades	2	3	3.5–4	4.5 – 5
Grading method	Written or oral test, Assessment possible using distance learning methods and techniques.			

EKP1	Student does not know the basics of operation and construction properties of an internal combustion engine. Does not know the properties of thermodynamic processes, the mechanics of engine construction and the principles of operation of engine installations. Does not know the issues related to the load on the engine components and the impact of its work on the environment	Knows the basics of operation and the construction properties of an internal combustion engine. Knows the properties of selected thermodynamic processes, the mechanics of engine construction and the principles of operation of engine installations. Does not know the issues related to the load on the engine components and the impact of its work on the environment	Knows the basics of operation and construction properties of the internal combustion engine and is able to evaluate the obtained measurement results. Knows the properties of selected thermodynamic processes, the mechanics of engine construction and the principles of operation of engine installations. Knows the issues related to the load on the engine components and the impact of its work on the environment	Knows the basics of operation and construction properties of the internal combustion engine and is able to evaluate the obtained measurement results. Can adjust the injector settings. Knows the properties of selected thermodynamic processes, the mechanics of engine construction and the principles of operation of engine installations. Can assess engine design in terms of the needs of the energy receiver. Knows the issues related to the load on the engine components and the impact of its work on the environment Is able to assess the impact of the works performed on the load on structural elements of the engine
EKP2	Does not know the definition and principles of determining the engine performance indicators	Knows the definitions and rules for determining the engine performance indicators	Knows definitions and rules for defining engine operation indicators. Knows the thermal losses of the engine and is able to prepare its heat balance	Knows definitions and rules for defining engine operation indicators. Knows the thermal losses of the engine and is able to prepare its heat balance. Can analyze the influence of variable conditions on internal combustion engine effectiveness
EKP3	Does not know the basics of operation, issues of exhaust gas toxicity and control of the rotational speed of the marine engine	Knows the selected issues of the basics of operation, issues of exhaust gas toxicity and control of the rotational speed of a ship engine	Knows the basics of operation, issues of exhaust gas toxicity and control of the rotational speed of the marine engine	Knows the basics of operation, issues of exhaust gas toxicity and control of the rotational speed of the marine engine Can carry out appropriate measurements, calculations and analysis of the current state of processes

Teaching tools:

Type	Description
Projector	Lectures and an introduction to laboratory exercises
Laboratory workbenches	Laboratory workbenches physically under the authority of the Maritime University
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. Piotrowski I., Witkowski K.: *Okrętowe silniki spalinowe*. Wydawnictwo Trademar, Gdynia 2002. 2. Piotrowski I., Witkowski K.: *Eksploatacja okrętowych silników spalinowych*. WSM, Gdynia 2002. 3. Kowalski Z., Łostowski S., Tittenbrun S.: *Regulacja prędkości obrotowej okrętowych silników spalinowych*. Wydawnictwo Morskie, Gdańsk 1988.
Complementary literature
1. Listewnik J., Marcinkowski J.: *Rozwój konstrukcji okrętowych wolnoobrotowych silników spalinowych*. WSM, Szczecin 1992.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		

Prof. Stefan Żmudzki, PhD Eng.	s.zmudzki@am.szczecin.pl	WM
Other teachers:		
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Tomasz Tuński, PhD Eng.	t.tunski@am.szczecin.pl	WM

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	30	Course:	Marine boilers *					
Major:		**Mechanics and Machine Building**	Specialisation:		**Marine Power Plant Operation**			
Studies cycle:		**First**	Form of studies:	**full-time**	Year of studies:	**3rd**	Semesters:	**5th**
Course status:		**mandatory**	Course group:	**vocational**				

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	T	L	E	S	P	SE	IP	PR	A	T	L	E	S	P	SE	IP	PR	
5th	12	2,55	0.5			0.3					30	6			4					3
Total during studies											30	6			4					3

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Thorough knowledge of thermodynamics in the field of thermodynamic transformations of gases, principles of thermodynamics, heat balance, combustion, principles of heat flow
2.	Thorough knowledge of technical chemistry in the field of water chemistry
3.	Basic knowledge of mathematics in the field of algebra, differential and integral calculus

Course objectives:

1.	Getting to know the construction of auxiliary, fired and utilization boilers, their structural elements and fittings
2.	Getting to know solutions of boiler systems (feed water, steam, condensate, fuel)
3.	Getting to know the construction of boiler burners
4.	Transfer of knowledge on the assessment of the impact of working processes on the boilers operating parameters
5.	Acquiring the skill of operating boilers
6.	Preparing the student for on-board practical trainings

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Describes and analyzes the structures of marine auxiliary boilers and their systems together with structural elements, fittings and burners	EK_W02, EK_U05, EK_U01, EK_U03
EKP2	Analyzes the impact of working processes on the operation of boilers	EK_W05, EK_U05, EK_U01
EKP3	Student knows and applies the working procedures while handling boilers, their systems and burners in various operating conditions	EK_W03, EK_U01, EK_U03

Programme content:

<table>
<tr><th>Form of classes</th><th>EKP relation</th><th>Implemented content</th><th>Number of hours</th></tr>
<tr><td colspan="2">Semester:</td><td colspan="2">5th</td></tr>
<tr><td rowspan="5">A</td><td>EKP2</td><td>Theoretical basis of ship boilers operation:
a) thermodynamic properties of water and steam;
b) cycle of thermodynamic changes in the boiler and their depiction on the i-s, T-s, i-p diagram;
c) physicochemical properties of diathermy oils</td><td rowspan="5">30</td></tr>
<tr><td>EKP1</td><td>Classification and construction of marine boilers.
Ship's main boilers:
a) water-tube,
b) drum-type,
c) with forced circulation,
d) flow,
e) special,
f) review of Foster-Wheeler, Sunrod designs.
Auxiliary ship boilers:
a) auxiliary fired,
b) fire-tube,
c) water-tube,
d) two-speed,
e) combined,
f) oil boilers,
g) review of Alborg, Senior Thermal, Metalport, Unex designs.
Characteristic values, parameters and indicators of modern main and auxiliary marine boilers:
a) water unit capacity,
b) heat load of the boiler chamber,
c) thermal load on the heat exchange surface,
d) pressure in the boiler,
e) temperatures in the boiler,
f) cumulative capacity</td></tr>
<tr><td>EKP1</td><td>Basics of construction and principles of waste-heat boilers operation:
a) examples of the construction of water-tube and fire-tube boilers,
b) boiler operating systems,
c) boiler automation</td></tr>
<tr><td>EKP1</td><td>Structural elements of ship boilers:
a) steam and steam-water drums,
b) main heating surfaces of boilers,
c) structure frame, gas-tight jacket, insulation,
d) steam drying,
e) air and water heaters,
f) steam heaters</td></tr>
<tr><td>EKP1</td><td>Boiler fittings and accessories:
a) shut-off, safety and return valves,
b) water gauges,
c) soot blowers,
d) level regulators, float, capacitive probes,
e) pressure switches, thermometers, thermocouples, manometers,</td></tr>
</table>

		f) installation for boiler cleaning on the flue gas side, g) boiler skimming installations, h) technical requirements	
	EKP1	Boiler installations: a) water supply systems (continuous and periodic supply), b) steam systems, c) skimming and desludging systems, c) boiler automation	
	EKP1	Fuel oil, diesel and petroleum waste fuel systems	
	EKP1	Boiler burners: a) pressure with mechanical spraying, b) rotating, c) dual-fuel, d) with steam spraying, e) with air spraying	
	EKP3	Ship boilers service: a) launching boiler operation, b) handling boilers during operation (water preparation during operation of boilers, water level control, daily operation, skimming of water gauges and level regulators), c) handling the fuel, water and steam system (service of filters and heaters, service of thermodynamic traps, heat box, observation tank, cooler condensate, excess condenser condensate), d) putting boilers out, e) putting the burner off, f) lowering pressure, boiler skimming, g) water refilling, h) adjusting waste-heat boiler efficiency, i) cooperation of a waste-heat and fired boiler	
	EKP3	Safe operation of ship boilers and emergency procedures	
E	EKP2	Working processes in the boiler: a) combustion: - the impact of fuel and air parameters as well as the technical condition of the burner on the quality of the combustion process, b) heat transfer: - radiation, - convection - types of pollutants and their influence on heat transfer, c) aerodynamics: - boiler structure impact on the flue gas flow resistance, - the influence of pollutants on the exhaust gas flow resistance, - exhaust fans, d) water circulation in the boiler: - natural circulation and its disturbances, - forced circulation	6
	EKP2	Boiler heat balance - efficiency and ways of increasing it: a) heat balance on the steam and water side, b) heat balance on the fuel side, c) methods of determining efficiency (direct and indirect), d) the effect of operating parameters *n* boiler efficiency	

S	EKP3	Ship power plant simulator: a) fuel, water and condensate systems preparation for operation; b) auxiliary and waste-heat boiler preparation for operation, starting up a fired boiler; c) launching the fired and waste-heat boiler; d) shutting down the auxiliary fired and waste-heat boiler; e) blockages of the boiler burner	4
Total in the semester:			40

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	**Estimated number of hours to complete the activity**	**ECTS points**
Total hours	40	3
Self study	20	
Participation in final tests and exams apart from classes	20	
Total	80	

Assessment methods and criteria:

Grades	**2**	**3**	**3.5–4**	**4.5 – 5**
Methods for evaluation	Written or oral test. Assessment possible using distance learning methods and techniques			
EKP1	Student incorrectly describes the structures of marine auxiliary boilers and their systems, structural elements, fittings and boiler burners	Student describes the structures of marine auxiliary boilers and their systems, structural elements, fittings and boiler burners in a basic manner.	Describes the structures of marine auxiliary boilers and their systems, structural elements, fittings and boiler burners in a technically correct manner	Describes and analyzes the structures of marine auxiliary boilers and their systems, structural elements, fittings and boiler burners in a technically correct manner
EKP2	Student is not able to apply mathematical dependencies to solve the given task	Correctly uses basic mathematical relationships to solve the given task	Correctly selects and applies mathematical relationships to solve the given task	Correctly selects, transforms and applies mathematical relationships to solve the given task. Analyzes the obtained results
Methods of evaluation	Demonstration with the use of an operational and graphic simulator of the power plant. Assessment possible using distance learning methods and techniques			
EKP3	Wrongly demonstrates operating procedures	Student knows and correctly demonstrates operating procedures	Knows and correctly demonstrates operating procedures, taking into account operational disruptions	Knows and correctly demonstrates operating procedures, taking into account operational disruptions introduced by the instructor

Teaching tools:

Type	Description
Overhead projector and multimedia projector	Auditorium classes in the form of film and multimedia presentations
Instructions and guides for classes	Materials for classes using marine power plant simulators
Ship power plant simulators	Classes with the use of a graphic and operational simulator of marine power plants
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. Górski Z., Perepeczko A.: *Okrętowe kotły parowe*. Fundacja Rozwoju WSM w Gdyni, 2001. 2. Perepeczko A.: *Okrętowe kotły parowe*. Wydawnictwo Morskie, Gdańsk 1979. 3. Piotrowski W.: *Okrętowe kotły parowe*. Wydawnictwo Politechniki Gdańskiej, Gdańsk 1985.
Complementary literature
1. Balcerski A.: *Siłownie okrętowe*. Wydawnictwo Politechniki Gdańskiej, Gdańsk 1990. 2. Cwynar L.: *Rozruch kotłów parowych*. WNT, Warszawa 1983. 3. Kruczek S.: *Kotły. Konstrukcje i obliczenia*. Wydawnictwo Politechniki Wrocławskiej, Wrocław 2001. 4. Rokicki H.: *Urządzenia kotłowe. Przykłady obliczeniowe*. Wydawnictwo Politechniki Gdańskiej, Gdańsk 1996. 5. Piotrowski W., Rokicki W.: *Kotły parowe. Przykłady obliczeniowe*. Wydawnictwo Politechniki Gdańskiej, Gdańsk 1975. 6. Manuals, brochures, bulletins, technical documentation, websites of marine boilers manufacturers.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Cezary Behrendt, PhD Eng.	c.behrendt@am.szczecin.pl	WM
Other teachers:		
Robert Jasiewicz, PhD Eng.	r.jasiewicz@am.szczecin.pl	WM
Marcin Szczepanek, PhD Eng.	m.szczepanek@am.szczecin.pl	WM

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	31	Course:	Marine machinery and equipment *					
Major:		**Mechanics and Machine Building**	Specialisation:		**Marine Power Plant Operation**			
Studies cycle:		**First**	Form of studies:	**full-time**	Year of studies:	**3rd-4th**	Semesters:	**5th 7th**
Course status:		**mandatory**	Course group:	**vocational**				

Semes-ter	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	E	L	EL	S	P	SE	TW	PR	A	E	L	EL	S	P	SE	TW	PR	
5th	12	2									24									1
7th	15	2E		3							30		45							6
Total during studies											54		45							7

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	

Course objectives:

1.	Getting to know the theory of processes occurring in ship machinery and auxiliary devices
2.	Getting to know the construction, operation and maintenance rules of ship machinery and auxiliary devices
3.	Developing the ability to prepare for work, start-up, assess the correctness of work and shutdown ship machinery and auxiliary devices
4.	Developing the ability to read and understand the diagrams of ship water, lubrication, fuel and hydraulic systems

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Identifies and characterizes devices and installations and explains the processes taking place in them and their impact on achieving the expected effects of the installation	EK_W02, EK_W03, EK_U07, EK_U01, EK_U10
EKP2	Student presents the processes occurring in machines and devices on charts and draws operational conclusions regarding the condition, processes and efficiency of devices	EK_W03, EK_W02, EK_U07, EK_U01, EK_U04, EK_U10
EKP3	Describes the principles of proper technical maintenance of the installation, identifies the parameters needed to assess the technical condition of devices and is able to interpret them, anticipates the impact of parameter settings and typical malfunctions on the operating parameters of the installation	EK_W03, EK_W02, EK_U07, EK_U01, EK_U10, EK_U02, EK_U06

EKP4	Demonstrates responsibility and understanding of the impact of decisions made during maintenance on the technical condition and operating costs of the ship, the safety of the crew and the condition of the natural environment	EK_W02, EK_U01, EK_K02, EK_K03

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		5th	
A	EKP1,2,3,4	Marine power plant mechanisms (including: installations and equipment for adjusting fuel viscosity, equipment for producing fresh water from sea water)	24
	EKP1,2,3,4	On-board devices	
	EKP1,2,3,4	Pumps and pumping systems	
	EKP1,2,3,4	Compressors	
	EKP1,2,3,4	Fuel and oil purification devices	
	EKP1,2,3,4	Shaft lines	
Total in the semester:			24

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	24	1
Self study	12	
Participation in final tests and exams apart from classes	5	
Total	41	

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		7th	
A	EKP1,2,3,4	Filters, filtration and purification	30
	EKP1,2,3,4	Heat exchangers	
	EKP1,2,3,4	Marine hydraulic systems (including: hydraulic installations for watertight doors)	
	EKP1,2,3,4	Steering system	
	EKP1,2,3,4	Adjustable screws	
	EKP1,2,3,4	Anchor equipment	
	EKP1,2,3,4	Hydraulic equipment for hatch covers	
	EKP1,2,3,4	Cargo handling machinery	
	EKP1,2,3,4	Tilting stabilizers	
	EKP1,2,3,4	Boat lifts	

L	EKP1,2,3,4	Cooperation of the pump with the pipeline, determining the flow, power and efficiency characteristics	45
	EKP1,2,3,4	Determination of impeller pump cavitation characteristics	
	EKP1,2,3,4	Determination of ship installation elements flow characteristics	
	EKP1,2,3,4	Studying efficiency of a reciprocating compressor	
	EKP1,2,3,4	Testing and calibration of viscometers	
	EKP1,2,3,4	Disassembly and assembly of the fuel centrifuge drum	
	EKP1,2,3,4	Testing of centrifugation efficiency as a function of operating parameters of the MAPX centrifuge and fuel properties	
	EKP1,2,3,4	Testing the spin efficiency as a function of FOPX centrifuge operation parameters and fuel properties	
	EKP1,2,3,4	Heat exchanger balance	
	EKP1,2,3,4	Power hydraulics system performance characteristics	
	EKP1,2,3,4	Steering gear testing and adjustment	
	EKP1,2,3,4	Operating parameters influence on the efficiency of the vacuum evaporator and the salinity of the condensate	
Total in the semester:			75

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	75	6
Self study	35	
Participation in final tests and exams apart from classes	30	
Total	140	

Assessment methods and criteria:

Grades	2	3	3.5–4	4.5 – 5
Grading method	Written or oral and practical tests during laboratory classes, Assessment possible with the use of distance learning methods and techniques			
EKP1	Student is not able to define the type of installation and characterize the devices in it	Student is able to determine the type of installation and characterize the most important devices and their role	Can correctly define the type of installation and characterize all devices and define their tasks and determine the scope of adjustment of operating parameters	Can correctly define the type of installation and characterize all devices and define their tasks, start and put the device out of service and determine the scope of adjustment of operating parameters, as well as estimate their selection and indicate alternative solutions
EKP2	Student is not able to show the processes on charts	Presents the processes on charts, draws operational conclusions regarding machines and devices	Presents processes on the graphs of the properties of working media, draws operational conclusions regarding the condition and efficiency of machines and devices	Presents processes on property charts, draws operational conclusions regarding the condition and efficiency of machines and devices, can analyze analytical relationships describing the processes

EKP3	Cannot describe the principles of proper technical maintenance of the installation or identify the parameters needed to assess the technical condition of devices	Describes the principles of proper technical maintenance of the installation, identifies the parameters needed to assess the technical condition of devices and is able to interpret them	Describes the principles of proper technical maintenance of the installation, identifies the parameters needed to assess the technical condition of devices and is able to interpret them, anticipates the impact of parameter settings on the operation of the installation	Describes the principles of proper technical maintenance of the installation, identifies the parameters needed to assess the technical condition of devices and is able to interpret them, anticipates the impact of parameter settings on the operation of the installation and indicates the impact of typical malfunctions on the operating parameters of the installation
EKP4	Student is unable to indicate the impact of decisions made during the service on the technical condition and operating costs of the ship, the safety of the crew and the condition of the natural environment	Student is able to indicate and explain the relationship between decisions made during the service and the technical condition and operating costs of the ship, the safety of the crew and the state of the natural environment	Demonstrates responsibility and understanding of the impact of decisions made during maintenance on the technical condition and operating costs of the ship, the safety of the crew and the condition of the natural environment	Demonstrates responsibility and understanding of the impact of decisions made during maintenance on the technical condition and operating costs of the ship, the safety of the crew and the condition of the natural environment Student can identify and justify typical hazards and carry out a risk analysis and indicate ways to reduce it during installation maintenance

Teaching tools:

Type	Description
Projector	Auditorium classes in the form of multimedia presentations and films
OMM	Operation and maintenance manuals of selected devices and apparatus
Diagrams	Documentation of actual installations used on ships
Test stand for centrifugal pumps	The stand is equipped with: marine centrifugal pumps controlled by an inverter, discharge valve, pressure and flow meters
Devices	Pumps, compressors, centrifuges, steering gear, heat exchangers, etc.
Centrifugation station for marine fuels	The stand is equipped with: FOPX centrifuge operating in the ALCAP system and MAPX centrifuge
Test stand for heat exchangers	The stand is equipped with the monitoring of operating parameters and execution of the heat balance of heat exchangers
Machine devices and installations simulators	Real-time simulation of commissioning, shutdown and monitoring during operation of plants, machines and devices
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. Praca zbiorowa: *Mały poradnik mechanika Tom II*. 2. Górski Z., Perepeczko A.: Okrętowe m*aszyny i urządzenia pomocnicze. Tom I i II*. 3. Operation and maintenance manuals of centrifugal and displacement pumps. 4. Urbański P.: *Siłownie okrętowe*. 5. Górski Z., Perepeczko A.: *Pompy okrętowe*. 6. Górski Z., Perepeczko A.: *Okrętowe sprężarki, dmuchawy i wentylatory*. 7. Manufacturers catalogs, User manuals for Alfa Laval, Westfalia, H. Cegielski, Aalborg, Saacke, Towimor, WSK Kraków. 8. Jasiewicz R., Szczepanek M.: *Przewodnik do ćwiczeń laboratoryjnych z pomp okrętowych realizowanych w Zakładzie Maszyn i Urządzeń Okrętowych*. 9. Biały W.: *Podstawy maszynoznawstwa*.

10. Bieniek C.: *Wentylatory osiowe*. 11. Smotrycki S.: *Maszyny i urządzenia pokładowe*. 12. Zabłocki M.: *Filtry paliwa silników wysokoprężnych*. 13. Szydelski Z.: *Sprzęgła i przekładnie hydrokinetyczne*. 14. Smotrycki S.: *Okrętowe mechanizmy pokładowe*. 15. Praca zbiorowa: *Vademecum hydrauliki Tom III*.
Complementary literature
1. Alfa-Laval materials available at www.alfalaval.com 2. Westfalia materials available at www.westfalia-separator.com 3. Aalborg materials available at www.aalborg.com 4. Saacke materials available at www.saacke.de/en 5. Towimor materials available at www.towimor.com.pl 6. WSK Kraków materials available at wsk.com.pl

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
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Other teachers:		
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Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

<table>
<tr><td>No.:</td><td>32</td><td>Course:</td><td colspan="6">Refrigeration and air conditioning *</td></tr>
<tr><td colspan="2">Major:</td><td>Mechanics and Machine Building</td><td colspan="2">Specialisation:</td><td colspan="4">Marine Power Plant Operation</td></tr>
<tr><td colspan="2">Studies cycle:</td><td>First</td><td>Form of studies:</td><td>full-time</td><td>Year of studies:</td><td>4th</td><td>Semesters:</td><td>7th</td></tr>
<tr><td colspan="2">Course status:</td><td>mandatory</td><td>Course group:</td><td colspan="5">vocational</td></tr>
</table>

<table>
<tr><td rowspan="2">Semes-ter</td><td rowspan="2">Number of weeks in the semester</td><td colspan="9">Number of hours per week / block</td><td colspan="9">Number of hours in a semester</td><td rowspan="2">ECTS</td></tr>
<tr><td>A</td><td>T</td><td>L</td><td>E</td><td>S</td><td>P</td><td>SE</td><td>IP</td><td>PR</td><td>A</td><td>T</td><td>L</td><td>E</td><td>S</td><td>P</td><td>SE</td><td>IP</td><td>PR</td></tr>
<tr><td>7th</td><td>15</td><td>2</td><td></td><td>2</td><td></td><td>0.3</td><td></td><td></td><td></td><td></td><td>30</td><td></td><td>30</td><td></td><td>5</td><td></td><td></td><td></td><td></td><td>5</td></tr>
<tr><td colspan="11">Total during studies</td><td>30</td><td></td><td>30</td><td></td><td>5</td><td></td><td></td><td></td><td></td><td>5</td></tr>
</table>

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	

Course objectives:

1.	Learning the theory of processes occurring in marine refrigeration, air conditioning and ventilation devices
2.	Getting to know the construction, operation and maintenance principles of marine refrigeration and air conditioning equipment
3.	Developing the ability to select optimal settings for the operation of marine refrigeration and air conditioning equipment
4.	Developing the skills of preparation for work, commissioning, evaluation of the correctness of work and shutting down of ship refrigeration and air conditioning equipment
5.	Developing the ability to read and understand diagrams of ship refrigeration and air conditioning systems

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Identifies and characterizes devices and installations and explains the processes taking place in them as well as their impact on achieving the expected effects of the installation	EK_W02, EK_W03, EK_U07, EK_U01, EK_U04, EK_U10
EKP2	Student presents thermodynamic processes on the graphs of the properties of working media and draws operational conclusions regarding the condition of media and processes as well as the efficiency of devices	EK_W03, EK_W02, EK_U07, EK_U01, EK_U04, EK_U10
EKP3	Describes the principles of proper technical maintenance of the installation, identifies the parameters needed to assess the technical condition of devices and is able to interpret them, anticipates the impact of parameter settings and typical malfunctions on the operating parameters of the installation	EK_W03, EK_W02, EK_U07, EK_U01, EK_U04, EK_U10, EK_U02, EK_U06, EK_U05, EK_U04

EKP4	Demonstrates responsibility and understanding of the impact of decisions made during maintenance on the technical condition and operating costs of the ship, the safety of the crew and the condition of the natural environment	EK_W02, EK_U01, EK_U01, EK_K02, EK_K03

Programme content:

Form of classes	**EKP relation**	**Implemented content**	**Number of hours**
Semester:		7th	
A	EKP1,2,3	Refrigeration and its application in shipbuilding	30
	EKP1,2,3	Cooling circuits and refrigeration systems used in sea-going ships	
	EKP1,2,3	Auxiliary systems	
	EKP1,2,3	Compressors and chillers	
	EKP1,2,3	Cooling apparatus	
	EKP1,2,3	Compressor interaction with other devices of the refrigeration system	
	EKP1,2,3	Automation of refrigeration equipment and installations	
	EKP1,2,3	Thermal balance of the cooler	
	EKP1,2,3	Operation of refrigeration installations	
	EKP1,2,3	Ventilation and air-conditioning systems used in sea-going ships	
	EKP1,2,3	Specialized ships	
	EKP1,2,3	Ship ventilation systems and fire protection	
	EKP1,2,3	Refrigerated containers	
	EKP2,3,4	Safe operation of refrigeration equipment	
	EKP2,3,4	Classification rules for refrigeration	
L	EKP1,2,3	Refrigeration installations diagrams	30
	EKP1,2,3	Cooling automatics settings	
	EKP1,2,3	Construction and operation of compressors and apparatus	
	EKP1,2,3	Examination of the heat transfer coefficient of a refrigerating chamber	
	EKP2,3,4	Operation of a reefer store	
	EKP1,2,3	Thermal balance of the reefer store and freezer system	
	EKP1,2,3	Air-conditioning unit testing	
S	EKP1,2,3,4	Installation of a reefer store	5
	EKP1,2,3,4	Installation of ship air conditioning	
Total in the semester:			65

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	**Estimated number of hours to complete the activity**	**ECTS points**
Total hours	65	5
Self study	60	
Participation in final tests and exams apart from classes	5	
Total	130	

Assessment methods and criteria:

Grades	2	3	3.5–4	4.5 – 5
Grading method	Written or oral and practical tests during laboratory classes, Assessment possible with the use of distance learning methods and techniques			
EKP1	Student is not able to define the type of installation and characterize the devices in it	Student is able to determine the type of installation and characterize the most important devices and their role	Can correctly define the type of installation and characterize all devices and define their tasks as well as determine the scope of adjustment of operating parameters	Can correctly define the type of installation and characterize all devices and define their tasks and determine the scope of automatic adjustment of operating parameters as well as estimate their selection and indicate alternative solutions
EKP2	Student is not able to present thermodynamic processes on the graphs of the properties of working media	Student presents thermodynamic processes on the graphs of the properties of working media, draws operational conclusions regarding the condition of the media and processes	Student presents thermodynamic processes on the graphs of the properties of working media and draws operational conclusions regarding the condition of media and processes as well as the efficiency of devices	Student presents thermodynamic processes on the graphs of the properties of working media and draws operational conclusions regarding the condition of media and processes as well as the efficiency of devices Can analyze analytical relationships describing thermodynamic processes
EKP3	Cannot describe the principles of proper technical maintenance of the installation or identify the parameters needed to assess the technical condition of devices	Describes the principles of proper technical maintenance of the installation, identifies the parameters needed to assess the technical condition of devices and is able to interpret them	Describes the principles of proper technical maintenance of the installation, identifies the parameters needed to assess the technical condition of devices and is able to interpret them, anticipates the impact of parameter settings on the operation of the installation	Describes the principles of proper technical maintenance of the installation, identifies the parameters needed to assess the technical condition of devices and is able to interpret them, anticipates the impact of parameter settings on the operation of the installation and indicates the impact of typical malfunctions on the operating parameters of the installation
EKP4	Student is unable to indicate the impact of decisions made during the service on the technical condition and operating costs of the ship, the safety of the crew and the condition of the natural environment	Student is able to indicate and explain the relationship between decisions made during the service and the technical condition and operating costs of the ship, the safety of the crew and the state of the natural environment	Demonstrates responsibility and understanding of the impact of decisions made during maintenance on the technical condition and operating costs of the ship, the safety of the crew and the condition of the natural environment	Demonstrates responsibility and understanding of the impact of decisions made during maintenance on the technical condition and operating costs of the ship, the safety of the crew and the condition of the natural environment Student can identify and justify typical hazards and carry out a risk analysis and indicate ways to reduce it during installation maintenance

Teaching tools:

Type	Description
Projector	Auditorium classes in the form of multimedia presentations and films
OMM	Operation and maintenance manuals of selected devices and apparatus
Diagrams	Documentation of actual refrigeration systems used on ships
Automation setting stations	Two stations: to control and set the pressure switches and to control and set the TEV
Devices	Typical elements of the installation: apparatus and compressors
Cold room provisions	Installation of a two-chamber reefer store equipped with computer monitoring of operating parameters with the possibility of determining the balance

Two-stage freezer	Two-stage installation with an economiser equipped for the monitoring of operating parameters and the implementation of the heat balance
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. Bohdal T., Charun H., Czapp M.: *Urządzenia chłodnicze sprężarkowe parowe*. WNT, Warszawa 2003. 2. Bonca Z. i in.: *Czynniki chłodnicze i nośniki ciepła*. IPPU Masta, Gdańsk 1997. 3. Bonca Z., Depta A.: *Wentylacja i klimatyzacja okrętowa*. Gdynia 1999. 4. Fodemski T.: *Domowe i handlowe urządzenia chłodnicze. Poradnik*. WNT, Warszawa 2000. 5. Jones W.P.: *Klimatyzacja*. Arkady, 1981. 6. Piotrowski I.: *Okrętowe urządzenia chłodnicze*. Fundacja Rozwoju Wyższej Szkoły Morskiej w Gdyni, Gdynia 1994. 7. Płaska Z., Sobecki M.: *Wybrane zagadnienia z chłodnictwa i klimatyzacji – zbiór zadań*. WSM, Szczecin 1980. 8. Recknagel H. i in.: *Poradnik ogrzewanie i klimatyzacja*. EWFE, Gdańsk 1994. 9. Starowicz Z.: *Poradnik montera chłodniczego*. WNT, Warszawa 1976. 10. Szolc Z.: *Chłodnictwo*. WSiP, Warszawa 1980. 11. Ulrich H.: *Technika chłodnicza. Poradnik. Tom 1 i 2*. IPPU Masta, Gdańsk 1999. 12. Wasiluk W., Korczak E.: *Wentylacja i klimatyzacja na statkach*. WM, Gdańsk 1997. 13. Zakrzewski B.: *Obliczenia obiegów chłodniczych i klimatyzacyjnych*. PS, Szczecin 1991.
Complementary literature
1. Danfoss materials. available at www.danfoss.com 2. ALCO materials. available at www.alco.com 3. Starcool materials. available at www.starcool.com 4. Carrier materials. available at www.carrier.com

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Ewelina Złoczowska, PhD Eng.	e.zloczowska@am.szczecin.pl	WM
Other teachers:		
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Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	33	Course:	Marine power plants*				
Major:		**Mechanics and Machine Building**	Specialisation:		**Marine Power Plant Operation**		
Studies cycle:		**First**	Form of studies:	**full-time**	Year of studies:	**3rd-4th**	Semesters: **5th, 7th**
Course status:		**mandatory**	Course group:	**vocational**			

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	E	L	EL	S	P	SE	TW	PR	A	E	L	EL	S	P	SE	TW	PR	
5th	12	2	0.5			2					24	6			24					2
7th	15	2E				2					30				30					3
Total during studies											54	6			54					5

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Participation in classes and successfully completing the following subjects: Ship materials, Fluid mechanics, Technical thermodynamics, Fundamentals of machine design, English, Ship electrical engineering
2.	Participation in classes in the following subjects: Ship automation and surveying, Ship boilers, Ship machinery and equipment, Chemistry of water, fuels and lubricants, Ship theory and construction, Ship piston engines, Marine environment protection
3.	Specialist workshop practice before the fifth semester and marine practice before the seventh semester

Course objectives:

1.	Acquiring the skill of detailed technical identification of a ship and a marine power plant
2.	Acquisition of practical and operational skills, operating all functional installations of the ship and marine power plants as well as devices and mechanisms used in them
3.	Acquisition of skills in servicing and safe operation of the ship's propulsion systems, main and auxiliary
4.	Developing the ability to adapt the current operation of the ship and the power plant to the changing conditions of sailing, as well as accidents and technical failures
5.	Acquisition of work organization skills in the field of technical operation of the ship and power plant

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Student can use and supervise functional installations in the ship's power plant and on the ship	EK_W03, EK_W01, EK_W02, EK_U10, EK_U05, EK_U04, EK_K03

EKP2	Student can use and supervise systems and auxiliary devices in the marine power plant and on the ship, in various operational states	EK_W03, EK_W01, EK_W02, EK_U10, EK_U05, EK_U04, EK_K03
EKP3	Can use and safely supervise the main and auxiliary propulsion systems	EK_W03, EK_W01, EK_W02, EK_U10, EK_U05, EK_U04, EK_K03
EKP4	Student can safely and economically operate a ship and a ship's power plant in various climatic conditions and emergency conditions	EK_W03, EK_W01, EK_W02, EK_U10, EK_U05, EK_U04, EK_K03

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		5th	
A	EKP1,2	Marine power plants - general information	24
	EKP1,2	Requirements for power plants and their influence on solutions used in marine power plants.	
	EKP1,2	Construction and operation of installations supporting auxiliary combustion engines	
	EKP1,2	Basic installations of marine power plants and the ship and their operation	
	EKP1,2	Steam engine systems	
	EKP1,2	Power engineering of the ship's power plant	
	EKP1,2	Modern solutions of propulsion and power systems with shaft generators and methods of their operation	
	EKP1,2	Waste-heat utilization, review of modern system solutions and principles of their operation	
C	EKP1,2,3,4	Fuel consumption calculations	6
	EKP1,2,3	Engine-propeller-fuselage cooperation, calculation of propeller slip	
S	EKP1,2	Introduction - construction and operation of a ship power plant simulator, start-up and basic operation of the simulator programs	24
	EKP1,2	Description of the procedures for starting the ship's power plant and operation in various operational states	
	EKP1,2	Cooling installations - sea water, fresh water and auxiliary installations	
	EKP1,2	Compressed air installation	
	EKP1,2	Steam and water installation - preparation for operation, start-up, supervision during operation and shutdown	
	EKP1,2	Fuel and lubricating installations - transport, cleaning and supply	
	EKP1,2	Preparation for work, start-up and operation of the main engine - slow-speed drive. The activities of taking over and keeping the engineering watch - basic knowledge	
	EKP1,2	The energy system of the power plant	
Total in the semester:			54

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	54	2
Self study	20	
Participation in final tests and exams apart from classes	5	
Total	79	

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		7th	
A	EKP3,4	The resistance characteristics of the ship	30
	EKP3,4	Main propulsion engines working area and cooperation of the engine - ship propeller system	
	EKP3,4	Main and auxiliary ship propulsion systems, construction and operation	
	EKP3,4	Operation of the drive system while maneuvering - Robinson curves	
	EKP3,4	Principles of economic exploitation of marine power plants. Energy balance of a ship power plant	
	EKP3,4	Operation of the ship's power plant and the ship in various weather conditions, as well as emergency and failure conditions	
	EKP3,4	Contemporary ship power plants - development trends. New solutions for power plant systems	
S	EKP3,4	Construction and operation of the main propulsion engine remote control system	30
	EKP3,4	Start-up and operation of the main drive - medium-speed drive	
	EKP3,4	Supervision of main propulsion marine engines during operation	
	EKP3,4	Working fields of main engines and cooperation of the engine - propeller system, determination of propulsion characteristics	
	EKP3,4	Ship power plant power engineering and operation of propulsion and power systems with shaft generators	
	EKP3,4	Cooperation of the main drive motor with heat utilization devices	
	EKP3,4	Ship propulsion systems and their safe and economic operation	
	EKP3,4	Operation of the ship's power plant and the ship in emergency and failure conditions	
Total in the semester:			60

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	60	3
Self study	20	
Participation in final tests and exams apart from classes	20	
Total	100	

Assessment methods and criteria:

Grades	**2**	**3**	**3.5–4**	**4.5 – 5**
Grading method	Credit for practical exercises in the ship power plant simulator. Oral exam, Assessment possible using distance learning methods and techniques			
EKP1	Student does not identify, does not know the construction and does not understand the principles of operation and purpose of the basic installations of the power plant and the ship. Is not able to independently use the basic installations of the power plant and the ship	Correctly identifies, understands the principle of operation and the purpose of the basic installations of the power plant and the ship. Is able to independently use the basic installations of the power plant and the ship	Correctly identifies, knows the structure and purpose, and understands the principle of operation of basic installations. Is able to correctly identify the individual elements of the basic installations of the marine power plants and the ship. Is able to independently use the basic installations of the power plant and the ship	Correctly identifies, knows the structure and purpose, and understands the principle of operation of basic installations. Is able to correctly identify the individual elements of the basic installations of the marine power plants and the ship. Can correctly describe the procedure of using the basic installations of the marine power plant and the ship. Is able to independently use the basic installations of the power plant and the ship
EKP2	Does not identify, does not know the structure, purpose and principles of operation of systems and auxiliary devices of propulsion systems in the ship's power plant. Is not able to independently, practically use the systems and auxiliary devices of the power plant and the ship	Correctly identifies, knows the structure, purpose and principle of operation of systems and auxiliary devices of propulsion systems of the ship's power plant. Is able to independently, practically use the systems and auxiliary devices of the power plant and the ship	Correctly identifies, knows the structure, purpose and principle of operation of systems and auxiliary devices of propulsion systems of the ship's power plant. Is able to use the instructions and documentation of the application of the procedure for the safe use of ship systems. Is able to independently, practically use the systems and auxiliary devices of the power plant and the ship	Correctly identifies, knows the structure, purpose and principle of operation of systems and auxiliary devices of propulsion systems of the ship's power plant. Is able to independently use instructions and documentation to prepare a procedure for the safe use of ship systems. Can independently, practically apply the developed procedures and use the systems and auxiliary devices of the marine power plant and the ship
Methods for evaluation	Written test and practical credit for exercises in the ship power plant simulator, Assessment possible using distance learning methods and techniques.			
EKP3	Does not identify, does not know the structure and does not understand the principles of operation and purpose of the main and auxiliary propulsion systems of the ship. Cannot independently use auxiliary propulsion systems of the ship	Correctly identifies, knows the structure and understands the principle of operation and purpose of the ship's main and auxiliary propulsion systems. Can use auxiliary and main propulsion systems under supervision	Correctly identifies, knows the structure and understands the principle of operation and purpose of the ship's main and auxiliary propulsion systems. Can use the documentation and instructions for the implementation of basic activities of supervision and use of auxiliary propulsion systems. Can independently use auxiliary propulsion systems	Correctly identifies, knows the structure and understands the principle of operation and purpose of the ship's main and auxiliary propulsion systems. Can use the documentation and instructions for the implementation of the basic activities of supervision and use of the main and auxiliary propulsion systems of the ship. Can independently use auxiliary propulsion systems

EKP4	Does not identify or know the operating procedures and purpose of the ship's main and auxiliary propulsion systems. Is not able to apply practically the activities for the safe and economic operation of the ship and the power plant	Correctly identifies, knows the operating procedures and purpose of the ship's main and auxiliary propulsion systems. Is able to use the documentation and instructions to practically apply the activities for the safe and economic operation of the ship and the power plant in standard climatic conditions	Correctly identifies and knows the operating procedures and purpose of the ship's main and auxiliary propulsion systems. Is able to use the documentation and instructions to practically apply the activities for the safe and economic operation of the ship and the power plant in standard climatic conditions	Correctly identifies, knows the operating procedures and purpose of the ship's main and auxiliary propulsion systems. Using the documentation and instructions, is able to practically apply activities for the safe and economic operation of the ship and the power plant in various climatic conditions and emergency states

Teaching tools:

Type	Description
A computer with LAN access. Projector	Auditorium lecture classes with presentations and specialist programs
Ship and marine power plants simulators: operational and graphic in accordance with the STCW requirements	Theoretical and practical classes with use of specialized simulators
Ship documentation and manuals	Main and auxiliary propulsion engines, ship installations and systems, auxiliary devices of marine power plants and ships.
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature

1. Rawson K.J., Tupper E.C.: *Basic Ship Theory*. Elsevier, 2001.
2. Schneekluth H., Bertram V.: *Ship Design for Efficiency and Economy*. Elsevier, 1998.
3. Bertram V.: *Practical Ship Hydrodynamics*. Elsevier, 1999.
4. Tupper E.C.: *Introduction to Naval Architecture*. Elsevier, 2004.

Complementary literature

1. Wojnowski W.: *Okrętowe siłownie spalinowe, Tom I, II i III*. Politechnika Gdańska, 1991–1992.
2. Urbański P.: *Gospodarka energetyczna na statkach*. Wydawnictwo Morskie, Gdańsk 1978.
3. Chachulski K.: *Podstawy napędu okrętowego*. Wydawnictwo Morskie, Gdańsk 1988.
4. Piotrowski I., Witkowski K.: *Eksploatacja okrętowych silników spalinowych*. Gdynia 2002.
5. Urbański P.: *Instalacje okrętów i obiektów oceanotechnicznych: instalacje spalinowych siłowni okrętowych*. Politechnika Gdańska, Gdańsk 1994.
6. Balcerski A.: *Siłownie okrętowe*. Gdańsk 1990.
7. Włodarski J.K.: *Podstawy eksploatacji maszyn okrętowych*. Gdynia 2006.
8. Świder J.: *Sterowanie i automatyzacja procesów technologicznych i układów mechatronicznych*. Politechnika Śląska, Gliwice 2006.
9. Kowalski Z., Tittenbrun S., Łastowski W.F.: *Regulacja prędkości obrotowej okrętowych silników spalinowych*. Wydawnictwo Morskie, Gdańsk 1988.
10. Wiewióra A.: *Ochrona środowiska morskiego*. WSM, Szczecin 1997.
11. Borkowski T.: *Emisja spalin przez silniki okrętowe – zagadnienia podstawowe*. WSM, Szczecin 2000.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Tadeusz Borkowski, PhD Eng.	t.borkowski@am.szczecin.pl	WM
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Abbreviations:
A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	**34**	Course:	**Introduction to ship construction and crew organization** *					
Major:		**Mechanics and Machine Building**	Specialisation:		**Marine Power Plant Operation**			
Studies cycle:		**First**	Form of studies:	**full-time**	Year of studies:	**First**	Semesters:	**First**
Course status:		**mandatory**	Course group:	**vocational**				

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	T	L	E	S	P	SE	IP	PR	A	T	L	E	S	P	SE	IP	PR	
First	15	2									30									2
Total during studies											30									2

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	

Course objectives:

1.	Getting to know the structure of maritime organizations and administration bodies and the scope of their activities. Understanding the division of competences of crew members required by the STCW convention
2.	Getting to know the basic types of ships, structural elements and hull dimensions
3.	Getting to know the general structure of the power plant, its equipment, propulsion, control, ship's deck and individual life saving equipment, types of ship maintenance, their ranges, docking

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Student knows the structure of maritime organizations and administration bodies and the scope of their activities. Understands the division of competences of crew members required by the STCW convention	EK_W03, EK_W01, EK_W02, EK_U10, EK_U05, EK_U04, EK_K03
EKP2	Distinguishes between the basic types of ships, distinguishes between structural elements and hull dimensions	EK_W02, EK_W04, EK_U05, EK_U11, EK_K01, EK_K03
EKP3	Knows the general structure of the power plant, its equipment, propulsion, control, ship's deck and individual life saving equipment, types of ship maintenance, their ranges, docking	EK_W02, EK_W04, EK_U05, EK_U11, EK_K01, EK_K03

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		First	
A	EKP1	The activities of IMO and classification institutions	30
	EKP1	Division of competences of crew members required by the STCW convention	
	EKP2	Ship types: bulk carriers, general cargo carriers, ferries, tankers, product carriers, gas carriers, spatial planning. Hull geometry, main dimensions, relations to main dimensions	
	EKP3	General characteristics of marine power plants. Types, construction of a gym, basic systems, types of auxiliary devices	
	EKP3	Propellers, types of propellers. Means of steering the ship, types of rudders	
	EKP3	On-board equipment	
	EKP3	Life-saving equipment	
	EKP3	Nomenclature and general principles of technical surveys of ships, their scopes, docking	
Total in the semester:			30

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	30	2
Self study	10	
Participation in final tests and exams apart from classes	2	
Total	42	

Assessment methods and criteria:

Grades	2	3	3.5–4	4.5 – 5
Grading method	Written or oral test after lectures. Assessment possible using distance learning methods and techniques			
EKP1	Student is unable to characterize maritime organizations and administration bodies and the scope of their activities. Is unable to determine the competencies of crew members at the levels required by the STCW convention	Can characterize maritime organizations and administration bodies and the scope of their activities. Can determine the competences of crew members at the levels required by the STCW convention	Can characterize maritime organizations and administration bodies and the scope of their activities. Can determine the competences of crew members at the levels required by the STCW convention. Finds links to information about the activities of maritime institutions	Can characterize maritime organizations and administration bodies and the scope of their activities. Can determine the competences of crew members at the levels required by the STCW convention. Finds links to information on maritime institutions scope of activities, responsibilities and competences of ship crew members

EKP2	Is unable to characterize the basic types of ships, does not distinguish between structural elements and dimensions of the ship's hull	Can characterize the basic types of ships, distinguishes between structural elements and ship hull dimensions	Can characterize the basic types of ships, determines their applications, distinguishes between elements of the structure and dimensions of the ship's hull	Can characterize the basic types of ships, determines their applications and specialized equipment, distinguishes between structural elements and dimensions of the ship's hull
EKP3	Student is unable to characterize the general structure of the power plant, its equipment, on-board equipment of the basic types of ships. Student does not distinguish between ship and individual life saving appliances, types of ship surveys, does not know the purpose of the docking of the ship	Can characterize the general structure of the power plant, its equipment, on-board equipment of basic types of ships. Distinguishes between ship and individual life saving appliances, types of ship maintenance, their scope, knows the purpose and general procedure of ship docking	Can characterize the general construction of the power plant, its equipment, ship's on-board equipment, including specialized ships. Distinguishes between ship and individual life saving appliances, types of ship maintenance, their scope, knows the purpose and general procedure of ship docking	Can characterize the general construction of the power plant, its equipment, ship's on-board equipment, including specialized ships. Distinguishes between ship and individual life-saving appliances, can characterize their usefulness in weather conditions. Distinguishes between the types of ship maintenance, their scope, knows the purpose and general procedure of ship docking

Teaching tools:

Type	Description
Projector	Auditorium classes in the form of multimedia presentations and films, internet connections
Printed auxiliary materials	Ship documents
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. Szarejko J., Roguski R.: *Zarys Budowy Okrętu*. Gdańsk 1974. 2. Babicz J.: *WÄRTSILÄ Encyklopedia of ship technology.* Gdańsk 2008. 3. SOLAS Convention, ed. 2004. 4. STCW 95 Convention, ed. IMO. 5. Polish Journal of Laws No. 105 item 117 - Regulation of the Minister of Infrastructure of August 24, 2000 on training and professional qualifications, watchkeeping and the composition of the crews of Polish sea-going ships.
Complementary literature
1. Poradnik motorzysty 2. Websites: www.dnv.com, www.gl-group.com, www.eagle.org, www.imo.org, www.prs.gda.com

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
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Other teachers:		
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Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	**35**	Course:	**Ship theory and construction** *				
Major:	**Mechanics and Machine Building**	Specialisation:		**Marine Power Plant Operation**			
Studies cycle:	**First**	Form of studies:	**full-time**	Year of studies:	**2nd**	Semesters:	**3rd-4th**
Course status:	**mandatory**	Course group:	**vocational**				

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	E	L	EL	S	P	SE	TW	PR	A	E	L	EL	S	P	SE	TW	PR	
3rd	12	2									24									2
4th	15	1.5	0.5								23	8								2
Total during studies											47	8								4

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Knowledge of mathematics, physics and computer science matters
2.	Knowledge of issues related to materials strength
3.	Knowledge of technical drawing and engineering graphics elements
4.	Basic knowledge of materials science
5.	Knowledge of the basic principles of a sea-going vessel construction
6.	Knowledge of sea-going vessel hull construction including knowledge of the on-board equipment
7.	Knowledge of the rules for assessing buoyancy and stability of a sea-going vessel
8.	Knowledge of the principles of assessing the position of the ship's equilibrium

Course objectives:

1.	Teaching the basic principles of a sea-going vessel construction
2.	Getting to know and interpret relevant regulations
3.	Teaching the principles of performing strength calculations with the understanding of the physical processes
4.	Knowledge and understanding of the theoretical basis for assessing the stability and buoyancy of a ship
5.	The ability to assess the influence of the ship's loading condition on its equilibrium and stability
6.	Knowledge of ship longitudinal stability assessment. Understanding the principles of determining the ship's trim and draft based on the load
7.	Knowledge of the assessment of the ship's stability in service based on load level. Understanding the influence of an external dynamic heeling moment on the ship's equilibrium position and stability
8.	Knowledge of ship stability documentation elements (construction and operation) - content, aplication
9.	Knowledge of damage stability issues related to partial loss of buoyancy or a supported vessel

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Student knows the spatial layout and operational parameters of various types of ships; knows the documentation related to the geometrical characteristics of the ship's hull	EK_W03, EK_W01,EK_W02, K_U04, EK_U04
EKP2	Knows the properties of materials used to build ships. Knows the welding works carried out on the ship and anti-corrosion protection	EK_W01, EK_W02
EKP3	Knows the rules of supervision over the general and local strength of the hull. Understands the loads acting on the ship structure. Understands the methods of calculating the shear forces and hull bending moments	EK_W03, EK_W01, EK_W02 EK_U05
EKP4	Knows typical solutions of knots and structural elements of a ship, tanks and watertight doors, as well as thrusters and rudders	EK_W03, EK_W01, EK_W02
EKP5	Knows the rules of the vessel's buoyancy. Knows the influence of outboard water density on the operational parameters of the ship	EK_W05, EK_W02
EKP6	Can define the initial stability of the ship. Can assess the stability of the ship. Knows the assessment and determination of the heeling moment. Knows the assessment and determination of the righting moment	EK_W05, EK_W02, EK_W03,
EKP7	Understands the states of equilibrium of the ship in service. Knows the influence of heavy duty operations on the ship's equilibrium position. Knows the geometrical parameters of the underwater part of the ship's hull	EK_W05 EK_W02, EK_W03,
EKP8	Understands issues related to longitudinal stability of the ship. Understands the principles of determining the ship's draft and trim resulting from the ship's equilibrium state. Understands the impact of heavy duty operations in the operation of the ship on the operational parameters of the ship - drafts, trim	EK_W05, EK_W05, EK_W02,
EKP9	Knows the rules of assessing the ship's stability. Knows the criteria for assessing the ship's stability	EK_W05, EK_W02, EK_W03
EKP10	Understands the influence of the external dynamic heeling moment on ship's stability	EK_W02, EK_W03
EKP11	Knows the ship's stability documentation. Is able to use the construction and operational documentation in ship's operation	EK_W02, EK_W03
EKP12	Knows the threats and safety assessment of the ship in emergency situations - partial loss of buoyancy, the ship aground	EK_W02, EK_W03
EKP13	Knows the threats and the ship's balance during docking	EK_W03
EKP14	Understands threats to the ship's stability resulting from partially filled liquid tanks	EK_W02, EK_W03

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		3rd	
A	EKP1,3	**Ship characteristics**: dimensions and sections, theoretical lines, fullness factors, freeboard and freeboard mark, loading scale, buoyancy curve	24

	EKP1,3,4	**Ship types, spatial planning**: bulk carriers, general cargo carriers, ferries, tankers, product carriers, gas carriers	
	EKP1,2,3,4	**Ship building**: types of bindings and hull structure elements, tanks on the ship and their typical equipment, rules for tank probing, watertight doors, typical hull damage, emergency schedules, emergency equipment, materials used in ship construction	
	EKP1,2,3	**Ship hull construction materials**: component connections, corrosion protection	
	EKP1,3,4	**Hull structure loads**: local and general hull strength, curves of weight, displacement and loads, hull bending, diagrams of shear forces and bending moments, hull torsion	
	EKP5,6.7	**Buoyancy, stability and unsinkability of the ship**: initial stability, heeling moment, righting moment	
	EKP6.7	**Center of gravity and center of buoyancy of the ship**: loading and unloading of a load, transferring the weight, raising the center of gravity above the keel, positioning the center of buoyancy in relation to the center of gravity, conditions for maintaining the balance of the ship	
	EKP7,8	**Longitudinal stability**: basic information on longitudinal stability, transverse metacentre, large metacentric radius, longitudinal metacentric height, metacentre plots, trim, draft change due to trim change	
Total in the semester:			24

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	24	2
Self study	16	
Participation in final tests and exams apart from classes	2	
Total	42	

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		4th	
A	EKP9,10,14	**Dynamic stability**: dynamic angle of heel, stability criteria, influence of free surfaces of liquids on the ship's behavior	23
	EKP9	**Ship ballasting**: purpose and effects	
	EKP12,13	**Stability of a supported vessel**: at component dock, aground	
	EKP11	**Practical requirements, use of documentation**: stability, buoyancy, construction	
	EKP13	**Ship docking procedures and rules**	

	EKP12	**Knowledge of the main actions to be taken in the event of a partial loss of buoyancy**: analysis of threats related to emergency situations resulting from partial loss of buoyancy, knowledge of procedures and actions limiting the effects of events resulting in partial loss of full buoyancy, analysis of the possibility of using emergency devices and systems as well as main and auxiliary devices and systems in emergency mode, preventive role of safe ship operation to reduce the occurrence of events resulting in partial loss of full buoyancy	
E	EKP12	Scaling tanks, measuring cargo amount	8
	EKP11	Use of ship's construction and stability documentation.	
Total in the semester:			31

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	**Estimated number of hours to complete the activity**	**ECTS points**
Total hours	31	2
Self study	16	
Participation in final tests and exams apart from classes	2	
Total	49	

Assessment methods and criteria:

Grades	**2**	**3**	**3.5–4**	**4.5 – 5**
Grading method	Written or oral test apart from auditorium classes. Assessment possible using distance learning methods and techniques			
EKP1	Does not know the spatial layout, geometric and operational parameters of different types of ships; does not know the documentation related to the geometrical characteristics of the ship's hull	Hardly knows the geometrical and operational parameters of ships. Can only name the basic individual features of the spatial layout of ships of various purposes and has difficulties with their justification	Demonstrates sufficient knowledge and knows the geometrical and operational parameters of ships. Can list the individual features of the spatial layout of ships for various purposes and partially justify them	Is fluent in the operational and geometrical parameters of ships. Can comprehensively list the individual features of the spatial layout of ships of various purposes and justify them
EKP2	Cannot name the materials used in ship building, nor their properties. Cannot describe welding work carried out on ships. Cannot explain corrosion or corrosion preventive measures	Lists, with difficulties, the basic materials used tin ship building and lists only some of their properties. Describes, with difficulties, the welding work carried out on ships. Doesn't know the welding methods. Explains corrosion in general. Lists, with difficulties, the factors influencing corrosion and the methods of prevention	Lists the basic materials used to build ships and gives their properties. Has difficulty determining their application. Describes welding work carried out on ships. Knows welding methods Lists their properties and limitations. Correctly explains the phenomenon of corrosion. Provides corrosion examples. Lists the factors influencing corrosion and the methods of prevention to full extent	Student is fluent in listing the basic materials used in shipbuilding and listing their properties and typical applications. Describes, fluently, the welding work carried out on ships. Knows welding methods Lists their properties and limitations. Correctly explains the phenomenon of corrosion. Provides corrosion examples. Lists the factors influencing corrosion and the methods of prevention to full extent

EKP3	Does not understand the loads acting on the ship's structure and cannot discuss the shear forces and bending moments acting on the ship	Partially understands the physical laws relating to the load and strength of the structure. Can barely explain the mechanism of the formation of shear forces as well as bending and torsional moments of the ship's hull. Student partially shows the cause and effect relationships between the ship loading condition and bending moments. Can explain the difference between general and local endurance	Understands the physics laws related to the load and strength of the structure. Can explain the mechanism of the formation of shear forces as well as bending and torsional moments of the ship's hull. Can indicate the cause-and-effect relationships between the ship loading level and bending moments. Can explain the difference between general and local endurance	Deeply understands the physical laws related to the load and strength of the structure. Logically and to the point explains the mechanism of the formation of shear forces as well as bending and torsion moments of the ship's hull. Can indicate the cause-and-effect relationships between the ship loading level, bending and torsional moments. Can explain the difference between general and local endurance
EKP4	Has no knowledge of typical designs of knots and structural elements of a ship, tanks and watertight doors, as well as thrusters and rudders.	Demonstrates sufficient knowledge and is able to define typical solutions of knots and structural elements of a ship, tanks and watertight closures, as well as propellers and rudders	Demonstrates sufficient knowledge and is able to define typical solutions of knots and structural elements of a ship, tanks and watertight closures, as well as propellers and rudders	Shows extensive knowledge and is able to correctly define typical solutions of knots and structural elements of a ship, tanks and watertight closures, as well as propellers and rudders
EKP5	Does not know the rules of the vessel's buoyancy, does not know the influence of outboard water density on the operational parameters of the vessel	Has poor knowledge of the rules of the ship's buoyancy. Has difficulties explaining the influence of outboard water density on the operational parameters of the ship	Has sufficient knowledge of the vessel's buoyancy. Has a good understanding of the influence of outboard water density on the operational parameters of a ship	Is fluent in explaining and describing in depth the principle of the vessel's buoyancy. Is fluent in explaining the influence of sea water density on the operational parameters of a ship
EKP6	Is not able to define the initial stability of the ship, is not able to assess the stability of the ship. Cannot assess and define the heeling moment. Cannot define and evaluate the righting moment	Barely defines the concept of the initial stability of the ship. Can poorly define the ship's heeling moment and righting moment. Explains the generalities of ship stability and the parameters describing the ship's stability	Has good knowledge of the concept of ship stability, can explain, describe and evaluate the stability of the ship. Has a good understanding and correctly assesses of the heeling moment and righting moment	Is fluent in explaining the concept of ship stability and the principles of assessing the ship's stability. Fluently explains the concept of the ship's heeling moment and righting moment
EKP7	Does not know and does not understand the ship's equilibrium states in service. Does not know the relationship between the ship's center of gravity and the state of equilibrium. Is unable to define and name the geometrical parameters describing the underwater part of the ship's hull	Barely recognizes and describes the ship's equilibrium states. Explains the relationship between the location of the center of gravity of the ship and the state of equilibrium poorly. Can list and define only some geometrical parameters describing the underwater part of the ship's hull	Knows well the ship's equilibrium states, sufficiently explains the relationship between the ship's center of gravity and its equilibrium state. Knows the geometrical parameters describing the underwater part of the ship's hull. Can define the geometrical parameters of the ship's hull	Is fluent in explaining and assessing the ship's equilibrium states. Thoroughly describes and explains the influence of the ship's center of gravity on its equilibrium. Knows and defines the geometrical parameters describing the underwater part of the ship's hull in depth
EKP8	Does not understand the issues related to the longitudinal stability of the ship, does not know the rules for determining the ship's draft and trim, does not understand the impact of heavy ship's operations on the change in draft and trim of the ship	Understands issues related to longitudinal stability of the ship poorly. Knows generalities of how heavy load operations affect the draft and trim of the ship. Can hardly explain how to determine the trim and draft of a ship based on its loading condition	Understands issues related to longitudinal stability of the ship very well. Can explain how to determine the draft and trim of a ship from its loading condition. Understands and is able to explain how heavy load operations on the ship affect the draft and trim of the ship	Fluently explains and describes issues related to the ship's longitudinal stability. Knows very well how the heavy load operations on the ship will affect the draft and trim of the ship. Fluently explains how to determine the draft and trim of a ship based on its loading condition

EKP9	Does not know the rules of assessing the ship's stability. Does not know how to judge a ship's stability. Does not know the criteria for assessing the ship's stability	Poorly knows the rules and tools for assessing the ship's stability. Poorly knows the methods used to assess the ship's stability. Can list the generalities of standards used to assess the ship's stability	Knows the methods and tools for assessing the ship's stability. Can name parameters describing the stability of the ship. Knows the criteria for assessing the ship's stability Knows what methods to use to assess the stability of a ship in operation	Fluently knows the methods and tools for assessing the ship's stability. Recognizes and explains all the quantities describing the ship's stability. Can thoroughly investigate, assess and describe the state of the ship's stability
EKP10	Cannot define an external dynamic heeling moment. Does not know how to determine the dynamic angle of heel of a ship	Can hardly define an external heeling moment. Explains the dynamic nature of the external heeling moment with difficulties. Knows generalities of how to determine the angle of heel of the ship due to the external heeling moment	Well defines and describes the dynamic nature of the external heeling moment. Can determine the angle of heel of a ship caused by the external heeling moment of dynamic nature. Knows how the size of the dynamic angle of heel influences the stability of a ship in service	Fluently defines and describes the dynamic nature of the external heeling moment. Can determine the angle of heel of a ship caused by the external dynamic heeling moment. Thoroughly knows how the size of the dynamic heel angle influences the stability of a ship in service
EKP11	Cannot list what is included in the ship's stability documentation. Does not know the content of these documents. Does not know how to use the ship's stability documentation in operation	Knows in general which documents are part of the stability documentation. Knows the general content of these documents. Generally knows what these documents are for. Can hardly define the quantities contained in these documents	Knows the documents included in the stability documentation well. Knows the content of these documents. Knows what these documents are for. Can define the quantities contained in these documents	Thoroughly knows which documents are part of the stability documentation. Fluently knows the content of these documents. Is able to use these documents comprehensively. Can fluently define the quantities contained in these documents
EKP12	Foes not know the safety hazards of the ship related to partial loss of buoyancy and the ship aground. Is unable to define or assess the impact of these threats on the safety of the ship	Poorly knows the safety threats to the ship related to the partial loss of buoyancy and the ship aground. Poorly defines and assesses the impact of these threats on the safety of the ship	Has a good understanding and explains the safety threats to the ship related to the partial loss of buoyancy and the vessel aground. Thoroughly defines and assesses the impact of these threats on the safety of the ship	Fluently knows the safety threats to the ship related to the partial loss of buoyancy and the ship aground. Thoroughly defines and assesses the impact of these threats on the safety of the ship Knows what actions should be taken to minimize the threats to the ship safety during partial loss of buoyancy or aground
EKP13	Does not know the threats to ship safety during docking. Is unable to describe and explain the ship's equilibrium states during docking	Poorly knows the threats to the safety of the ship during docking. Can briefly describe and explain the ship's equilibrium states during docking	Knows the threats to ship safety during docking very well. Can describe and explain the ship's equilibrium states during docking	Thoroughly knows the threats to ship safety during docking. Knows what their influence is on the ship's stability. Can comprehensively describe and explain the ship's equilibrium states during docking
EKP14	Does not know the relationship between a partially filled liquid tank and the ship's stability. Does not know what a free liquid surface correction is. Does not know what the value above depends on and what its impact on the ship's stability is	Poorly knows the relationship between a partially filled liquid tank and the ship's stability. Does not know what a free liquid surface correction is. Can briefly explain what determines the value above and what is its impact on the ship's stability	Knows the relationship between a partially filled liquid tank and the ship's stability. Know what a free liquid surface correction is. Can explain what determines the value above and what is its impact on the ship's stability	Thoroughly knows the relationship between a partially filled liquid tank and the ship's stability. Comprehensively explains what is a free liquid surface correction. Can thoroughly explain what determines the value above and what is its impact on the ship's stability

Teaching tools:

Type	Description
Projector	Auditorium classes in the form of multimedia presentations and films
Overhead projectors	Auditorium classes in the form of presentation of folios
OMM	Ship's Hull Technical Documentation
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. Szozda Z.: *Stateczność statku morskiego*. Akademia Morska w Szczecinie, Szczecin 2004. 2. Dudziak J.: *Teoria okrętu*. Wydawnictwo Morskie, Gdańsk 2008. 3. Więckiewicz W.: *Budowa kadłubów statków morskich*. Wydawnictwo Akademii Morskiej, Gdynia 2008. 4. Więckiewicz W.: *Podstawy pływalności i stateczności statku handlowego*. Wydawnictwo Akademii Morskiej, Gdynia 2006. 5. Więckiewicz W.: *Zarys budowy statków morskich*. Wyższa Szkoła Morska w Gdyni, 2001. 6. Bogucki D., Czarnecki S.: *Geometria kształtu kadłuba*. Biblioteka Okrętownictwa, Wydawnictwo Morskie, Gdańsk 1983. 7. Kabaciński J.: *Stateczność i niezatapialność statku*. Dział Wydawnictw WSM, Szczecin 1999.
Complementary literature
1. *Przepisy budowy i klasyfikacji statków morskich, cz. 2: Kadłub*. Polski Rejestr Statków, 2007. 2. Clarc I.C.: *Stability, trim and strenth for Merchant chips and fishing vessels*. The Nautical Institute, London 2008. 3. Brian A.: *Ship hydrostatic and stability*. Butterworth-Heinemann, Amsterdam 2007. 4. Derrett D.R.: *Ship stability for masters and mates*. Maritime Press, London 2006. 5. International Convention for the Safety of Life at Sea, SOLAS 1974, Amendments 2005, 2006, 2007, PRS Edition 2009. 6. International Convention on Load Lines, 1966 as amended under Protocol 1988 - Consolidated Text, PRS Edition, 2006.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Dorota Łozowicka, PhD Eng.	d.lozowicka@am.szczecin.pl	WN
Other teachers:		
Tomasz Cepowski, PhD Eng.	t.cepowski@am.szczecin.pl	WN

General information about the course:

<table>
<tr><td>No.:</td><td>36</td><td>Course:</td><td colspan="5">Ecological aspects of ship operation*</td></tr>
<tr><td colspan="2">Major:</td><td>Mechanics and Machine Building</td><td colspan="2">Specialisation:</td><td colspan="3">Marine Power Plant Operation</td></tr>
<tr><td colspan="2">Studies cycle:</td><td>First</td><td>Form of studies:</td><td>full-time</td><td>Year of studies:</td><td>3rd</td><td>Semesters: 5th</td></tr>
<tr><td colspan="2">Course status:</td><td>mandatory</td><td>Course group:</td><td colspan="4">vocational</td></tr>
</table>

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	T	L	E	S	P	SE	IP	PR	A	T	L	E	S	P	SE	IP	PR	
5th	12	1.75		0.3							21		4							2
Total during studies											21		4							2

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	

Course objectives:

1.	Developing environmental awareness and responsibility for the state of the marine environment in the student as a future member of sea-going ships crews
2.	Teaching the specificity of pollution from ships, management of substances harmful to the environment and operational procedures preventing pollution
3.	Teaching the construction and principles of operation of ship devices related to the marine environment protection
4.	Teaching the principles of keeping documentation related to environmental protection appropriate for the Machinery Department of a sea-going vessel

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Can assess the threat to the marine environment caused by the operation of floating objects, including ships, and knows the rules of conduct in accordance with global and local regulations	EK_W03, EK_U04, EK_U02, EK_K01
EKP2	Knows the procedures and rules of operation of devices related to the storage, transport, removal or disposal of substances harmful to the marine environment	EK_W02, EK_U04
EKP3	Knows the requirements and rules of keeping marine environment protection documentation in the Machine Department	EK_U05, EK_U07

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		5th	
A	EKP1	Characteristics of the ship as a hazard to the marine environment. Types of pollutants and their amounts	21
	EKP1,2,3	Legal protection of sea waters against ship pollution. Ship documentation concerning the marine environment protection	
	EKP2	Prevention of Sea Pollution by Oil (MARPOL Annex I)	
	EKP1,2	Prevention of contamination with harmful substances transported in bulk and in packaging (Annex II and III of the MARPOL Convention)	
	EKP1,2	Protection of marine waters against pollution by invasive species inhabited in ballast waters (BWM Convention)	
	EKP1,2	Prevention of Sea Pollution by Sewage (MARPOL Annex I)	
	EKP1,2	Prevention of Sea Pollution by Waste (MARPOL Annex V)	
	EKP1,2	Prevention of atmosphere pollution with toxic components of exhaust gases from ship engines, boilers and incinerators, methods of reducing toxic exhaust components emission	
	EKP1,2	The influence of the ship's energy efficiency on harmful substances emission. Energy efficiency indicators	
L	EKP1,2	Marine environmental protection devices: oil separator, sewage treatment plant - preparation, commissioning and service, integrated measuring devices	4
	Total:		5
Total in the semester:			25

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	25	2
Self study	20	
Participation in final tests and exams apart from classes	2	
Total	45	

Assessment methods and criteria:

Grades	2	3	3.5–4	4.5 – 5
Grading method	Written or oral and practical credit during laboratory classes. Assessment possible using distance learning methods and techniques			
EKP1	Student is not able to correctly determine the impact of ship operation on the marine environment, lacks knowledge of the rules of conduct in accordance with environmental protection regulations	Student is able to determine the threat the ship's operation poses on the natural environment, knows the rules of conduct in accordance with the environmental protection regulations	Is able to correctly indicate the factors posing threat to marine environment in the various operational states of the ship, can choose the appropriate method of dealing with the environment endangering factors appropriate for the operational state	Is able to correctly identify the factors threatening the marine environment in particular operational states of the ship and predict their influence on the change of the rules of the ship's operation. Can choose procedure appropriate for the operational state and indicate alternative methods
EKP2	Does not know the procedures and rules of operation of devices related to the storage, transport, removal or disposal of substances harmful to the marine environment	Knows the procedures and rules of operation of devices related to the storage, transport, removal or disposal of substances harmful to the marine environment	Can justify the application of the procedure related to the storage, transport, removal or disposal of substances harmful to the marine environment and knows the principles of operation of marine environmental protection devices	Student can indicate the most appropriate procedure related to the storage, transport, removal or disposal of substances harmful to the marine environment, taking into account the specificity of selected sea areas. Knows the rules of operation of marine environmental protection devices and is able to indicate their limitations
EKP3	Does not know the requirements and rules of keeping marine environment protection documentation in the Machine Department	Can list the requirements and rules of keeping marine environment protection documentation in the Machine Department	Can correctly describe the requirements and provide examples of records in the documentation for each of the operations included in the marine environment protection documentation of the Machinery Department	Can correctly describe the requirements and provide examples of records in the documentation for each of the operations included in the marine environment protection documentation of the Machinery Department and indicate guidelines for action in the event of operation interruption, damage to the device or other emergency situation

Teaching tools:

Type	Description
Projector	Auditorium classes in the form of a multimedia presentation
OMM	Technical and operational documentation of selected devices
Legal acts	International conventions and local legal acts regulating the protection of the marine environment
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. Lipiński A.: *Prawne podstawy ochrony środowiska*. Wolters Kluwer Polska Sp. z o.o., Warszawa 2007. 2. Kenig-Witkowska M.M.: *Prawo środowiska Unii Europejskiej. Zagadnienia systemowe*. PiE, Warszawa 2007. 3. Wierzbowski B., Rakoczy B.: *Podstawy prawa ochrony środowiska*. PiE, Warszawa 2007.

4. Wiewióra A.: *Ochrona środowiska morskiego w eksploatacji statków*. Lecture notes for full-time and extramural studies and SDKO courses at WSM, Szczecin 2003.
Complementary literature
1. Act of the Republic of Poland of April 27, 2001, Environmental Protection Law (Journal of Laws of 2001, No. 62, item 627). 2. Act of the Republic of Poland of March 16, 1995 on the Prevention of Sea Pollution by Ships (Journal of Laws of 1995, No. 47, item 243, as amended). 3. Convention on the Protection of the Marine Environment of the Baltic Sea Area, 1992 (Journal of Laws of 2000, No. 28, item 346, as amended). 4. London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (Journal of Laws of 1994, No. 73, item 46, as amended Journal of Laws of 1997, No. 78 item 300). 5. Regulation of the Minister of Infrastructure on the provision of information on wastes on board (Journal of Laws of 2003, No. 101, item 936). 6. Regulation of the Minister of Transport and Construction on the method, scope and dates of carrying out surveys and inspections, the method of confirming and specimens of international certificates for the protection of the sea against pollution by ships (Journal of Laws of 2006, No. 49, item 357). 7. Regulation of the Minister of Infrastructure on the operation of port inspection. (Journal of Laws of 2004, No. 102, item 1078).

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Piotr Treichel, PhD Eng.	p.treichel@am.szczecin.pl	WM
Other teachers:		
Tadeusz Borkowski, PhD Eng.	t.borkowski@am.szczecin.pl	WM

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	**37**	Course:	**Operation of marine power plant equipment - simulator***				
Major:		**Mechanics and Machine Building**	Specialisation:		**Marine Power Plant Operation**		
Studies cycle:		**First**	Form of studies:	**full-time**	Year of studies:	**4th**	Semesters: **8th**
Course status:		**mandatory**	Course group:	**vocational**			

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	E	L	EL	S	P	SE	TW	PR	A	E	L	EL	S	P	SE	TW	PR	
8th	15	1				2					15				30					2
Total during studies											15				30					2

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	

Course objectives:

1.	Discussing the basic technical diagnostics, presentation of models and methods of diagnosing ship devices
2.	Overview of the rules of conduct during the preparation and commissioning of the gym equipment, explanation of the principles of parameter control during the preparation and operation of the device or system
3.	Discussion of selected issues in the field of ship power plant operation, activities related to the takeover and watchkeeping

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Student can identify technical condition of marine power plant devices, has detailed knowledge of the principles of their operation	EK_W03, EK_W01, EK_U04, EK_U02, EK_K01
EKP2	Student is able to supervise the work of the marine power plant devices during the watch, knows the activities related to taking over and keeping the watch	EK_W04, EK_U10, EK_U04, EK_K02
EKP3	Is able to make a critical analysis of the functioning of mechanisms in the event of failure of functional systems of main and auxiliary propulsion engines and selected auxiliary devices	EK_U02, EK_U05

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		8th	
A	EKP1	Basic concepts of technical diagnostics	15
	EKP1	Diagnostic models	
	EKP1	Diagnostics of the marine internal combustion engine (evaluation of mechanical and thermal load, diagnostics of the supercharging system, diagnostics of the fuel injection process and evaluation of the combustion process, diagnostics of bearings, measurements of bearing temperature and journal trajectory)	
	EKP1	Diagnostics of boilers and steam turbines	
	EKP1	Diagnostics of pumps and hydraulic devices	
	EKP1	Review of the diagnostic systems used	
S	EKP1,2	Operation of the simulated power plant devices, control of parameters during the preparation and operation of the device or system	30
	EKP2	Measurement and control equipment, alarm system, controlling the operation of mechanisms and systems, organization and operation of the alarm system	
	EKP2	Watch-taking and watchkeeping activities	
	EKP1,2	Detection of failure of the main engine, auxiliary engines, boilers and other equipment of the power plant - identification and location of failure	
	EKP2,3	Operation of propulsion systems in marine power plants, procedures to be followed in cases of reduced serviceability or failure	
	EKP2,3	Selected issues of the operation of ship power plants	
	EKP2,3	Acquainting with the specificity of managing a ship's power plant, organizing the work of the machine crew during the preparation of the power plant for operation. Commanding the machine crew - examples resulting from professional practice	
	EKP2	Organization of the work of the machine crew during maneuvers and in sea traffic: procedures for starting the power plant from a cold state, maneuvering and sea traffic; procedures for starting and shutting down the power plant equipment; crisis management, operation of the crew in crisis and stress situations (including the establishment of the necessary procedures).	
Total in the semester:			45

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	45	2
Self study	15	
Participation in final tests and exams apart from classes	2	
Total	62	

Assessment methods and criteria:

Grades	2	3	3.5–4	4.5 – 5
Grading method	Written or oral and practical credit during laboratory classes. Assessment possible using distance learning methods and techniques			
EKP1	Student is not able to correctly identify the technical condition of the marine power plant equipment and does not have detailed knowledge of the principles of their operation	Student is able to identify the technical condition of the marine power plant devices and has knowledge of the principles of their operation	Can correctly indicate the factors influencing the change in the technical condition of the marine power plant equipment, he can choose the appropriate procedure for operating the device	Is able to correctly indicate the factors influencing the change of the technical condition of the marine power plant equipment. Can choose the appropriate procedure for operating the device and indicate alternative methods of proceeding in the event of an unexpected change in the technical condition
EKP2	Student is not able to supervise the work of the marine power plant devices during the watch, knows the activities related to taking over and keeping the watch	Student is able to supervise the work of the marine power plant devices during the watch, knows the activities related to taking over and keeping the watch	Is able to indicate the differences in the course of keeping the watch for automated and non-automated power plants, can justify the purposefulness of measuring particular parameters of the work of the power plant	Is able to prepare the gym to start up from any operational state, knows the duties of each member of the machine crew, can justify the choice of the place of control of the most important devices of the power plant
EKP3	Is not able to perform a critical analysis of mechanisms functioning in the event of failure of functional main and auxiliary propulsion engine systems and selected auxiliary devices	Is able to identify irregularities in the functioning of mechanisms during the failure of functional systems of main and auxiliary propulsion engines and selected auxiliary devices	Is able to correctly indicate irregularities in the functioning of mechanisms resulting from the failure of functional systems of main and auxiliary propulsion engines and selected auxiliary devices, and can indicate or apply appropriate corrective measures	Is able to correctly indicate irregularities in the functioning of mechanisms resulting from the failure of functional systems of the main and auxiliary propulsion engines and selected auxiliary devices. Can indicate or apply appropriate remedial measures. Can indicate the differences in the operation of devices with the deterioration of the technical condition of their functional systems

Teaching tools:

Type	Description
Projector	Auditorium classes in the form of a multimedia presentation
OMM	Technical and operational documentation of selected devices
Ship power plant operating simulator	A simulator that enables, in individual and group operation conditions, the operation of marine power plant devices, diagnostics of devices and simulation of malfunctions
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. Engine Room Simulator – ERS-L11 MAN B&W-5L90MC–VLCC Version MC90-IV Machinery and Operation – Part 1–3. 2. Engine Room Simulator – ERS-L11 MAN B&W-5L90MC–VLCC Version MC90-IV. Actuators & Controllers. 3. Engine Room Simulator – ERS-L11 MAN B&W-5L90MC–VLCC Version MC90-IV. Variable list. 4. Engine Room Simulator – ERS-L11 MAN B&W-5L90MC–VLCC Version MC90-IV. Alarm list.

5. Engine Room Simulator – ERS-L11 MAN B&W-5L90MC–VLCC Version MC90-IV. Malfunction list. 6. Engine Room Simulator – ERS-L11 MAN B&W-5L90MC–VLCC Version MC90-IV. Trip codes.
Complementary literature
1. Supplementary literature consists of literature lists for all technical subjects taught at the OoMER Specialisation.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Piotr Treichel, PhD Eng.	p.treichel@am.szczecin.pl	WM
Other teachers:		
		WM

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	38	Course:	**Management of safe ship operation** *					
Major:		**Mechanics and Machine Building**	Specialisation:		**Marine Power Plant Operation**			
Studies cycle:		**First**	Form of studies:	**full-time**	Year of studies:	**2nd**	Semesters:	**4th**
Course status:		**mandatory**	Course group:	**vocational**				

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	T	L	E	S	P	SE	IP	PR	A	T	L	E	S	P	SE	IP	PR	
4th	15	1.6	1.4								24	21								3
Total during studies											24	21								3

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	

Course objectives:

1.	Knowledge of the requirements of SOLAS, STCW and ISM and ISPS codes and their application in everyday work on board a ship
2.	Rules of conduct in emergency situations
3.	Ability to carry out risk analysis related to selected activities performed on the ship

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Student can characterize the requirements of the SOLAS, STCW Conventions and ISM and ISPS Codes, and can characterize their application in everyday work on the ship	EK_W02, EK_W04, EK_U04, EK_K01, EK_K02
EKP2	Can characterize the rules of conduct in emergency situations	EK_W04, EK_U07, EK_U04, EK_K01, EK_K02
EKP3	Is able to carry out risk analysis related to selected activities performed on the ship	EK_W04, EK_01, EK_U04, EK_K01, EK_K02
EKP4	Student knows the issues of: *Trainings in the field of ship security* (course 1.5) i *Training for crew members assigned with security duties*, can use them within the scope of the assigned position on the ship (course 2.8)	EK_W02, EK_W04, EK_U04, EK_K01, EK_K02

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		4th	
A	EKP1	Conventions and legal regulations concerning safety at work and life protection at sea	24
	EKP1	Qualification requirements and competences of ship's crew members in the light of the STCW convention	
	EKP1	Watch procedures and rules of taking over and releasing duties	
	EKP1,2	Principles of keeping the power plant watch and watch-less power plant supervision. Influence of swimming conditions on human abilities and activity	
	EKP1,2	Duties and responsibilities of crew members for safe ship operation and protection of the marine environment	
	EKP1,2	Crew members' responsibilities during alarms and emergency situations	
	EKP1,2	Ship installations and equipment for the protection of the marine environment	
	EKP1,2	Ship safety management system (ISM code)	
	EKP1,2	Rules of instructions and trainings on board	
	EKP1,3	Risk analysis for operational activities	
	EKP1,3	Ship documents	
	EKP1,3	Rules for the use of ship mechanisms emergency switches	
	EKP1,2	Procedures for starting and shutting down emergency systems of the main propulsion and auxiliary systems and emergency devices	
	EKP1,2,4	Ship and Port Facility Security Code, requirements of the Ship and Port Facility Security Code - ISPS code for the protection of shipping and seaports. Principles of creating the Ship Security Plan. Application of the provisions of the ship security plan	
	EKP1,4	Sailing hazards, ship security risks and threats	
	EKP1,4	Ship security methodology, methods of checking the effectiveness of the ship security system, protective equipment and principles of its safe use	
E	EKP1,2	Watch procedures and rules for taking over and releasing duties in normal operation and in emergency situations	21
	EKP1,2	Duties and responsibilities of crew members for safe ship operation and protection of the marine environment	
	EKP1,2	Crew members' responsibilities during alarms and emergency situations	
	EKP1,2	Ship safety management system (ISM Code)	
	EKP1,2	Risk analysis when undertaking operational activities, principles of planning the reserves of the necessary fuel, lubricating oils, water and other operating factors of the power plant and the ship, entries in the operating documentation of the ship: reports, fuel and lubricating oil settlements	
	EKP1,2	Procedures for starting and shutting down emergency systems of the main propulsion and auxiliary systems and emergency devices	
	EKP1,2,4	ISPS Code, the requirements of the Ship and Port Facility Security Code - the ISPS code for the protection of shipping and seaports. Principles of creating the Ship Security Plan. Application of the provisions of the ship security plan	

	EKP1,4	Sailing hazards, ship security risks and threats	
	EKP1,4	Ship security methodology, methods of checking the effectiveness of the ship security system, protective equipment and principles of its safe use	
Total in the semester:			45

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	45	3
Self study	35	
Participation in final tests and exams apart from classes	4	
Total	84	

Assessment methods and criteria:

Grades	2	3	3.5–4	4.5 – 5
Grading method	Written or oral and practical tests during the exercises. Assessment possible using distance learning methods and techniques			
EKP1	Student is not able to characterize the requirements of the SOLAS Convention, ISM and ISPS codes and is not able to characterize their application in everyday work on the ship	Student can characterize the requirements of the SOLAS, STCW Conventions and ISM and ISPS Codes, and can characterize their application in everyday work on the ship	Is able to characterize the requirements of the SOLAS Convention, ISM and ISPS codes and is able to characterize their application in everyday work on board, is able to analytically interpret the records and indicate non-conformities	Is able to characterize the requirements of the SOLAS Convention, ISM and ISPS codes and is able to characterize their application in everyday work on the ship, is able to analytically interpret the records and indicate non-conformities, is able to develop changes
EKP2	Student is unable to characterize the rules of conduct in typical emergency situations	Can characterize the rules of conduct in emergency situations	Can characterize the rules of conduct in typical emergency situations and in various operational states of the ship	Can characterize the rules of conduct in typical emergency situations and in various operational states of a ship, is able to optimize contingency plans depending on the type of ship
EKP3	Student is unable to carry out a risk analysis related to selected activities performed on the ship based on the ship procedures	Is able to carry out a risk analysis related to selected activities performed on the ship based on the ship procedures	Is able to carry out a risk analysis related to selected activities performed on the ship based on the ship's procedures, is able to indicate methods and ways to reduce the risk	Is able to carry out a risk analysis related to selected activities performed on the ship based on the ship's procedures, is able to indicate methods and ways to reduce the risk and is able to indicate the improvement of procedures
EKP4	Student does not know the issues of: *Trainings in the field of ship security* (course 1.5) i *Training for crew members assigned with security duties*, can use them within the scope of the assigned position on the ship (course 2.8)	Student knows the basics of: *Trainings in the field of ship security* (course 1.5) i *Training for crew members assigned with security duties*, can use them within the scope of the assigned position on the ship (course 2.8)	Student knows the issues of: *Trainings in the field of ship security* (course 1.5) i *Training for crew members assigned with security duties*, can use them within the scope of the assigned position on the ship (course 2.8) Can independently identify risks and threats to ship security, methods of checking the effectiveness of ship security systems	Student knows the issues of: *Trainings in the field of ship security* (course 1.5) i *Training for crew members assigned with security duties*, can use them within the scope of the assigned position on the ship (course 2.8) Can independently identify risks and threats to ship security, methods of checking the effectiveness of ship security systems. Analyzes ship security plans, is able to indicate the possibilities of improving the ship and port security plan

Teaching tools:

Type	Description
Projector	Auditorium classes in the form of multimedia presentations and films
Printed auxiliary materials	Ship documents, checklists, ship procedures
Printed and electronic auxiliary materials	Ship plans for building and validating Ship Security Assessment
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. SOLAS Convention, ed. 2004. 2. STCW 95 Convention, ed. IMO. 3. PEiRE 95/21, 99/64, 1999/95 / EC, 2001/25 / EC, 2003/103 / EC Directives. 4. Polish Journal of Laws No. 105 item 117 - Regulation of the Minister of Infrastructure of August 24, 2000 on training and professional qualifications, watchkeeping and the composition of the crews of Polish sea-going ships. 5. International Code of Safety Management IMO, www.mi.gov.pl. 6. International Ship and Port Facility Security Code, ed. PRS 2003. 7. Course 1.5 training content. Training in ship security issues, 2.8. Training for crew members assigned with security duties.
Complementary literature
1. Websites: www.dnv.com www.gl-group.com www.eagle.org www.imo.org www.prs.gda.com

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Włodzimierz Kamiński, PhD Eng.	w.kaminski@am.szczecin.pl	WM
Other teachers:		
Grzegorz Kidacki, PhD Eng.	g.kidacki@am.szczecin.pl	WM

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	39	Course:	Organization of sea-going ships technical supervision*				
Major:		**Mechanics and Machine Building**	Specialisation:		**Marine Power Plant Operation**		
Studies cycle:		**First**	Form of studies:	**full-time**	Year of studies:	**4th**	Semesters:	**8th**
Course status:		**mandatory**	Course group:	**vocational**			

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	E	L	EL	S	P	SE	TW	PR	A	E	L	EL	S	P	SE	TW	PR	
8th	15	1	1								15	15								1
Total during studies											15	15								1

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	

Course objectives:

1.	Developing awareness and the ability to interpret technical requirements for the organization of technical supervision of a ship in the light of applicable legal requirements
2.	Development of skills related to keeping technical operation of the ship documentation
3.	Developing skills related to the preparation of the ship for classification surveys
4.	Developing the ability to organize the machine crew in standard and emergency situations

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Student can characterize the technical supervision requirements of ships in accordance with the provisions of Classification Societies and the requirements of the International Conventions	EK_W02, EK_W04, EK_U01, EK_U04, EK_K03,EK_K02
EKP2	Can characterize and demonstrate the ability to keep ship technical operation documentation	EK_W03, EK_W01, EK_U07, EK_U04, EK_K02,
EKP3	Can characterize resource management - machine crew members and gym equipment - Engine Resource Management	EK_W04, EK_U01, EK_U04, EK_K01, EK_K02,EK_K03,

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		8th	
A	EKP1	Technical issues of ship operation	15

	EKP1	International regulations concerning the supervision over the technical operation of the ship	
	EKP1	Organization of sea-going ships technical supervision	
	EKP1	Ship technical supervision carried out by Classification Societies	
	EKP2	Ship documentation related to the technical operation of the ship	
	EKP3	Managing human resources and power plant equipment in the operation of a ship power plant	
	EKP3	Organization of machine crew work	
	EKP2	Preparing the ship for shipyard repair	
E	EKP1	Ship documents related to the safety of navigation	15
	EKP1	Ship documents issued by classification institutions	
	EKP2	Keeping machine and maneuvering logs, ORB, etc.	
	EKP2	Keeping documentation of the work performed	
	EKP3	Organization of work in the machinery department, work permits, check-lists, risk analyzes	
	EKP2	Planning surveys of all ship engines and devices based on PMS records and the hull, thrusters and bottom valves, preparation of repair and service specifications	
	EKP2	Preparation of repair specifications for shipyards	
Total in the semester:			30

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	30	1
Self study	10	
Participation in final tests and exams apart from classes	2	
Total	42	

Assessment methods and criteria:

Grades	**2**	**3**	**3.5–4**	**4.5 – 5**
Methods of evaluation	Written or oral and practical tests during the exercises. Assessment possible using distance learning methods and techniques			
EKP1	Student cannot characterize the technical supervision requirements of ships in accordance with the provisions of Classification Societies and the requirements of the International Conventions	Student can characterize the technical supervision requirements of ships in accordance with the provisions of Classification Societies and the requirements of the International Conventions	Is able to characterize the requirements of the technical supervision of ships in accordance with the provisions of Classification Societies and the requirements of the International Conventions for various types of ships	Is able to characterize the technical supervision requirements of ships in accordance with the provisions of the Classification Societies and the requirements of the International Conventions for various types of ships and knows the differences in the requirements between different Classification Societies

EKP2	Is unable to characterize and demonstrate the ability to keep ship documentation related to the technical operation of the ship, does not know the principles of planning surveys and preparation of ship repair documentation	Can characterize and demonstrate the ability to keep ship documentation regarding the technical operation of a ship, knows the principles of planning surveys and preparation of ship repair documentation	Is able to characterize and demonstrate the ability to keep ship documentation regarding the technical operation of the ship and is able to analytically interpret the records, knows the principles of planning surveys and preparation of ship repair documentation, is able to prepare repair documentation for the indicated device	Student can characterize and demonstrate the ability to keep ship documentation regarding the technical operation of the ship and is able to analytically interpret the records and is able to indicate optimal solutions, knows the principles of planning surveys and preparation of ship repair documentation, is able to prepare repair documentation for the indicated device. Analyzes the correctness of the adopted solution
EKP3	Cannot characterize resource management - machine crew members and gym equipment - Engine Resource Management	Can characterize resource management - machine crew members and gym equipment - Engine Resource Management	Can characterize resource management - machine crew members and power plant equipment - Engine Resource Management for different types of ships	Can characterize resource management - machine crew members and power plant equipment - Engine Resource Management for different types of ships and can specify the requirements of specialist training

Teaching tools:

Type	Description
Projector	Auditorium classes in the form of multimedia presentations and films
Printed auxiliary materials	Ship documents, checklists, ship procedures, repair specifications
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. SOLAS Convention, ed. 2004. 2. STCW 95 Convention, ed. IMO. 3. PEiRE 95/21, 99/64, 1999/95 / EC, 2001/25 / EC, 2003/103 / EC Directives. 4. Polish Journal of Laws No. 105 item 117 - Regulation of the Minister of Infrastructure of 4 August 2000 on training and professional qualifications, keeping watch and the composition of crews. 5. International Code of Safety Management IMO, www.mi.gov.pl. 6. *International Ship and Port Facility Security Code*. Ed. PRS 2003. 7. *Przepisy klasyfikacji budowy statków morskich, Części I, II, VII, VII*. Wydawnictwo PRS, Gdańsk 8. *Alternatywne systemy nadzoru urządzeń maszynowych*. Publikacja PRS 81/P, Gdańsk 2009.
Complementary literature
Websites: www.dnv.com, www.gl-group.com, www.eagle.org, www.imo.org, www.prs.gda.com

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Grzegorz Kidacki, PhD Eng.	g.kidacki@am.szczecin.pl	WM
Other teachers:		
Włodzimierz Kamiński, PhD Eng.	w.kaminski@am.szczecin.pl	WM

General information about the course:

No.:	40	Course:	**Maritime law and insurance***				
Major:		**Mechanics and Machine Building**	Specialisation:		**Marine Power Plant Operation**		
Studies cycle:		**First**	Form of studies:	**full-time**	Year of studies:	**4th**	Semesters: **8th**
Course status:		**mandatory**	Course group:	**vocational**			

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	T	L	E	S	P	SE	IP	PR	A	T	L	E	S	P	SE	IP	PR	
8th	15	1									15									1
Total during studies											15									1

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	

Course objectives:

1.	Preparing the future graduate to learn, understand and apply the provisions of maritime law
2.	Getting to know the elementary scope of maritime law
3.	Getting to know international conventions, regulations and legal recommendations
4.	Getting to know the legal provisions related to: the legal situation in sea waters, certificates and documents of the ship and crew; international shipping safety requirements; environmental protection regulations; domestic and foreign labor law; maritime insurance

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Student can freely navigate in all legal forms related to the operation of a ship and knows the legal regulations in force	EK_W02, EK_U05
EKP2	Student knows the scope of responsibility for the performance of crew duties and the problems of marine insurance	EK_W02, EK_U05

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		8th	
A	EKP1	Basic concepts, scope of regulations and sources of maritime law.	15
	EKP1	The concept of a sea-going vessel: - nationality of the sea-going vessel; - ship register, maritime chambers; - owner, shipowner; - contracts for the use of the ship	
	EKP1	Maritime administration: competences, inspections, documents - vessel seaworthiness control; - liability for law infringement	
	EKP1	Ship clearance: sanitary, customs, passport	
	EKP1	Legal situation of the vessel in sea waters: - division of sea waters; - consequences of law infringement for the ship and crew responsibility	
	EKP2	Ship and crew certificates and documents required by international conventions	
	EKP2	International shipping safety requirements: - legal regulations concerning the loading level of the ship; - liability under the International Convention on Load Lines; - legal regulations concerning life at sea - SOLAS convention; - legal regulations regarding training, certification and service standards on board - the STCW convention; - liability resulting from international regulations for the safety of ships, crew, passengers and cargo; - international health requirements, marine health declaration	
	EKP1	International conventions and regulations concerning environmental protection - MARPOL convention	
	EKP2	Legal regulations concerning national international labor law	
	EKP2	Maritime insurance: - the subject of maritime insurance. Insurance risk: - exclusions, preparation of accident documentation	
Total in the semester:			15

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	15	1
Self study	10	
Participation in final tests and exams apart from classes	2	
Total	27	

Assessment methods and criteria:

Grades	2	3–3.5	4–4.5	5
Methods of evaluation	Assessment of activity in the classroom, written single-choice test. Assessment possible using distance learning methods and techniques			
EKP1	Student does not know the legal provisions related to ship operation. Cannot list legal recommendations regarding environmental protection. Cannot list the regulations in force in sea waters	Knows the legal rules related to ship operation. Lists legal recommendations for environmental protection. Lists the regulations in force in sea waters	Knows the rules and legal relationships related to ship operation. Knows the legal recommendations and the consequences of non-compliance with environmental protection regulations. Lists and explains the regulations in force in sea waters	Is fluent in all legal forms related to the operation of a ship. Can explain the legal recommendations and the consequences of non-compliance with environmental protection regulations. Lists and correctly interprets the regulations in force in sea waters
EKP2	Does not know the basic scope of responsibilities related to the performance of duties. Cannot list ship, cargo and crew documents. Cannot list the types of marine insurance	Knows the basic scope of responsibilities related to the performance of duties. Lists ship, cargo and crew documents. Lists the types of marine insurance	Knows the basic scope of responsibilities and interprets the regulations correctly. Lists and presents ship, cargo and crew documents. Lists and presents the types of marine insurance	Knows the basic scope of responsibilities along with commentary and interprets the regulations correctly. Lists and presents ship, cargo and crew documents. Lists and correctly interprets the types of marine insurance

Teaching tools:

Type	Description
Projector	Lectures are conducted partly with the help of a multimedia presentation
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. Łopuski J.: *Prawo morskie*, *t. I.* Oficyna Wydawnicza Branta, Bydgoszcz 1996. 2. Łopuski J.: *Prawo morskie, t. II/1*. Oficyna Wydawnicza Branta, Bydgoszcz 1998. 3. Łopuski J.: *Prawo morskie, t. II/2*. Oficyna Wydawnicza Branta, Bydgoszcz 2000.
Complementary literature
1. Młynarczyk J.: *Prawo morskie*. Wydawnictwo ARCHE, Warszawa 2002. 2. Łukaszuk L.: *Międzynarodowe prawo morza*. Wyd. Naukowe SCHOLAR, Warszawa 1997. 3. Brodecki Z.: *Prawo ubezpieczeń morskich*. Wyd. prawnicze LEX, Sopot 1999.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
		WN
Other teachers:		

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	41	Course:	**Diploma seminar**				
Major:		**Mechanics and Machine Building**	Specialisation:		**Marine Power Plant Operation**		
Studies cycle:		**First**	Form of studies:	**full-time**	Year of studies:	**4th**	Semesters: **8th**
Course status:		**mandatory**	Course group:	**vocational**			

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	E	L	EL	S	P	SE	TW	PR	A	E	L	EL	S	P	SE	TW	PR	
8th	15	1									15									1
Total during studies											15									1

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Knowledge provided in the plan and programs of the studied discipline at the 1st cycle level

Course objectives:

1.	Preparing the student to independently carry out the diploma process
2.	Preparing the student for creative solving of research problems - engineering tasks
3.	Developing the skills of substantive preparation of the completed task and editing the diploma thesis
4.	Developing the ability to convincingly report / present the results achieved during the diploma examination

Course outcome:

No.	**Description**	**EK codes for the field of study**
EKP1	Obtains information from literature, databases (also in English) and other sources, integrates them, interprets them, draws conclusions and formulates and justifies opinions	EK_U05
EKP2	The student can plan and carry out experiments, including computer measurements and simulations, interpret obtained results and draw conclusions.	EK_U01
EKP3	Can use analytical, simulation and experimental methods typical for a marine power plant to formulate and solve practical engineering tasks	EK_U01
EKP4	Possesses the skills of oral presentations in Polish and a foreign language, concerning detailed issues of the studied engineering field.	EK_U05 EK_U08

Programme content:

Form of clas-ses	EKP relation	Implemented content	Num-ber of hours
Semester:		8th	
A	EKP1	**Formal and legal regulations regarding the diploma process**. The supervisor and the topic of the thesis. Relationships graduate student - diploma manager - diploma seminar instructor. The first step in choosing a topic. Selection procedure and deadline for the diploma thesis topic. Motivation behind the topic. Function of the diploma seminar	15
	EKP1	**Formulating the diploma topic and thesis**. Topic background and its justification. Definition of the thesis. Purpose and content of the thesis. Thesis card - formal closure of the issue. Work plan and outline	
	EKP1,2	**Methodology and stages of thesis completion - the art of stress-free efficiency**. State of knowledge of the graduate student. Thesis review The date of diploma examination. Collection of data, problems. Analysis of their significance (validity) and making a decision as to further proceedings. Arranging the results (outcomes). Verification of these results as possible options for action (variants of thesis solutions). Work schedule. Execution, competion of work	
	EKP1,3	**Subject literature and notes**. Studying literature and collecting materials. Assessment and selection of the collected literature. Bibliographic notes for articles and bibliography of books. Quotes	
	EKP3,4	**Spontaneous thinking session** - the degree of topic recognition. Concept of work - proposals for task completion. Analysis of the topic as a problem. Research tools and methods. Presentation of work progress - students present the issues	
	EKP1,2,3	**Research methodology**. Machine as a research object. Evolution of machine technical condition. Observation and experiment. Experiment planning and forms. Computer-aided experiment. Choice of the research method	
	EKP2,3	**Methodology of diagnostic theses implementation**. Formulating the research problem. Thesis layout. Research, conclusions, diagnostic methods. Establishing working methods. Choosing form of an experiment. Research object. Description of the test stand and apparatus. Conditions for the experiment execution	
	EKP1,2,3	**Mathematical methods of measurement results interpretation**. Application of numerical methods for the development and presentation of results - the use of Mathematica and Statistica environments. Measurement reliability and graphic interpretation of results	
	EKP1,2,3	Editing the diploma thesis. Thesis layout and table of contents. The font, its size, figures and tables. Classification of subsequent parts of the thesis. References and footnotes. Bibliographic description of book, article, unpublished works, previously cited book	
	EKP1,2,3	**Copyrights, protection of intellectual property**. Citations, references. Anti-plagiarism protection	
	EKP2	**Conclusion - final conclusions. Critical analysis of the obtained results. Thesis completion level. Cognitive and utilitarian conclusions. The validity of thesis generalizations. References. Summaries**	

	EKP4	**The course of the diploma examination**. Preparation of materials for presentation. The structure of the self-presentation. Presentation techniques	
	EKP4	**Mock diploma exam**. Students report the main goal of the thesis, the background the topic, working hypotheses, research problem, method of implementation, degree of work completion, obtained results, final conclusions	
Total in the semester:			15

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	15	1
Self study	7	
Participation in final tests and exams apart from classes	2	
Total	24	

Assessment methods and criteria:

Grades	**2**	**3**	**3.5–4**	**4.5 – 5**
Methods of evaluation	Written and oral credit during work schedule discussion in the seminar classes. Assessment possible using distance learning methods and techniques			
EKP1	Student is not able to obtain information of the indicated scope and draw any conclusions as to its use	Is able to obtain information from literature, databases and other sources, integrates it, selects it and draws conclusions as well as formulates and justifies opinions	Is able to obtain information from literature, databases (also in English) and other sources, integrates them, selects them and draws conclusions as well as formulates and justifies opinions	Is able to independently obtain information from literature, databases (also in English) and other sources, integrates them creatively, selects and interprets them, draws conclusions and formulates and justifies opinions
Methods of evaluation	Practical credit through the completion of the diploma thesis. Assessment possible using distance learning methods and techniques			
EKP2	Cannot plan experiments and make simple measurements	Is able to take measurements, interpret the obtained results and draw conclusions	Is able to design and carry out experiments, including taking measurements, planning simulations, interpreting the obtained results and drawing conclusions	Is able to design and carry out experiments, including configuring measurement systems, planning computer simulations, interpreting the obtained results and drawing conclusions
Methods of evaluation	Practical credit during the seminar classes - thesis presentation. Assessment possible using distance learning methods and techniques			
EKP3	Student cannot solve the tasks in technical facilities of the marine power plant	Can solve practical engineering problems with the help of experimental methods typical for technical facilities of a marine power plant	Is able to formulate and solve practical engineering tasks with analytical and experimental methods, typical for technical facilities of a marine power plant	Is able to formulate and correctly solve practical engineering tasks with analytical, simulation and experimental methods, typical for technical facilities of a marine power plant
EKP4	Is unable to deliver a multimedia presentation on the diploma task	Can deliver a multimedia presentation in Polish on the diploma task, obtained results and final conclusions	Can deliver a multimedia presentation in Polish on working hypotheses, research problem, way of performing work, obtained results and final conclusions	Is able to deliver a multimedia presentation in Polish or English on the genesis of the topic, working hypotheses, research problem, way of performing the work, obtained results and final conclusions

Teaching tools:

Type	Description
Projector	Auditorium classes in the form of a lecture and multimedia presentation
Applicable Documents	Documentation of the diploma process
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. Adamkiewicz W.: *Seminarium dyplomowe: przewodnik dla dyplomantów i promotorów magisterskich prac dyplomowych wykonywanych w Wyższych Szkołach Morskich*. Wydawnictwo Uczelniane Wyższej Szkoły Morskiej, Gdynia 1985. 2. Kaczorek T.T.: *Poradnik dla studentów piszących pracę licencjacką lub magisterską*. www.kaczmarek.waw.pl. 3. Krajczyński E.: *Metodyka pisania prac dyplomowych*. Wyższa Szkoła Morska, Gdynia 1998. 4. Żółtowski B.: *Seminarium dyplomowe. Zasady pisania prac dyplomowych*. Wydawnictwo Uczelniane Akademii Techniczno-Rolniczej w Bydgoszczy, Bydgoszcz 1997.
Complementary literature
1. Regulations of Studies at the Maritime University of Szczecin, Szczecin 2007.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Cezary Behrendt, PhD Eng.	c.behrendt@am.szczecin.pl	WM
Other teachers:		

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

Courses carried out as part of the Marine Power Plant Operation Specialisation for the diploma fields:

Drive systems with reciprocating engines

General information about the course:

No.:	42.1	Course:	**Contemporary constructions of marine reciprocating engines**				
Major:		**Mechanics and Machine Building**	Specialisation:		**Marine Power Plant Operation**		
Studies cycle:		**First**	Form of studies:	**full-time**	Year of studies:	**4th**	Semesters: **8th**
Course status:		**elective**	Course group:	**field-specific course**			

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	T	L	E	S	P	SE	IP	PR	A	T	L	E	S	P	SE	IP	PR	
8th	15	1				1					15				15					1
Total during studies											15				15					1

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	When starting classes in the subject of "contemporary construction of marine reciprocating engines", the student should know the basics of the construction and operation of thermal machines, energy transmission and the basic nomenclature in English. In particular, the student will use the knowledge gained during participation in such courses as: - Fundamentals of machine construction, - Technical thermodynamics, - Marine reciprocating engines, - Ship machinery and equipment, - Marine power plants

Course objectives:

1.	After listening to the lectures and completing classes on the ship power plant simulator, the student should know: 1) The principle of operation of selected components of reciprocating engines. 2) Engine processes during normal operation. 3) Quantities characterizing the performance of engines and their conditions in operation. 4) The construction, materials and techniques of manufacturing structural elements of modern marine engines. 5) Construction, operation and performance characteristics of selected marine engine control installations and new solutions for the fuel, oil, cooling, control and start-up installations. 6) Phenomena accompanying engine operation: mechanical and thermal loads, vibrations and noises, exhaust gas toxicity. 7) Rules for the use of modern marine engines
2.	After listening to the lectures and completing classes on the ship power plant simulator, the student should know: 1) Use the information about the operating parameters of the engine for the current operation. 2) Operate the engines under steady and variable conditions. 3) Diagnose the technical condition of the engine and analyze possible changes to the control parameters. 4) Use the measured parameters and engine operation indicators for its correct operation. 5) Use recommended tools and measuring instruments during the period of operation.

	6) Ensure safe and reliable operation of the main and auxiliary engines

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Has detailed technical knowledge necessary for the proper maintenance and operation of ship equipment and installations, electrical and electronic equipment and automatic control systems as well as for managing the safe operation of the ship power plant	EK_W03
EKP2	Has detailed knowledge of managing safe ship operation, organization and resource management of a marine power plant	EK_W04
EKP3	Obtains information from literature, databases (also in English) and other sources, integrates them, interprets them, draws conclusions and formulates and justifies opinions	EK_U05
EKP4	Can communicate in professional English (Maritime English) and can communicate using various techniques in ship conditions	EK_U07
EKP5	The student can plan and carry out experiments, including computer measurements and simulations, interpret obtained results and draw conclusions.	EK_U01
EKP6	Can use analytical, simulation and experimental methods typical for a marine power plant to formulate and solve practical engineering tasks	EK_U01
EKP7	Can apply knowledge to interpret phenomena occurring in ship machinery, equipment and installations	EK_U10
EKP8	Is able to make a critical analysis of ship mechanisms and devices functioning and assess the existing technical solutions necessary for the correct and safe operation of the ship	EK_U02
EKP9	Is able to and has experience in operating machinery and equipment of marine power plants (appropriate for the watch engineer officer diploma)	EK_U05

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		7th	
A	EKP 1-4,7,9	**Engine control systems** Integrated electronic control systems for the main reciprocating motors. Design and principle of operation Programmable control in engines: Wärtsilä "RT-flex" (WECS - Wärtsilä Engine Control System) and MAN B&W	15
	EKP 1-4,7,9	**Construction of selected engine components**. Construction, manufacturing and materials of selected hull elements. Cylinder block, cylinder liner, cylinder head, main bearings. Tie bolts. Construction, workmanship and materials of selected crank system elements. Pistons, piston rings, crankshaft bearings. Thermal loads of the combustion chamber elements. Deformations during engine operation and increase in mechanical loads. Contemporary design solutions and operation of the cylinder and piston cooling system	

	EKP 1-4,7,9	**Principles of engine foundation**. Foundation of marine engines - flexible founding of foundation frames. External forces and moments acting on the engine during the ship's motion during undulations. Characteristic features and identification of engine vibrations. Torsional and longitudinal vibration dampers - structures and operation. Two-stroke engine body fixing: mechanical and hydraulic. Automatic adjustment in hydraulic shock absorber systems	
	EKP 1-4,7,9	**Outlet valves**. Construction, workmanship and materials of modern outlet valves. Thermal loads and deformations. Design and operation of the valve train with electronic control of the opening and closing phases. Timing system components: hydraulic and pneumatic system. Characteristics of programming and controlling outlet valve operating phases	
	EKP 1-4,7,9	**Starting system and engine management**. Principles of measuring crankshaft position and speed during start-up and normal operation. Overview of engine control system built-in protections. Description of the control system operation during maneuvering the engine	
	EKP 1-4,7,9	**Electronically controlled fuel injection system**. The principle of controlling fuel dose. Possibilities of controlling the fuel dose and influencing the operating properties of the marine engine. Construction and operation of electronically controlled injection systems in the following engines: Wartsila (common rail system) and MAN B&W (individual systems). Construction and operation of electronically controlled injectors	
	EKP 1-4,7,9	**Electronic rotation speed regulators**. Additional functions of the rotation speed controller, engine operating properties with the use of additional controller functions. Basic description of the electronic controller. Purposefulness of using load size control, description of the operation of additional devices cooperating with the electronic controller. Typical controller settings for motors operating in various drive systems	
	EKP 1-4,7,9	**Supercharging of marine engines**. Modern constructions and materials used in the construction of marine engine turbochargers. Cooperation of the engine with the supercharging system - operating characteristics. Possibilities of automatic adjustment to change the operating characteristics of turbochargers. Changes in the operating characteristics of the engine and the field of cooperation with a turbocharger in electronic control systems	
	EKP 1-4,7,9	**Emission of exhaust fumes and noise**. The mechanism of the formation of harmful exhaust components: nitrogen oxides, hydrocarbons, carbon oxides, solid particles and sulfur oxides. Methods of influencing the speed of the formation processes of individual exhaust gas components. Design and adjustment possibilities of reducing emissions of selected exhaust gas components. Certificate on the nitrogen oxides emission. Certification rules, technical documentation as certificate attachment - EIAPP (Engine International Air Pollution Protection) and IAPP (International Air Pollution Protection) - Marpol 73/78 Convention. The specificity of engine noise emission. Certificate of noise measurements	
S	EKP 1,3–9	**Operation of the fuel injection phase shift system**. The operating characteristics of the system with the engine running at various loads. Development of a system control program to obtain: minimum engine fuel consumption, minimum NOx emissions	15

	EKP 1,3–9	**The use of fuel-water emulsions to power engines**. Principle of operation, commissioning of the installation, supervision during operation and shutdown. Determination of operating characteristics for engine operation in the entire load range. Determination of engine performance in the case of using a fuel-water mixture. Determination of the NOx emission factors	
	EKP 1,3–9	**Cooperation of the main propulsion engine with shaft electricity generator operating in the generator system - PTO (Power Take Off) and the engine system - PTI (Power Take In)**. Possibility of efficient circuit use. Determination of driving characteristics when working in two operating modes	
	EKP 1,3–9	**Reduction of nitrogen oxide emissions in the engine exhaust.** Exhaust gas treatment systems - SCR (Selective Catalytic Reduction), principle of operation, system start-up, supervision during operation and shutdown. Evaluation of the effectiveness of operation during operation under various, determined loads in operation. Installation operating characteristics. Determination of the NOx emission factors	
	EKP 1,3–9	**Driving characteristics of a slow-speed engine system with the use of a variable pitch propeller**. Selection of the rotational speed control characteristics and propeller pitch setting. Engine operation in dynamic states. Periodic and long-term overloading of the engine	
Total in the semester:			30

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	30	1
Self study	10	
Participation in final tests and exams apart from classes	2	
Total	42	

Assessment methods and criteria:

Grades	**2**	**3**	**3.5–4**	**4.5 – 5**
Grading method	Written credit for auditorium classes (5 exam questions - max. 5 points). Assessment possible using distance learning methods and techniques			
EKP 1-4,7,9	Correct answer to fewer than 3 questions (0-2.9 points)	Correct answer to 3 questions (3–3.9 points)	Correct answer to 4 questions (4-4.9 points)	Correct answer to 5 questions (5 points)
Grading method	Performing exercises on the simulator. Assessment possible using distance learning methods and techniques			
EKP 1,3–9	Failure to complete all exercises or failure to deliver any of the reports, or failing any of the end-of-class tests	Performing all exercises and delivering reports and completing all end-of-class tests. For each credit task, the student receives a partial grade, the average grade must be 3–3.9	Performing all exercises and delivering reports and completing all end-of-class tests. For each credit task, the student receives a partial grade, the average grade must be 4-4.9	Performing all exercises and delivering reports and completing all end-of-class tests. For each credit task, the student receives a partial grade, the average grade must be 5

Teaching tools:

Type	Description
Projector	Presentation of lectures during auditorium classes
Ship power plant simulator	Completing the tasks during exercises on the ship power plant simulator
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. Listewnik J., Marcinkowski J.: *Rozwój konstrukcji okrętowych wolnoobrotowych silników spalinowych*. WSM, Szczecin 2000. 2. Wajand J.A.: *Doświadczalne tłokowe silniki spalinowe*. WNT, Warszawa 2003. 3. Wimmer A., Glaser J.: *Indykowanie silnika*. AVL, Instytut Zastosowań Techniki, Warszawa 2004.
Complementary literature
1. *EGS 200 User Manual* (960.310.600). STN Atlas Marine 2003. 2. *Emission Control MAN B&W Two-stroke Diesel Engines*. MAN B&W Diesel A / S, Copenhagen 2004. 3. Wartsila ST-Flex and MAN B&W engine manuals of ME and ME-C series. 4. Skupińska J.: *Utylizacja i neutralizacja odpadów przemysłowych. Katalityczne oczyszczanie gazów odlotowych z tlenków azotu*. Website: http://www.chem.uw.edu-.pl/people/JSkupinska/cw23a/NOwstep.htm - 16.11.2009. 5. Super-VIT Fuel Pumps: Adjustment & Maintenance. L50/60/70/80/90MC. K80/90MC/90MC-2. S50/60/70/80MC. MAN B&W Service Letter SL87-223UM 1987. 6. Variable Injection Timing and Fuel Quality Setting. Service Bulletin RTA-53. Sulzer RTA Engines. Wärtsilä June 12, 2001.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Leszek Chybowski, PhD Eng.	l.chybowski@am.szczecin.pl	WM
Other teachers:		
Tomasz Tuński, PhD Eng.	t.tunski@am.szczecin.pl	WM

Abbreviations:
A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	43.1	Course:	Ecological indicators of operational efficiency				
Major:		**Mechanics and Machine Building**	Specialisation:		**Marine Power Plant Operation**		
Studies cycle:		**First**	Form of studies:	**full-time**	Year of studies:	**4th**	Semesters: **8th**
Course status:		**elective**	Course group:	**field-specific course**			

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	E	L	EL	S	P	SE	TW	PR	A	E	L	EL	S	P	SE	TW	PR	
8th	15	1		0.4		1					15		6		15					2
Total during studies											15		6		15					2

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	

Course objectives:

1.	Expanding the student's environmental awareness and responsibility for the state of marine and land environments
2.	Acquainting the student with legal requirements of selected countries regarding the specificity of pollution, management of substances harmful to the environment and operating procedures preventing pollution
3.	Acquainting students with the operating procedures of environmental protection devices

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Can assess the threat to the marine environment caused by the operation of floating objects, including ships, and knows the rules of conduct in accordance with global and local regulations	EK_W03, EK_U04, EK_U02, EK_K01
EKP2	Knows the procedures and rules of operation of devices related to the storage, transport, removal or disposal of substances harmful to the marine environment	EK_W02, EK_U04
EKP3	Knows the requirements and rules of keeping marine environment protection documentation in the Machine Department	EK_U05, EK_U07

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		8th	

A	EKP 1,2	World ISO and European EMAS standards - the concept, general issues, requirements for environmental protection regulations	15
	EKP 1,2,3	Administrative bodies and environmental protection institutions. Legal protection of soil, water and air against pollution. Determining the responsibilities of crew members	
	EKP 1	Structural security required by law, rules of proper operation, security measures limiting the environmental effects of failures and catastrophes	
	EKP 1,2	Measurement systems and techniques in environmental monitoring	
	EKP 1	Noise protection	
	EKP 1,2,3	Development directions of technical methods and devices in the field of environmental protection	
L	EKP 2	Assessment of correct operation of oil separators at the de-oiling processes test stand	6
S	EKP 1,2	Assessment of the effectiveness of the ship's sewage treatment plants in various operating conditions	15
	EKP 1,2	Catalytic reduction of harmful compounds in marine engines exhaust gases - start-up, operation and shutdown of the installation	
	EKP 1,2	Comparison of the efficiency of reducing nitrogen oxide emissions based on selected technical solutions available in simulated power plants	
	EKP 1,2	Assessment of the influence of sailing conditions, settings of the propulsion system, as well as the technical condition of the ship and its equipment on the emission of greenhouse gases and harmful compounds in the exhaust fumes of marine propulsion engines	
Total in the semester:			36

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	**Estimated number of hours to complete the activity**	**ECTS points**
Total hours	36	2
Self study	16	
Participation in final tests and exams apart from classes	2	
Total	54	

Assessment methods and criteria:

Grades	**2**	**3**	**3.5–4**	**4.5 – 5**
Grading method	Written or oral and practical credit during laboratory classes. Assessment possible using distance learning methods and techniques			
EKP1	Student is not able to correctly determine the impact of ship operation on the marine environment, lacks knowledge of the rules of conduct in ac-	Student is able to determine the threat the ship's operation poses on the natural environment, knows the rules of conduct in accordance with the environmental protection regulations	Is able to correctly indicate the factors posing threat to marine environment in various operational states of the ship, can choose the appropriate method of dealing with the environment en-	Is able to correctly identify the factors threatening the marine environment in particular operational states of the ship and predict their influence on the change of the rules of the ship's operation. Can choose procedure appropriate for the operational state and indicate alternative methods

	cordance with environmental protection regulations		dangering factors appropriate for the operational state	
EKP2	Does not know the procedures and rules of operation of devices related to the storage, transport, removal or disposal of substances harmful to the marine environment	Knows the procedures and rules of operation of devices related to the storage, transport, removal or disposal of substances harmful to the marine environment	Can justify the application of the procedure related to the storage, transport, removal or disposal of substances harmful to the marine environment and knows the principles of operation of marine environmental protection devices	Student can indicate the most appropriate procedure related to the storage, transport, removal or disposal of substances harmful to the marine environment, taking into account the specificity of selected sea areas. Knows the rules of operation of marine environmental protection devices and is able to indicate their limitations
EKP3	Does not know the requirements and rules of keeping marine environment protection documentation in the Machine Department	Can list the requirements and rules of keeping marine environment protection documentation in the Machine Department, knows the responsibility of crew members for environmental pollution	Can correctly describe the requirements and give examples of records in the documentation for each of the operations included in the marine environment protection documentation, knows the responsibility of crew members for environmental pollution	Can correctly describe the requirements and give examples of records in the documentation for each of the operations included in the marine environment protection documentation of the Machinery Department, and indicate the guidelines for action in the event of an operation interruption, damage to the device or other emergency situation, knows the responsibility of crew members for environmental pollution

Teaching tools:

Type	Description
Projector	Auditorium classes in the form of a multimedia presentation
OMM	Technical and operational documentation of selected devices
Legal acts	International conventions and local legal acts regulating the protection of the marine environment
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature

1. Lipiński A.: *Prawne podstawy ochrony środowiska*. Wolters Kluwer Polska Sp. z o.o., Warszawa 2007.
2. Kenig-Witkowska M.M.: *Prawo środowiska Unii Europejskiej. Zagadnienia systemowe*. PiE, Warszawa 2007.
3. Wierzbowski B., Rakoczy B.: *Podstawy prawa ochrony środowiska*. PiE, Warszawa 2007.
4. Wiewióra A.: *Ochrona środowiska morskiego w eksploatacji statków*. Lecture notes for full-time and extramural studies and SDKO courses at WSM, Szczecin 2003.

Complementary literature

1. Act of the Republic of Poland of April 27, 2001, Environmental Protection Law (Journal of Laws of 2001, No. 62, item 627).
2. Act of the Republic of Poland of March 16, 1995 on the Prevention of Sea Pollution by Ships (Journal of Laws of 1995, No. 47, item 243, as amended).
3. Convention on the Protection of the Marine Environment of the Baltic Sea Area, 1992 (Journal of Laws of 2000, No. 28, item 346, as amended).
4. London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (Journal of Laws of 1984, No. 11, item 46, as amended J. of L. of 1997 No 47 it.300).
5. Regulation of the Minister of Infrastructure on the provision of information on wastes on board (Journal of Laws of 2003, No. 101, item 936).

6. Regulation of the Minister of Transport and Construction on the method, scope and dates of carrying out surveys and inspections, the method of confirming and specimens of international certificates for the protection of the sea against pollution by ships (Journal of Laws of 2006, No. 49, item 357). 7. Regulation of the Minister of Infrastructure on the operation of port inspection. (Journal of Laws of 2004, No. 102, item 1078).

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Piotr Treichel, PhD Eng.	p.treichel@am.szczecin.pl	WM
Other teachers:		
Tadeusz Borkowski, PhD Eng.	t.borkowski@am.szczecin.pl	WM

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	**44.1**	Course:	**Marine propulsion systems**				
Major:		**Mechanics and Machine Building**	Specialisation:		**Marine Power Plant Operation**		
Studies cycle:		**First**	Form of studies:	**full-time**	Year of studies:	**4th**	Semesters: **8th**
Course status:		**elective**	Course group:	**field-specific course**			

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	T	L	E	S	P	SE	IP	PR	A	T	L	E	S	P	SE	IP	PR	
8th	15	1E				0.8					15				10					1
Total during studies											15				10					1

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	When starting classes in the subject "ship propulsion systems", the student should know the basics of shipbuilding, operation of thermal machines, energy transmission and know the basic nomenclature in English. In particular, the student will use the knowledge gained during participation in such courses as: - English, - Math, - Physics, - Mechanical Engineering, - Fundamentals of machine construction, - Technical thermodynamics, - Fluid mechanics, - Ship electrical engineering, - Ship automation and surveying, - Marine reciprocating engines, - Ship boilers, - Ship machinery and equipment, - Theory and construction of the ship, - Marine environment protection

Course objectives:

1.	After listening to the lectures and completing classes on the ship power plant simulator, the student should know: 1) various design solutions, principles of operation and operation of the main and auxiliary propulsion systems in marine power plants; 2) construction and operation of power plant installations with reciprocating engines, steam engines and turbine sets; 3) rules for the selection of various ship propulsion systems, their characteristics and the possibility of using these characteristics during operation; 4) control and supervision systems of the main propulsion systems and the main operating principles
2.	After listening to the lectures and completing classes on the ship power plant simulator, the student should know:

	1) how to read and interpret diagrams and descriptions of the main propulsion systems; 2) use the drive systems of combustion power plants; 3) assess the correctness of the selection of the main settings of the ship's propulsion systems; 4) assess the influence of operational factors on the behavior of the ship's propulsion system in terms of reliability and energy

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Has detailed technical knowledge necessary for the proper maintenance and operation of ship equipment and installations, electrical and electronic equipment and automatic control systems as well as for managing the safe operation of the ship power plant	EK_W03
EKP2	Has detailed knowledge of managing safe ship operation, organization and resource management of a marine power plant	EK_W04
EKP3	Obtains information from literature, databases (also in English) and other sources, integrates them, interprets them, draws conclusions and formulates and justifies opinions	EK_U05
EKP4	Can communicate in professional English (Maritime English) and can communicate using various techniques in ship conditions	EK_U07
EKP5	The student can plan and carry out experiments, including computer measurements and simulations, interpret obtained results and draw conclusions.	EK_U01
EKP6	Can use analytical, simulation and experimental methods typical for a marine power plant to formulate and solve practical engineering tasks	EK_U01
EKP7	Can apply knowledge to interpret phenomena occurring in ship machinery, equipment and installations	EK_U10
EKP8	Is able to make a critical analysis of ship mechanisms and devices functioning and assess the existing technical solutions necessary for the correct and safe operation of the ship	EK_U02
EKP9	Is able to and has experience in operating machinery and equipment of marine power plants (appropriate for the watch engineer officer diploma)	EK_U05

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		8th	
A	EKP1,2,3 7,9	Main engines of marine propulsion systems, comparison of their performance indicators and characteristics. Simple and combined drive systems (CODAG, CODOG, COGAG, CODLAG, CONAS etc.)	15
	EKP1,2,3 7,9	Work fields - loads and selected characteristics of reciprocating engines, steam turbines and turbine sets. Operational properties of drive systems with these engines	
	EKP1,2,3 7,9	Design of the shaft line of the main propulsion systems. Components: intermediate, thrust and screw shafts. Types and design of clutches in main drive systems. Support and thrust bearings: design and operating principles. Gears: types, construction and operating principles. Determination of the total efficiency of the main drive system and component losses	
	EKP1,2,3 7,9	Contemporary types of ship propellers, construction, operational properties, criteria and principles of selection. Principles of determining the value of propeller thrust force in practice	
	EKP1,2,3 7,9	Methods of preparing the actual rotational and driving characteristics in operation: general knowledge. Determining the characteristics of main drive systems on the basis of measurements for drives with a fixed pitch propeller. Determining the characteristics of main drive systems on the basis of measurements for drives with an adjustable pitch propeller. Selection and verification of pitch and rotational speed settings of the propeller engine in steady and variable sailing conditions	
S	EKP1,3–9	Main engines of marine propulsion systems, comparison of their performance indicators and characteristics.	10
	EKP1,3–9	Work fields - loads and selected characteristics of reciprocating engines, steam turbines and turbine sets. Operational properties of drive systems with these engines Methods of preparation and analysis of characteristics and data from sea trials	
	EKP1,3–9	Design of the shaft line of the main propulsion systems. Components: intermediate, thrust and screw shafts. Types and design of clutches in main drive systems. Support and thrust bearings: design and operating principles. Gears: types, construction and operating principles.	
	EKP1,3–9	9. Contemporary types of ship propellers, construction, operational properties, criteria and principles of selection. Principles of determining the value of propeller thrust force in practice	
	EKP1,3–9	Methods of preparing the actual rotational and driving characteristics in operation: general knowledge. Determining the characteristics of main drive systems based on measurements for drives with a fixed pitch propeller.	
Total in the semester:			25

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	25	1
Self study	10	
Participation in final tests and exams apart from classes	2	
Total	37	

Assessment methods and criteria:

Grades	**2**	**3**	**3.5–4**	**4.5 – 5**
Grading method	Written credit for auditorium classes (5 exam questions - max. 5 points). Assessment possible using distance learning methods and techniques			
EKP 1,2,3 7,9	Correct answer to fewer than 3 questions (0-2.9 points)	Correct answer to 3 questions (3–3.9 points)	Correct answer to 4 questions (4-4.9 points)	Correct answer to 5 questions (5 points)
Grading method	Performing exercises on a simulator, Assessment possible with the use of distance learning methods and techniques.			
EKP1,3–9	Failure to complete all exercises or failure to deliver any of the reports, or failing any of the end-of-class tests	Performing all exercises and delivering reports and completing all end-of-class tests. For each credit task, the student receives a partial grade, the average grade must be 3–3.9	Performing all exercises and delivering reports and completing all end-of-class tests. For each credit task, the student receives a partial grade, the average grade must be 4-4.9	Performing all exercises and delivering reports and completing all end-of-class tests. For each credit task, the student receives a partial grade, the average grade must be 3–3.9

Teaching tools:

Type	Description
Projector	Presentation of lectures during auditorium classes
Ship power plant simulator	Completing the tasks during exercises on the ship power plant simulator
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature

1. Rawson K.J., Tupper E.C.: *Basic Ship Theory*. Elsevier, 2001.
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Complementary literature

1. Wojnowski W.: *Okrętowe siłownie spalinowe. Tom I, II i III*. Politechnika Gdańska, 1991–1992.
2. Michalski R.: *Siłownie okrętowe*. Wydawnictwo Politechniki Szczecińskiej, Szczecin 1997.
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Course instructor:

Degree / title, name, surname, form of clas-ses	**E-mail address**	**Teaching unit**
Course supervisor:		
Leszek Chybowski, PhD Eng.	l.chybowski@am.szczecin.pl	WM
Other teachers:		
Tomasz Tuński, PhD Eng.	t.tunski@am.szczecin.pl	WM

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	45.1	Course:	**Ship energy management**				
Major:	**Mechanics and Machine Building**	Specialisation:		**Marine Power Plant Operation**			
Studies cycle:	**First**	Form of studies:	**full-time**	Year of studies:	**4th**	Semesters:	**8th**
Course status:	**elective**	Course group:	**field-specific course**				

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	E	L	EL	S	P	SE	TW	PR	A	E	L	EL	S	P	SE	TW	PR	
8th	15	1E				1					15				15					2
Total during studies											15				15					2

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Thorough knowledge of: Marine internal combustion engines, Marine power plants, Marine boilers
2.	Thorough knowledge of: Ship machinery and equipment, Ship propulsion systems, Chemistry of water, fuels and lubricants, Use of fuels and lubricants

Course objectives:

1.	Developing the ability to assess energy demand in ship systems including ship propulsion systems
2.	Acquiring the ability to determine the energy indices of ship heat engines and power plants in practice, and to determine the possibility of their correction in the real conditions of the ship's surroundings and operation
3.	Preparing the graduate for effective management of fuels and lubricants in the ship's energy system

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Can assess the energy demand in various ship systems and ship propulsion systems	EK_W05, EK_W04, EK_U01
EKP2	Can assess the impact of the actual environmental conditions and ship operation on the power plant and ship operating efficiency	EK_W02, EK_U01
EKP3	Student can assess the influence of fuel and lubricants on the operating efficiency of a marine power plant and a ship	EK_W03
EKP4	Can use waste energy in the ship's energy system to improve the economy of sea transport	EK_W03, EK_U01, EK_U04

Programme content:

Form of clas-ses	EKP rela-tion	Implemented content	Num-ber of hours
Semester:		8th	
A	EKP1	**Efficiency and specification of marine energy equipment and systems:** propeller mechanical energy demand, electric energy and thermal energy necessary for ship servicing. Solutions of energy systems for ships powered by dieseln reciprocating engines and steam turbines	15
	EKP2	**Energy characteristics of combustion processes in reciprocating engines, turbo sets and steam boilers:** internal losses of heat engines. Energy losses of propulsion systems and practical methods of their determination in ship systems	
	EKP3	**Influence of composition and physicochemical properties of fuels for diesel engines on their most important operational properties:** the importance of ignition delay for the proper course of the combustion process and minimum fuel consumption. Structure and stability of residual fuels. Causes and effects of stability loss on the combustion process in the engine. Additional parameters describing fuel properties: water and sulfur content. The effects of water and sulfur presence in fuel on the course and energy effects of the combustion process. Burning fuel-water emulsions to power engines. Practical methods of taking into account the properties of fuels and emulsions in the calculation of fuel consumption by marine engines and boilers	
	EKP3,4	**Energy indices of heat engines and marine power plant**: principles of using energy indicators in ship operation. The influence of operational factors on indicator values. Forecasting fuel consumption based on drive characteristics and measurements in operating conditions. Consumption of lubricating oils in drive engines, main operating conditions. Determining the actual consumption of lubricating oils	
	EKP4	**Ways to increase the overall efficiency of the marine power plant:** use of exhaust gas heat as well as engine and charge air cooling water. The use of turbine generator sets. Construction and operation of heat utilization systems in modern ship power plants. Analysis and selection of appropriate methods of regulating energy utilization systems. Generation of electricity in ship's power plants, generation sets with reciprocating engines and steam turbines, shaft generators. Principles of economic use of these systems	
S	EKP2	Practical verification of energy characteristics of combustion processes in reciprocating engines, turbine sets and steam boilers	15
	EKP3	Practical determination of ignition delay for various types of fuels and engines. Practical determination of the effect of water and sulfur content in fuel on the consumption of fuel and lubricating oils	
	EKP3,4	Practical determination of fuel and lubricating oils consumption and Energy indices of a ship power plant	
	EKP4	Practical determination of the overall efficiency of a ship power plant with the use of various waste heat utilization systems	
Total in the semester:			30

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	30	2
Self study	10	
Participation in final tests and exams apart from classes	20	
Total	60	

Assessment methods and criteria:

Grades	2	3	3.5–4	4.5 – 5
Grading method	Written examination. Assessment possible using distance learning methods and techniques			
EKP1	Student does not understand the concept of energy efficiency of ship devices and mechanisms	Student understands the concept of efficiency of ship devices and mechanisms	Understands the concept of efficiency of ship devices and mechanisms. Can determine the mechanical energy necessary to propel the ship	Understands the concept of efficiency of ship devices and mechanisms. Can determine the demand for mechanical, electrical and thermal energy required to service the ship. Knows various solutions of ship energy systems
EKP2	Is unable to determine the environmental and operating conditions affecting the operating efficiency of the marine power plant and the ship	Is able to determine the environmental and operating conditions affecting the operating efficiency of the marine power plant and the ship	Is able to determine the environmental and operating conditions affecting the operating efficiency of the marine power plant and the ship Can determine the energy losses of the drive system	Is able to determine the environmental and operating conditions affecting the operating efficiency of the marine power plant and the ship Can determine the energy losses of the drive system. Can select the settings of the propulsion system components to increase the economy of the ship's operation
EKP3	Does not know the types of fuels and lubricating oils used on ships	Knows the types of fuels and lubricating oils used on ships. Knows their basic features influencing consumption level	Knows the types of fuels and lubricating oils used on ships. Knows their basic features influencing the consumption level. Can forecast their consumption depending on the operating conditions of the ship	Knows the types of fuels and lubricating oils used on ships. Knows their basic features influencing the consumption level. Can forecast their consumption depending on the operating conditions of the ship. Is able to select the optimal settings of the drive system components with the use of various types of fuels
EKP4	Does not understand the concept of waste energy	Understands the concept of waste energy and is able to estimate its value. Knows its sources in marine power plants	Understands the concept of waste energy and is able to estimate its value. Knows its sources in marine power plants. Can identify the possibilities of its use	Understands the concept of waste energy and is able to estimate its value. Knows its sources in marine power plants. Can identify the possibilities of its use. Can use various waste energy recovery systems depending on the actual environmental conditions and ship operation

Teaching tools:

Type	Description
Projector	Auditorium classes in the form of a multimedia presentation
Graphic simulator of ships and power plants in accordance with the STCW requirements	Theoretical and practical classes with the use of simulators
Ship equipment manuals and documentation	Main and auxiliary propulsion engines, ship installations and systems, auxiliary devices of marine power plants and ships.

Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. Urbański P., *Gospodarka energetyczna na statkach*. Wydawnictwo Morskie, Gdańsk 1978. 2. Urbański P., *Instalacje okrętów i obiektów oceanotechnicznych: instalacje spalinowych siłowni okrętowych*. Politechnika Gdańska, Gdańsk 1994. 3. Urbański P., *Paliwa, smary i woda na statkach morskich*. Wydawnictwo Morskie, Gdańsk 1976. 4. Wojnowski W., *Okrętowe siłownie spalinowe. Tom I, II i III*. Politechnika Gdańska, Gdańsk 1991–1992. 5. Michalski R., *Siłownie okrętowe*. Politechnika Szczecińska, Szczecin 1997.
Complementary literature
1. Kowalewicz A., *Podstawy procesów spalania*. WNT, Warszawa 2000. 2. Piotrowski I., Witkowski K., *Eksploatacja okrętowych silników spalinowych*. Gdynia 2002. 3. Kruczek S., *Kotły – konstrukcje i obliczenia*. Politechnika Wrocławska, Wrocław 2001. 4. Balcerski A., *Siłownie okrętowe*. Gdańsk 1990. 5. Włodarski J., K., *Podstawy eksploatacji maszyn okrętowych*. Gdynia 2006. 6. Schneekluth, H.; Bertram V., *Ship Design for Efficiency and Economy*. Elsevier, 1998.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Tomasz Tuński, PhD Eng. ChEng	t.tunski@am.szczecin.pl	WM
Other teachers:		
Prof. Oleh Klyus, PhD Eng.	o.klyus@am.szczecin.pl	WM

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

Turbine drives

General information about the course:

No.:	42.2	Course:	**Operation of marine steam and gas turbines**				
Major:		**Mechanics and Machine Building**	Specialisation:		**Marine Power Plant Operation**		
Studies cycle:		**First**	Form of studies:	**full-time**	Year of studies:	**4th**	Semesters: **8th**
Course status:		**elective**	Course group:	**field-specific course**			

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	T	L	E	S	P	SE	IP	PR	A	T	L	E	S	P	SE	IP	PR	
8th	15	2				0.3					30				5					2
Total during studies											30				5					2

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Detailed knowledge in the field of machinery building and marine engines

Course objectives:

1.	Developing the ability to assess the quality of energy conversion in ship turbines and to formulate operational methods of correcting its efficiency
2.	Preparing a graduate to operate and manage the operation of steam and gas turbines in the ship's energy system at a level certified by a watch mechanic officer diploma issued by a relevant maritime administration body

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Has detailed knowledge of the rational control of the safe operation of the ship's main propulsion steam and diesel turbine sets, auxiliary steam and turbine internal combustion engines as well as compression-ignition marine engine turbochargers	EK_W04
EKP2	Can use the information contained in the design and operation and maintenance documentation of turbines and rotor compressors to make operational decisions based on the assessment of their technical condition. Can apply knowledge to interpret energy conversion in marine rotating machinery	EK_U10 EK_U04
EKP3	Can make a critical analysis of the operation of turbines and rotor compressors and assess possible ways of restoring the technical condition of their flow channels necessary for their correct and safe operation	EK_U02
EKP4	Can identify and formulate the specification of simple engineering tasks of a practical nature, including: starting and operating during work of turbines, inspections, planning and repair of ship turbines and installations supporting them	EK_U05

Programme content:

Form of clas-ses	EKP relation	Implemented content	Num-ber of hours
Semester:		8th	
A	EKP1,2,3	**Classification of thermal rotating machines**. Definitions and terms. Functions of rotating machines in basic energy technologies. Construction and tasks of the turbine stage elements. Characteristics of a perfect turbine	30
	EKP1,2	**Steam turbines in marine energy systems**. Classification of marine steam turbines. Turbine in the steam-water cycle. Circulation of the working medium, steam parameters and efficiency of a steam turbine power plant. Parameters of the beginning and end of the steam expansion process in ship turbines and their influence on the efficiency of the turbines. Configuration of steam turbine drive transmission systems. Main and auxiliary turbine gears	
	EKP1,2,3	**Construction and basic characteristics of main propulsion steam turbines**. Multi-stage turbines: action, reaction, combined action and reaction, combined action and reaction Steam turbine power control, maneuvering devices. Operation of turbines in non-design conditions. Cooperation of the main propulsion steam turbine sets with the propeller	
	EKP1,2,3	**Steam turbines in auxiliary drives**. Cooperation of turbines with various energy receivers. Steam turbines of generating sets. Steam turbines of cargo pumps. Steam utilization turbines in waste energy recovery systems in compression-ignition engines	
	EKP1,2,3	**Assembly and tests of ship turbines. Active maintenance of steam turbines**. Preparation of the steam turbine set for operation, operation and control during operation, shutdown and storage. Damage and failures of turbine assemblies	
	EKP1,2,3	**Maintenance of steam turbines in marine propulsion systems**. Supervision of classification societies regulations. Control of turbine operation. Repairs and adjustments in corrective actions. Prevention of erosive and corrosive wear of turbines. Methods for diagnosing turbines: in making operational and post-failure decisions; thermo-flow, vibroacoustic, endoscopic, oil composition analysis	
	EKP1,2,3	**Steam turbines in marine energy systems**. Basics of operation of turbine combustion engine. Classification of engines and working medium circuits: open and closed circuit, carnotization of circuits. Mechanical-flow systems of engines. Features and indicators of turbine combustion engines. Influence of operating parameters on the efficiency of a turbine engine	
	EKP1,2,3	**Construction of turbine combustion engine components and their characteristics**: compressors, combustion chambers, turbines. Fuel and oil installation. Start-up of turbine engines. Starters used. Start-up process steps. Automatic control systems for turbine engines - regulation programs. The role and tasks of border regulators. Layouts of cooling and operation of high-temperature components of turbine combustion engines. Intake air (sea aerosol separators) and exhaust gas collectors	

	EKP1,2,3	**The specificity of cooperation between combustion turbines of single-rotor units and drive turbines of multi-rotor engines with energy receivers**: ship generators, ship propellers and thrusters. Operation at non-design engine partial loads. Reversibility of internal combustion engine drive turbines	
	EKP1,2,3	**Characteristics of gas turbine engines**: external characteristics, load, mass flow and exhaust gas temperature. The influence of weather conditions on the characteristics of turbine engines. The operational change in the characteristics of IC turbine engines as a result of the deterioration of the technical condition of the flow channels. Inspection of the technical condition and methods of cleaning the flow channels of turbine engines. Unstable work of compressors and ways to prevent it	
	EKP1,2,3,4	**Maintenance of combustion turbines in marine energy systems**. The role of the regulations of classification societies in the assembly, handover tests and putting into operation of turbine engines. Maintenance activities in the strategy of predictive, corrective, plan-preventive and reliability maintenance. Comparison of the characteristics of combustion and steam turbines	
S	EKP1,2	**Preparation of turbines for start-up, start-up of turbine sets, supervision of their work**	5
Total in the semester:			35

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	**Estimated number of hours to complete the activity**	**ECTS points**
Total hours	35	2
Self study	20	
Participation in final tests and exams apart from classes	2	
Total	57	

Assessment methods and criteria:

Grades	**2**	**3**	**3.5–4**	**4.5 – 5**
Grading method	Written or oral test. Assessment possible using distance learning methods and techniques			
EKP1	Student is unable to define the problem related to the control of the operation of thermal rotating machines	Is able to define a problem related to the control of the operation of rotating machines of turbine sets and turbochargers of diesel-ignition marine engines	Is able to correctly define the problem related to the rational control of the safe operation of rotating machines of main propulsion turbine sets, auxiliary turbine sets and turbo-compressors of diesel engines	Is able to correctly assess and define the problem related to the rational control of the safe operation of rotating machines of main propulsion turbine sets, auxiliary turbine sets and diesel engine turbochargers

EKP2	Student is not able to use the information contained in the technical and operational documentation of turbines and rotary compressors to assess their technical condition	Student can use the information contained in the technical and operational documentation of turbines and rotary compressors to assess their technical condition	Student is able to use the information contained in the technical and operational documentation of turbines and rotary compressors to assess their technical condition Can apply knowledge to interpret energy conversion in marine rotating machinery	Is able to correctly use and use the information contained in the design, technical and operational documentation of turbines and rotor compressors to assess their technical condition. Can apply knowledge to interpret energy conversion in marine rotating machinery
EKP3	Is not able to analyze the functioning of turbines and rotor compressors and to assess the ways of restoring the technical condition of their flow channels	Can analyze the functioning of turbines and rotor compressors and assess the ways of restoring the technical condition of their flow channels	Can make a critical analysis of the operation of turbines and rotor compressors and assess possible ways of restoring the technical condition of their flow channels necessary for their correct and safe operation	Can make a critical analysis of the operation of turbines and rotor compressors and assess possible ways of restoring the technical condition of their flow channels necessary for their correct and safe operation
EKP4	Is unable to identify and formulate the simplest engineering task such as inspection and repair of a device	Can identify and formulate a simple engineering task such as inspection and repair of a device	Can reliably identify and formulate a specification of simple practical engineering tasks such as: inspections, planning and repair of devices	Is able to reliably identify and formulate the specification of engineering tasks such as: inspections, planning and renovation of energy equipment and installations

Teaching tools:

Type	Description
Projector	Auditorium classes in the form of multimedia presentations, films and cold models
OMM	Operation and maintenance manuals of selected rotating machines
Cold parts / machine models	Elements of turbine and compressor stages, cold model of a gas turbine engine
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature

1. Adamkiewicz A.: *Okrętowe turbozespoły spalinowe. Część I. Termodynamika obiegów. Sprężarki wirnikowe*. Wyższa Szkoła Marynarki Wojennej, Gdynia 1983.
2. Adamkiewicz A.: *Okrętowe turbozespoły spalinowe. Część II. Komory spalania. Turbiny spalinowe. Instalacje. Charakterystyki. Eksploatacja*. Wyższa Szkoła Marynarki Wojennej, Gdynia 1985.
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Complementary literature

1. Adamkiewicz A.: *Zastosowanie turbin gazowych w okrętowych systemach energetycznych*. Redakcja Rynku Energii, CIRE. Konferencja Rynek Gazu 2011, Kazimierz Dolny, 15–17 czerwca 2011. Rynek Gazu 2011. Praca zbiorowa pod redakcją Henryka Kapronia, Wydawnictwo KAPRINT, Lublin 2011, s. 177–196.
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6. Adamkiewicz. A., Rutkowski J.: *Eksploatacyjna ocena nośności informacyjnej systemu nadzoru pracy pomocniczej turbiny parowej jednostki pływającej typu FPSO*. Postępy Nauki i Techniki Advances in Science and Technology 11/2011. s. 5–16, ISSN 2080-4075, Politechnika Lubelska, Lublin 2011.
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12. Behrendt C., Adamkiewicz A., Krause P.: *Dostępność energii odpadowej w układach energetycznych statków morskich z utylizacyjnymi kotłami parowymi*. Prace Naukowe Monografie. Konferencje. Zeszyt 16. Politechnika Śląska, Instytut Maszyn i Urządzeń Energetycznych, Gliwice 2006, s. 29–48.
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Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Andrzej Adamkiewicz, PhD Eng.	a.adamkiewicz@am.szczecin.pl	WM
Other teachers:		
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Marcin Szczepanek, PhD Eng.	m.szczepanek@am.szczecin.pl	WM

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	43.2	Course:	**Main steam boilers**				
Major:		**Mechanics and Machine Building**	Specialisation:		**Marine Power Plant Operation**		
Studies cycle:		**First**	Form of studies:	**full-time**	Year of studies:	**4th**	Semesters:	**8th**
Course status:		**elective**	Course group:	**field-specific course**			

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	E	L	EL	S	P	SE	TW	PR	A	E	L	EL	S	P	SE	TW	PR	
8th	15	1	0.67			0.3					15	10			5					1
Total during studies											15	10			5					1

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Thorough knowledge of thermodynamics in the field of thermodynamic transformations of gases, principles of thermodynamics, heat balance, combustion, principles of heat flow
2.	Thorough knowledge of technical chemistry in the field of water chemistry
3.	Knowledge of ship structures, fired auxiliary boilers, their components, fittings as well as steam-water and fuel systems
4.	Knowledge of the procedures: start-up, work supervision, shutdown and diagnosis of marine auxiliary boilers
5.	Knowledge acquired during maritime practical trainings

Course objectives:

1.	Transfer of knowledge about combustion processes in main boilers
2.	Acquainting with the construction of main boilers and their structural elements as well as development trends
3.	Transfer of knowledge on methods of preparing the heat balance of the main boilers
4.	Acquiring the skills to carry out the procedures: start-up, work supervision, shutdown of the main boilers and their diagnostics
5.	Transfer of knowledge necessary to work on ships equipped with main boilers

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Describes and analyzes the design solutions of the main boilers, their components and fittings, working processes with their disturbances, and methods of determining the efficiency of the boiler	EK_W02, EK_U05, EK_U01, EK_U03
EKP2	Student knows and demonstrates operating and diagnostic procedures	EK_W02, EK_U01, EK_U01, EK_U03, EK_U05

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		7th	
A	EKP1	Combustion processes in main boilers. Types of fuels, the impact of operating parameters on the quality of atomization and combustion, excess air ratio, burner regulation, exhaust emission	15
	EKP1	Construction of modern ship's main boilers (drums with fittings, boiler sections, soot blowers, insulation, operation and principles of safe and economical operation)	
	EKP1	Development trends of the main and auxiliary boilers. Changes in the design of boilers and their systems, utilization of waste heat and reduction of the emission of harmful exhaust components	
	EKP1	Boiler heat balance. Boiler efficiency - direct and indirect method, soot and scale contamination of the heat exchange surface, influence of contamination on the boiler efficiency and its operation	
	EKP1	Principles of water circulation in the boiler and its disturbances. Influence of boiler design and operating conditions on circulation disturbances. Threats resulting from circulation disorders	
E	EKP1	Boiler heat balance. Boiler efficiency - direct and indirect method	10
L	EKP2	Preparation, start-up and work supervision, shutdown of the main boiler. Boiler diagnostics	5
Total in the semester:			30

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	30	1
Self study	10	
Participation in final tests and exams apart from classes	2	
Total	42	

Assessment methods and criteria:

Grades	2	3	3.5–4	4.5 – 5
Methods for evaluation	Written test, simulator test, Assessment possible with the use of distance learning methods and techniques			
EKP1	Student incorrectly defines combustion processes and methods of determining the efficiency of boilers. Student incorrectly describes the design solutions of boilers and their components	Correctly defines combustion processes and methods of determining the efficiency of boilers. Describes in a basic way the design solutions of boilers and their components	Correctly defines and describes combustion processes and methods of determining the efficiency of boilers. Describes the design solutions of boilers and their components in a technically correct manner	Correctly defines, describes and analyzes combustion processes and methods of determining the efficiency of boilers. Describes and analyzes the design solutions of boilers and their components in a technically correct manner
Methods of evaluation	Demonstration with the use of an operational and graphic simulator of the power plant. Assessment possible using distance learning methods and techniques			
EKP2	Student does not know and cannot correctly demonstrate operating and diagnostic procedures	Knows and correctly demonstrates operating and diagnostic procedures	Knows and correctly demonstrates operating procedures, taking into account operational disruptions	Knows and correctly demonstrates operating procedures, taking into account operational disruptions introduced by the instructor

Teaching tools:

Type	Description
Overhead projector and multimedia projector	Auditorium classes in the form of film and multimedia presentations
Instructions and guides for classes	Materials for classes using marine power plant simulators
Ship power plant simulator:	Classes with the use of a graphic and operational simulator of marine power plants
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature

1. Górski Z., Perepeczko A.: *Okrętowe kotły parowe*. Fundacja Rozwoju WSM w Gdyni, Gdynia 2001.
2. Perepeczko A.: *Okrętowe kotły parowe*. Wydawnictwo Morskie, Gdańsk 1979.
3. Piotrowski W.: *Okrętowe kotły parowe*. Wydawnictwo Politechniki Gdańskiej, Gdańsk 1985.
4. Manuals and guides for ship power plant simulator classes.

Complementary literature

1. Balcerski A.: *Siłownie okrętowe*. Wydawnictwo Politechniki Gdańskiej, Gdańsk 1990.
2. Cwynar L.: *Rozruch kotłów parowych*. WNT, Warszawa 1983.
3. Kruczek S.: *Kotły. Konstrukcje i obliczenia*. Wydawnictwo Politechniki Wrocławskiej, Wrocław 2001.
4. Piotrowski W., Rokicki W.: *Kotły parowe. Przykłady obliczeniowe*. Wydawnictwo Politechniki Gdańskiej, Gdańsk 1975.
5. Manuals, brochures, bulletins, technical documentation, websites of marine boilers manufacturers.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Cezary Behrendt, PhD Eng.	c.behrendt@am.szczecin.pl	WM
Other teachers:		
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Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	44.2	Course:		**Ship turbines support equipment and installations**			
Major:		**Mechanics and Machine Building**	Specialisation:		**Marine Power Plant Operation**		
Studies cycle:		**First**	Form of studies:	**full-time**	Year of studies:	**4th**	Semesters:	**8th**
Course status:		**elective**	Course group:	**field-specific course**			

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	T	L	E	S	P	SE	IP	PR	A	T	L	E	S	P	SE	IP	PR	
8th	15	1				0.7					15				10					1
Total during studies											15				10					1

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Thorough knowledge of thermodynamics in the field of thermodynamic transformations of gases, principles of thermodynamics
2.	Thorough knowledge of the construction and Marine Power Plant Operation
3.	Thorough knowledge of the construction and operation of ship machinery and equipment
4.	Knowledge acquired during maritime practical trainings

Course objectives:

1.	Transfer of knowledge on the construction of installations and their devices in a turbopair and gas turbine power plant
2.	Transfer of knowledge on procedures related to the operation of equipment and installations of a turbine and gas turbine power plants
3.	Transfer of knowledge necessary to work on ships equipped with steam and gas turbines

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Analyzes the design solutions of installations and their devices in a turbine and gas turbine power plant, defines procedures related to the operation of turbine power plants and equipment	EK_W02, EK_U05, EK_U01, EK_U03

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		8th	
A	EKP1	Installations and devices of turbosteam power plants: – gears, – main condensers,	15

		– excess condensers, – thermal condensers, – feed water condensate pumps, oil, – oil system, – cooling sea water systems	
	EKP1	Supervision and service during the operation of installations and devices of turbosteam power plants	
	EKP1	Installations and devices of turbogas power plants: – gears, – fuel systems, – heat exchangers, – regulatory systems, – oil system, – cooling systems, – fire safety systems	
S	EKP1	Supervision and service during the operation of installations and devices of turbogas power plants	10
Total in the semester:			25

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	25	1
Self study	10	
Participation in final tests and exams apart from classes	2	
Total	35	

Assessment methods and criteria:

Grades	**2**	**3**	**3.5–4**	**4.5 – 5**
Methods of evaluation	Written or oral test. Assessment possible using distance learning methods and techniques. Assessment possible using distance learning methods and techniques.			
EKP1	Student does not know the design solutions of installations and devices of steam turbine and gas turbine power plants and their devices. Incorrectly defines the procedures related to their operation	Correctly defines the basic design solutions of installations and devices of steam turbine and gas turbine power plants. Correctly defines the basic procedures related to their operation	Correctly defines design solutions for installations and devices of steam turbine and gas turbine power plants. Correctly defines the procedures related to their operation	Correctly defines the basic design solutions of installations and devices of steam turbine and gas turbine power plants. Correctly defines and analyzes the procedures related to their operation

Teaching tools:

Type	Description
Multimedia and foil projector	Auditorium classes in the form of multimedia presentations and films
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. Kowalski A.: *Okrętowe zespoły turbospalinowe*. Wydawnictwo Morskie, Gdańsk 1983. 2. Kowalski A., Krzyżanowski J.: *Okrętowe siłownie parowe*. Wydawnictwo WSM w Gdyni, Gdynia 1991. 3. Meier-Peter H., Behrnhardt F.: *Compendium Marine Engineering*. DVV Media Group, Hamburg 2009. 4. Nikiel T.: *Turbiny parowe*. WNT, Warszawa 1980. 5. Cwielewicz R., Perepeczko A.: *Okrętowe turbiny parowe*. Wydawnictwo Fundacji Rozwoju AM w Gdyni, Gdynia 2002. 6. Perycz S.: *Turbiny parowe i gazowe*. Wydawnictwo Ossolineum, Wrocław 1992.
Complementary literature
1. Balcerski A.: *Siłownie okrętowe*. Wydawnictwo Politechniki Gdańskiej, Gdańsk 1990. 2. Wojnarowski W.: *Siłownie okrętowe*. Wydawnictwo Politechniki Gdańskiej, Gdańsk 1991. 3. Manuals, brochures, bulletins, technical documentation, websites of steam and gas turbine producers.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
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Other teachers:		
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Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	45.2	Course:	**Operation of marine turbosteam power plants**				
Major:		**Mechanics and Machine Building**	Specialisation:		**Marine Power Plant Operation**		
Studies cycle:		**First**	Form of studies:	**full-time**	Year of studies:	**4th**	Semesters:	**8th**
Course status:		**elective**	Course group:	**field-specific course**			

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	E	L	EL	S	P	SE	TW	PR	A	E	L	EL	S	P	SE	TW	PR	
8th	15	1E				1					15				15					2
Total during studies											15				15					2

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Thorough knowledge of thermodynamics in the field of thermodynamic transformations of gases, the principles of thermodynamics, theoretical cycles of steam power plants

Course objectives:

1.	Transfer of knowledge on the construction of steam-water systems of turbo steam power plants and procedures related to their operation
2.	Transfer of knowledge on the methods of assessing and increasing the efficiency of marine turbosteam power plants

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Analyzes the design solutions of steam-water systems of turbosteam power plants and their energy efficiency	EK_W02, EK_U10, EK_U02
EKP2	Student knows and demonstrates the operating procedures of turbosteam power plants	EK_W03, EK_U01, EK_U01, EK_U03

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		8th	
A	EKP1	Modern steam-condensate cycles of a turbosteam power plant	15
	EKP1	The efficiency of the primary circuit and ways of increasing it (interstage superheating, carnotization, coupled parameters)	
	EKP1	Turbosteam power plant operating procedures (commissioning, operation during operation, maneuvering, shutting down)	
	EKP1	Emergency procedures for turbo steam power plants	
S	EKP2	Turbosteam power plant operation procedures: – main, – auxiliary: turbo generator, cargo turbo pumps	15
Total in the semester:			30

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	30	2
Self study	20	
Participation in final tests and exams apart from classes	2	
Total	52	

Assessment methods and criteria:

Grades	2	3	3.5–4	4.5 – 5
Methods of evaluation	Written or oral test. Assessment possible using distance learning methods and techniques			
EKP1	Student erroneously describes solutions for the construction of turbosteam power plant systems. Does not know the method of determining their energy efficiency	Correctly describes the design solutions of turbosteam power plant systems. Knows the methods of determining their energy efficiency	Correctly describes the design solutions of turbosteam power plant systems with their devices. Knows the methods of determining their energy efficiency	Correctly describes and analyzes the design solutions of turbosteam power plant systems with their devices. Knows and analyzes methods of determining their efficiency aimed at increasing energy effects
EKP2	Wrongly demonstrates operating procedures	Student knows and correctly demonstrates operating procedures	Knows and correctly demonstrates operating procedures, taking into account operational disruptions	Knows and correctly demonstrates operating procedures, taking into account operational disruptions introduced by the instructor

Teaching tools:

Type	Description
Overhead projector and multimedia projector	Auditorium classes in the form of film and multimedia presentations
Instructions and guides for classes	Materials for classes using marine power plant simulators
Ship power plant simulator:	Classes with the use of a graphic and operational simulator of marine power plants
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. Kosowski K.: *Ship Turbine Power Plaust*. Fundation for the Promotion of Marine Industry, Gdańsk 2005. 2. Kowalski A.: *Okrętowe zespoły turbospalinowe*. Wydawnictwo Morskie, Gdańsk 1983. 3. Kowalski A., Krzyżanowski J.: *Okrętowe siłownie parowe*. Wydawnictwo WSM w Gdyni, Gdynia 1991. 4. Meier-Peter H., Behrnhardt F.: *Compendium Marine Engineering*. DVV Media Group, Hamburg 2009. 5. Nikiel T.: *Turbiny parowe*. WNT, Warszawa 1980. 6. Cwilewicz R., Perepeczko A.: *Okrętowe turbiny parowe*. Wydawnictwo Fundacji Rozwoju AM w Gdyni, Gdynia 2002. 7. Perycz S.: *Turbiny parowe i gazowe*. Wydawnictwo Ossolineum, Wrocław 1992. 8. Manuals and guides for ship power plant simulator classes.
Complementary literature
1. Balcerski A.: *Siłownie okrętowe*. Wydawnictwo Politechniki Gdańskiej, Gdańsk 1990. 2. Wojnowski W.: *Siłownie okrętowe*. Wydawnictwo Politechniki Gdańskiej, Gdańsk 1991. 3. Manuals, brochures, bulletins, technical documentation, websites of steam and gas turbine producers.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Cezary Behrendt, PhD Eng.	c.behrendt@am.szczecin.pl	WM
Other teachers:		
Marcin Szczepanek, PhD Eng.	m.szczepanek@am.szczecin.pl	WM

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

Operation of tankers and chemical tankers

General information about the course:

No.:	42.3	Course:	**Construction of tankers and chemical tankers**				
Major:		**Mechanics and Machine Building**	Specialisation:		**Marine Power Plant Operation**		
Studies cycle:		**First**	Form of studies:	**full-time**	Year of studies:	**4th**	Semesters: **8th**
Course status:		**elective**	Course group:	**field-specific course**			

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	T	L	E	S	P	SE	IP	PR	A	T	L	E	S	P	SE	IP	PR	
8th	15	1				1					15				15					1
Total during studies											15				15					1

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Theory and construction of the ship
2.	Information technology
3.	Fundamentals of automation and robotics
4.	Ship machinery and equipment
5.	Marine environment protection
6.	Management of the safe operation of the ship

Course objectives:

1.	Getting to know, on the basis of the applicable conventions and regulations, the requirements concerning the structure, construction and equipment of tankers

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Student has knowledge of the types and construction of ships as well as the regulations and specificity of sea transport by tankers	EK_W03, EK_W02, EK_W04, EK_U05, EK_U07, EK_U10, EK_U02, EK_U04, EK_K03, EK_K01
EKP2	Knows the technical solutions of the structure of cargo tanks, the construction and equipment of cargo systems, safety systems as well as cargo control and calculation	EK_W03, EK_W02, EK_W04, EK_U05, EK_U07, EK_U10, EK_U02, EK_U04, EK_K03, EK_K01
EKP3	Knows the certification and inspection procedures for tanker safety systems	EK_W03, EK_W02, EK_W04, EK_U05, EK_U07, EK_U10, EK_U02, EK_U04, EK_K03, EK_K01

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		8th	
A	EKP1	Sea transport of petroleum products, types of cargo and regulations for the transport of petroleum products	15
	EKP1	Physico-chemical properties of typical cargo carried by tankers and the risks to human health and the environment arising from these properties	
	EKP1	Tanker types and their ability to carry specific petroleum products	
	EKP2	Requirements for the construction and equipment of tankers in the light of applicable conventions and regulations	
	EKP2	Tanker-specific design solutions	
	EKP2	Design solutions of cargo systems and atmosphere control in cargo tanks of tankers	
	EKP3	Tanker-specific certification, surveys and inspections	
S	EKP3	Student operates ship power plants, tankers and chemical tankers	15
Total in the semester:			30

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	30	1
Self study	10	
Participation in final tests and exams apart from classes	2	
Total	42	

Assessment methods and criteria:

Grades	2	3	3.5–4	4.5 – 5
Grading method	Final written test, attendance control. Assessment possible using distance learning methods and techniques			
EKP1	Student has no elementary knowledge of the specifics of petroleum products sea transport. Does not know the basic regulations and conditions relating to the transportation of petroleum products by ships. Cannot list and describe basic types of tankers	Student has elementary knowledge of the specifics of petroleum products sea transport. Knows the basic rules and requirements for the transportation of petroleum products by ships. Can list and describe the basic types of tankers	Student has elementary knowledge of the specifics of petroleum products sea transport. Can describe the physical and chemical properties of cargo. Knows the basic rules and requirements for the transportation of petroleum products by ships. Can describe and characterize basic types of tankers	Student has good knowledge of the specifics of petroleum products sea transport. Can describe the physico-chemical properties of cargo and characterize the threats existing during the sea transport of petroleum products. Knows the basic rules and requirements for the transportation of petroleum products by ships. Can describe and characterize basic types of tankers
EKP2	Does not know the basic requirements for the structure of tanker hull defined in the classification rules. Cannot describe the construction of the basic types of oil tankers cargo tanks. Does not know the configuration of cargo systems, inert gas and security systems	Can define the basic requirements for tanker hull structure defined in the classification regulations. Has elementary knowledge of the construction of basic types of cargo tanks of tankers. Can describe configuration of cargo systems, inert gas and security systems	Can define and characterize the basic requirements for tanker hull structure defined in the classification regulations. Has knowledge of the construction of basic types of cargo tanks of tankers. Can describe configuration of cargo systems, inert gas and security systems	Can define and characterize the basic requirements for tanker hull structure defined in the classification regulations. Has knowledge of the design of cargo tanks of oil tankers. Can characterize the technology and materials used in the construction of cargo tanks. Can describe the configuration of cargo systems, inert gas, security systems and vapor return system
EKP3	Cannot list and define the basic procedures for surveys, inspection and certification of tanker safety systems	Can list and define the basic procedures for surveys, inspection and certification of tanker safety systems	Can characterize the basic procedures for the survey, inspection and certification of gas detection systems, cargo tank pressure control and tanker safety systems	Can characterize the basic procedures for the maintenance, inspection and certification of gas detection systems, pressure control in cargo tanks and tanker safety systems. Has knowledge of the construction of testing devices and knows the rules of use and handling of testers

Teaching tools:

Type	Description
Projector	Auditorium classes in the form of multimedia presentations and films
Ship documentation	Operation and maintenance documentation of selected tanker ship installations (product carrier, VLCC)
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature

1. International Convention for the Safety of Life at Sea SOLAS 74/78 as amended. PRS, 2009.
2. International Convention for the Prevention of Pollution from Ships MARPOL 73/78 as amended. PRS, 2007.
3. IMO Publications MEPC (Marine Environment Protection Committee) 2010–2013, www.imo.org.
4. ISM - International Management Code for the Safe Operation of Ships and for Pollution Prevention. PRS, 2009.

5. ISGOTT 5^{th} edition, ed. International Chamber of Shipping Oil Companies, 2006.
Complementary literature
1. Technical and operational instructions for selected tankers 2. Sample SMS of a tanker / VLCC

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Władysław Kamiński, PhD Eng.	w.kaminski@am.szczecin.pl	WM
Other teachers:		

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	43.3	Course:	Operation of tankers and chemical tankers				
Major:	**Mechanics and Machine Building**	Specialisation:		**Marine Power Plant Operation**			
Studies cycle:	**First**	Form of studies:	**full-time**	Year of studies:	**4th**	Semesters:	**8th**
Course status:	**elective**	Course group:	**field-specific course**				

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	E	L	EL	S	P	SE	TW	PR	A	E	L	EL	S	P	SE	TW	PR	
8th	15	1E		1		0.4					15		15		6					2
Total during studies											15		15		6					2

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Construction of tankers
2.	Ship machinery and equipment
3.	Fundamentals of automation and robotics
4.	Information technology
5.	Marine environment protection
6.	Management of the safe operation of the ship

Course objectives:

1.	Understanding the principles of operation of cargo systems, cargo pumps, hydraulic systems, cargo handling and calculation systems as well as ship safety systems for the transport of petroleum products
2.	Acquiring the ability to carry out basic cargo operations

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Student knows the cargo handling systems, fittings and pipelines of cargo systems as well as the specificity and procedures of cargo operations	EK_W03, EK_W02, EK_W04, EK_U05, EK_U07, EK_U10, EK_U02, EK_U04, EK_K03, EK_K01
EKP2	Knows the operation principles of devices used in cargo systems, cargo pumps, their drives, inert gas installations and the VRS (vapor recovery system)	EK_W03, EK_W02, EK_W04, EK_U05, EK_U07, EK_U10, EK_U02, EK_U04, EK_K03, EK_K01
EKP3	Knows the principles of operation and testing of detection systems, atmosphere control in tanks, security systems and load calculation systems	EK_W03, EK_W02, EK_W04, EK_U05, EK_U07, EK_U10, EK_U02, EK_U04, EK_K03, EK_K01

EKP4	Has the ability to carry out basic cargo operations for a ship for petroleum products transport	EK_W03, EK_W02, EK_W04, EK_U05, EK_U07, EK_U10, EK_U02, EK_U04, EK_K03, EK_K01

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		8th	
A	EKP1	The specificity of loading / unloading procedures based on design features specific to tankers	15
	EKP1	Tanker cargo handling procedures and technical systems for their handling	
	EKP1,3	Pipelines and fittings used in tankers cargo systems	
	C	Cargo handling systems (inert gas, ship-to-shore connection system, VRS)	
	EKP2	Operation of pumps used in cargo systems	
	EKP2	Operation of cargo pumps and their propulsion systems on tankers	
	EKP3,4	Operation of toxic gas detection installations and pressure control in the cargo tanks of an oil tanker	
	EKP4	Handling the control of the cargo amount in the oil tanker cargo tanks	
L	EKP4	Configuration and operation of computer systems for calculating the amount of cargo in ship's tanks	15
	EKP2	Construction and operation of hydraulic systems of cargo pumps	
S	EKP1,3,4	Tanker loading operation	6
	EKP1,3,4	Tanker unloading operation	
	EKP1,3,4	Operation to regulate the pressure atmosphere and the oxygen content in the cargo tanks of a tanker	
	EKP1,3,4	Parallel cooperation of cargo pumps	
Total in the semester:			36

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	36	2
Self study	10	
Participation in final tests and exams apart from classes	10	
Total	56	

Assessment methods and criteria:

Grades	2	3	3.5–4	4.5 – 5
Grading method	Auditorium classes - final written and oral exam. Simulator - practical and theoretical completion of all topics of exercises. Assessment possible using distance learning methods and techniques			
EKP1	Has no elementary knowledge of the construction and operation of cargo systems and is unable to list basic cargo procedures	Has elementary knowledge of the construction and operation of cargo systems and can list the basic loading procedures	Has basic knowledge of the construction and operation of cargo systems and is able to define basic cargo procedures	Can describe the structure and fittings of cargo systems, can explain the functions and principles of operation of safety and cargo handling systems and can characterize the basic cargo procedures
EKP2	Has no elementary knowledge of the construction and operation of cargo pumps and gas inert generators. Can't explain gas inert system diagrams	Has elementary knowledge of the construction and operation of cargo pumps and gas inert generators. Can explain gas inert system diagrams	Has a basic knowledge of the construction and operation of cargo pumps and inert gas generators. Can explain gas inert systems and characterize their functions	Has good knowledge of the construction and operation of cargo pumps and gas inert generators. Can explain gas inert system diagrams, characterize their functions and discuss operating procedures
EKP3	Has no elementary knowledge of the structure and principles of operation and methods of testing gas detection systems. Cannot describe the devices and methods of atmosphere control in tanks. Cannot describe the structure and operation of radar systems for measuring the level of cargo in tanks and can not explain the principle of calculating the amount of cargo	Has elementary knowledge of the structure of gas detection systems. Is able to define the alarm thresholds and define the threats resulting from their exceeding. Can describe the devices and methods of atmosphere control in tanks. Can describe the configuration of radar systems for measuring the level of cargo in tanks and can describe the structure of the computer system for calculating the amount of cargo	Has elementary knowledge of the structure of gas detection systems. Is able to define the alarm thresholds and define the threats resulting from their exceeding. Can describe the devices and methods of atmosphere control in tanks. Can describe the configuration of radar systems for measuring the level of cargo in tanks and can describe the structure of the computer system for calculating the amount of cargo Knows the rules for calculating the amount of cargo	Has good knowledge of the structure of gas detection systems. Is able to define the alarm thresholds and define the threats resulting from their exceeding. Knows the methods of testing the system and measuring devices. Can describe the devices and methods of atmosphere control in tanks. Can describe and characterize the configuration of radar systems for measuring the level of cargo in tanks. Has knowledge of the operation of these systems and their calibration. Can characterize the structure of the computer system for calculating the amount of cargo and knows the rules of calculating the amount of cargo
EKP4	Has no elementary theoretical knowledge in the field of basic cargo operations procedures. During exercises on the simulator, student is not able to properly carry out basic cargo operations	Has elementary theoretical knowledge in the field of basic cargo operations procedures. During exercises on the simulator, student is able to correctly carry out basic cargo operations	Has basic theoretical knowledge in the field of basic cargo operations procedures. Knows the basic principles of safe cargo transfer. During exercises on the simulator, student is able to correctly carry out basic cargo operations	Has basic theoretical knowledge in the field of basic cargo operations procedures. Knows the basic principles of safe cargo transfer. During exercises on the simulator, student is able to correctly carry out basic cargo operations Has the ability to diagnose simulated failures and is able to solve the resulting problems

Teaching tools:

Type	Description
Projector	Auditorium classes in the form of multimedia presentations and films
Ship documentation	Technical and operational documentation of selected ship installations
Simulators	Simulator exercises in the field of cargo operations on ships for the transport of petroleum products
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. International Convention for the Safety of Life at Sea SOLAS 74/78 as amended. PRS, 2009. 2. International Convention for the Prevention of Pollution from Ships MARPOL 73/78 as amended. PRS, 2007. 3. IMO: MEPC Publications (Marine Environment Protection Committee) 2010–2013, www.imo.org. 4. ISM - International Management Code for the Safe Operation of Ships and for Pollution Prevention. PRS, 2009. 5. ISGOTT 5th edition. Ed. International Chamber of Shipping Oil Companies, 2006.
Complementary literature
1. Technical and operational instructions for selected tankers 2. Sample SMS of a tanker / VLCC 3. Sample of a P&A Manual (Procedure & Arrangement) for a tanker.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Władysław Kamiński, PhD Eng.	w.kaminski@am.szczecin.pl	WM
Other teachers:		

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	**44.3**	Course:	**Ecological aspects of tankers and chemical tankers opration**				
Major:	**Mechanics and Machine Building**	Specialisation:	**Marine Power Plant Operation**				
Studies cycle:	**First**	Form of studies:	**full-time**	Year of studies:	**4th**	Semesters:	**8th**
Course status:	**elective**	Course group:	**field-specific course**				

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	T	L	E	S	P	SE	IP	PR	A	T	L	E	S	P	SE	IP	PR	
8th	15	1				0.7					15				10					1
Total during studies											15				10					1

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Building of ships for chemicals transportation
2.	Ship machinery and equipment
3.	Fundamentals of automation and robotics
4.	Information technology
5.	Marine environment protection
6.	Management of the safe operation of the ship

Course objectives:

1.	Acquiring knowledge in the field of: ecological aspects of tanker operation, tanker operation procedures related to reducing the impact of petrochemical products on the environment and human health, environmental accident prevention procedures and emergency procedures

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Knows and identifies the risk of a dangerous impact of tankers on humans and the environment, knows, understands, is able to practically use and apply international environmental protection regulations specific to tankers	EK_W02, EK_U05, EK_U04
EKP2	Knows the methods of control and knows how to control the atmosphere of cargo tanks with the use of specialized equipment, knows the procedures of tank washing and knows how to properly plan the operation of washing the cargo tanks	EK_W02, EK_U05, EK_U04
EKP3	Knows the procedures related to the prevention of environmental accidents and knows emergency procedures and is able to properly react to emergency situations	EK_W02, EK_U05, EK_U04

EKP4	Knows the publications: P&A Manual, MSDS and SOPEP, Ballast Management and knows how to use them in practice	EK_W02, EK_U05, EK_U04

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		8th	
A	EKP1	Risks to crew health and the environment related to the carriage of petrochemical products on board ships	15
	EKP1,2	Tanker cargo tank atmosphere and methods of its control	
	EKP1	Fire protection of tankers	
	EKP1,2	Specialist equipment on tankers devoted to environmental protection	
	EKP1,3,4	Marpol regulations and IMP-MPEC arrangements for the prevention of spills and environmental protection for tankers	
	EKP1,4	Instruments and equipment for the safety control of tankers	
	EKP4	Procedures for preparing tanker cargo operations	
	EKP4	Ship's ballasting procedures	
	EKP1,2,4	General procedures for cleaning the cargo tanks, disposal of cargo residues and tank ventilation	
	EKP3	Tankers alarm and emergency procedures	
S	EKP3,4	Practical use of "SOPEP"	10
	EKP4	Practical use of "Cargo Record Book"	
	EKP1,3,4	Practical use of "check lists" for typical tanker procedures	
	EKP1,4	Practical use of "MSDS"	
	EKP2,4	Practical use of the "P&A Manual"	
	EKP1,4	Practical use of the "Ballast Management Manual"	
Total in the semester:			25

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	25	1
Self study	10	
Participation in final tests and exams apart from classes	2	
Total	37	

Assessment methods and criteria:

Grades	2	3	3.5–4	4.5 – 5
Grading method	Written credit at the end of the semester, checking class attendance. Assessment possible using distance learning methods and techniques			

EKP1	Student does not know and is not able to identify the risk of a dangerous impact of petrochemical products on humans and the environment, and is not familiar with international regulations specific to tankers regarding environmental protection	Has elementary knowledge of the hazardous human and environmental effects of petrochemical products, and of international tanker-specific environmental protection regulations	Is able to define and characterize the impact on human health and the environment of transported petrochemical products and knows the international regulations specific to tankers related to environmental protection	Can define and characterize the impact on human health and the environment of transported petrochemical products and knows the international regulations specific to tankers related to environmental protection. Has knowledge of the latest international publications
EKP2	Is unable to characterize the methods of controlling the atmosphere of cargo tanks and does not know the basic principles of washing the cargo tanks	Has a basic knowledge of how to control the atmosphere of cargo tanks and knows the basic principles of washing cargo tanks, can plan the operation of washing cargo tanks	Is able to characterize the methods of controlling the atmosphere of cargo tanks and knows the rules of washing cargo tanks, is able to properly plan the operation of washing the cargo tanks	Is able to characterize the methods of controlling the atmosphere of cargo tanks and knows the rules of washing cargo tanks, is able to properly plan the operation of washing the cargo tanks of a ship for various typical and atypical petroleum products
EKP3	Has no knowledge of procedures related to the prevention of environmental accidents and does not know emergency procedures	Has elementary knowledge of procedures related to the prevention of environmental accidents and knows emergency procedures	Has knowledge of procedures related to the prevention of environmental accidents and knows emergency procedures and is able to properly respond to emergency situations	Has knowledge of procedures related to the prevention of environmental accidents, knows emergency procedures and is able to properly react to emergency situations. Can indicate the possibilities of increasing the possibilities of prevention and prevention of environmental accidents
EKP4	Is not able to name and characterize publications on the ecological aspects of tanker operation	Has elementary knowledge of the following publications: P&A Manual, MSDS and SOPEP, Ballast Management Plan regarding the ecological aspects of tanker operation	Has knowledge of the following publications: P&A Manual, IBC Code and SOPEP, Ballast Management Plan regarding the ecological aspects of tanker operation and is able to use it in practice	Has knowledge of the following publications: P&A Manual, MSDS and SOPEP, Ballast Management Plan regarding the ecological aspects of tanker operation and is able to use it in practice. Can point out weak points in the instructions and the possibility of their modification in order to prevent environmental accidents

Teaching tools:

Type	Description
Projector	Auditorium classes in the form of multimedia presentations and films
Ship documentation	Technical and operational documentation of selected ship installations
Ship documentation	P&A Manual, IBC Code, SOPEP, Ballast Management Plan, MSDS
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature

1. International Convention for the Safety of Life at Sea SOLAS 74/78 as amended. PRS, 2009.
2. International Convention for the Prevention of Pollution from Ships MARPOL 73/78 as amended. PRS, 2007.
3. IMO: International Code for the Construction & Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code). 2007 edition.
4. ISM - International Management Code for the Safe Operation of Ships and for Pollution Prevention. PRS, 2009.
5. ISGOTT 5th edition. Ed. International Chamber of Shipping Oil Companies, 2006.

Complementary literature
1. Technical and operational instructions for selected tankers 2. Sample SMS of a tanker. 3. Sample "Ballast Management Plan" of a tanker. 4. Sample "Ship Oil Pollution Emergency Plan" of an oil tanker. 5. Sample "MSDS (material safety data sheet)" of petrochemical products being shipped in bulk. 6. Sample of the "Precedures & Arrangement Manual" of a tanker.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Władysław Kamiński, PhD Eng.	w.kaminski@am.szczecin.pl	WM
Other teachers:		

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	**45.3**	Course:	**Work safety on tankers and chemical tankers**				
Major:		**Mechanics and Machine Building**	Specialisation:		**Marine Power Plant Operation**		
Studies cycle:		**First**	Form of studies:	**full-time**	Year of studies:	**4th**	Semesters:	**8th**
Course status:		**elective**	Course group:	**field-specific course**			

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	E	L	EL	S	P	SE	TW	PR	A	E	L	EL	S	P	SE	TW	PR	
8th	15	1E				1					15			15						2
Total during studies											15			15						2

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Construction of tankers and chemical tankers
2.	Ship machinery and equipment
3.	Fundamentals of automation and robotics
4.	Information technology
5.	Marine environment protection
6.	Management of the safe operation of the ship

Course objectives:

1.	Acquiring knowledge in the field of: safety and safety management, risk related to the properties of the transported cargo, fire detection and fighting, and emergency procedures

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Student knows the issues related to the properties of the transported petroleum products and chemical substances in cargo tanks, such as toxicity, explosiveness and their impact on human health, with particular emphasis on the principles of first aid	EK_W02, EK_U05, EK_U04
EKP2	Knows the systems of detecting and fighting fires on the ship	EK_W02, EK_U05, EK_U04
EKP3	Knows the SMS requirements for safety and ship safety management	EK_W02, EK_U05, EK_U04
EKP4	Knows the procedures of "risk assessment" when undertaking hazardous works, procedures for granting permits for special works and devices for controlling explosive and toxic cargo, and knows the procedures and systems used in critical situations	EK_W02, EK_U05, EK_U04

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		8th	
A	EKP1	Selected issues regarding flammability, toxicity and explosiveness of petroleum products transported in cargo tanks of tankers and chemical tankers	15
	EKP1	The influence of typical petroleum and chemical products on human health and the principles of first aid	
	EKP2	Fire protection Tankers and chemical tankers, extinguishing agents and fire detection and fighting systems	
	EKP3	Procedures and guidelines for safe operation of loading and unloading installations of tankers and chemical tankers	
	EKP3	Ship Safe Operation Management (ISM code)	
	EKP4	Instruments and equipment for the control of toxicity, explosiveness and atmosphere in confined spaces	
	EKP4	Permission procedures for special works	
	EKP4	Risk Assessment when undertaking dangerous work	
	EKP4	Contingency plans and emergency procedures	
S	EKP4	Construction, principle of operation and testing of an explosive vapor and gas detection system. Portable devices for determining the explosiveness, toxicity and composition of the atmosphere in confined spaces	15
	EKP2	Fire detection and fighting systems, extinguishing agents and extinguishing equipment. Fire fighting procedures	
Total in the semester:			30

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	30	2
Self study	16	
Participation in final tests and exams apart from classes	2	
Total	48	

Assessment methods and criteria:

Grades	2	3	3.5–4	4.5 – 5
Grading method	Written credit at the end of the semester, checking class attendance. Assessment possible using distance learning methods and techniques			
EKP1	Student does not know the physico-chemical properties of petroleum products transported in cargo tanks. Does not know how to proceed and provide first	Has an elementary knowledge of the physico-chemical properties of petroleum products and crude oil products transported in cargo tanks.	Can define and characterize the flammability, explosiveness and toxicity of petroleum and ecological products transported in cargo tanks. Knows their	Can define and characterize the flammability, explosiveness and toxicity of petroleum and ecological products transported in cargo tanks. Can indicate

	aid in case of poisoning with petroleum products and their vapors	Knows their effects on human health Know hows to proceed and provide first aid in case of poisoning with petroleum products and their vapors	effects on human health Knows how to proceed and provide first aid in case of poisoning with petroleum products and their vapors	the alarm thresholds of explosiveness and toxicity and knows the rules of their measurement. Has knowledge of safe handling of petroleum products. Knows the influence of the transported petroleum and natural products on human health. Knows how to proceed and provide first aid in case of poisoning with petroleum products and their vapors
EKP2	Does not know fire detection systems, cannot describe the construction of ship fire protection installations. Has no elementary knowledge of extinguishing agents and firefighting equipment as well as fire fighting procedures on tankers and chemical tankers	Has a basic knowledge of fire detection systems and is able to describe the construction of ship fire protection installations. Has a satisfactory knowledge of extinguishing agents and firefighting equipment as well as procedures for fighting fires on tankers and chemical tankers	Knows the construction of fire detection systems and is able to describe and characterize the construction of ship fire protection installations. Has a satisfactory knowledge of extinguishing agents and firefighting equipment, and is able to discuss fire fighting procedures in the aspect of various levels of ship hazard	Knows the construction of fire detection systems and is able to describe and characterize the construction of ship fire protection installations. Also knows the basic principles of their exploitation. Has knowledge of extinguishing agents and firefighting equipment, and is able to discuss fire fighting procedures in the aspect of various levels of ship hazard
EKP3	Has no knowledge of the safety and ship safety management requirements and procedures. Is not able to define the basic guidelines for the transport of petroleum and chemical products contained in the IMO regulations, and is also unable to discuss the basic assumptions specified in the ship's safety system manuals	Has an elementary knowledge of the requirements and procedures for safety and ship safety management. Can list the basic guidelines for the transport of petroleum and chemical products contained in the IMO regulations. Can also discuss the instructions of the ship's safety system	Has knowledge of the safety and ship safety management requirements and procedures. Is able to list and interpret the basic regulations regarding the transport of petroleum and ecological products contained in the IMO regulations. Can also discuss the instructions of the ship's safety system	Has knowledge of the safety and ship safety management requirements and procedures. Is able to list and interpret the basic rules and construction and equipment requirements for ships carrying petroleum products and crude oil products included in the IMO regulations. Can also discuss the instructions of the ship's safety system and knows the recommendations of classification societies regarding the safe operation of gas tankers and chemical tankers
EKP4	Does not know the structure and operation of the vapor and gas detection system. Is not familiar with portable devices for measuring the explosiveness, toxicity and composition of the atmosphere in tanks. Is unable to define the rules for obtaining permits for special works on the ship. Does not know the rules for creating risk assessment procedures for hazardous work. Is also unable to explain emergency procedures and contingency plans	Knows the structure and operation of the vapor and gas detection system. Is familiar with portable devices for measuring the explosiveness, toxicity and composition of the atmosphere in tanks. Is able to define the rules for obtaining permits for special works on the ship. Knows the rules for creating risk assessment procedures for hazardous work. Has elementary knowledge of the procedures used in critical situations	Knows the structure, principle of operation and methods of testing the vapor and gas detection system. Is familiar with portable devices for measuring the explosiveness, toxicity and composition of the atmosphere in tanks. Can define the rules of obtaining permits for special works and can give the basic rules for the organization of such works on the ship. Knows the rules for creating risk assessment procedures for hazardous work. Can explain the procedures used in critical situations	Knows the structure, principle of operation and methods of testing the vapor and gas detection system. Knows the structure and methods of using portable devices for measuring the explosiveness, toxicity and composition of the atmosphere in tanks. Can define the rules of obtaining permits for special works and can give the basic rules for the organization of such works on the ship. Knows the principles of creating risk assessment procedures for hazardous work and can, based on

			and has a general understanding of the rules of conduct in such situations	these procedures, indicate correct actions. Can explain the procedures used in critical situations and has a general understanding of the rules of conduct in such situations

Teaching tools:

Type	Description
Projector	Auditorium classes in the form of multimedia presentations and films
Ship documentation	Technical and operational documentation of selected ship installations
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. International Convention for the Safety of Life at Sea SOLAS 74/78 as amended. PRS, 2009. 2. International Convention for the Prevention of Pollution from Ships MARPOL 73/78 as amended. PRS, 2007. 3. IMO: MEPC Publications (Marine Environment Protection Committee) 2010–2013, www.imo.org. 4. ISM - International Management Code for the Safe Operation of Ships and for Pollution Prevention. PRS. 2009. 5. 5. ISGOTT 5th edition. Ed. International Chamber of Shipping Oil Companies, 2006.
Complementary literature
1. Technical and operational instructions for selected tankers 2. Sample SMS of a tanker

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Władysław Kamiński, PhD Eng.	w.kaminski@am.szczecin.pl	WM
Other teachers:		

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

Operation of gas carriers

General information about the course:

No.:	42.4	Course:	Construction of ships for the transportation of liquefied gases				
Major:	**Mechanics and Machine Building**	Specialisation:		**Marine Power Plant Operation**			
Studies cycle:	**First**	Form of studies:	**full-time**	Year of studies:	**4th**	Semesters:	**8th**
Course status:	**elective**	Course group:	**field-specific course**				

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	T	L	E	S	P	SE	IP	PR	A	T	L	E	S	P	SE	IP	PR	
8th	15	1				1					15				15					1
Total during studies											15				15					1

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Theory and construction of the ship
2.	Information technology
3.	Fundamentals of automation and robotics
4.	Ship machinery and equipment
5.	Marine environment protection
6.	Management of the safe operation of the ship

Course objectives:

1.	Based on the applicable conventions and regulations, familiarizing with the requirements for the construction, construction and equipment of ships for the carriage of liquefied gases

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Student has knowledge of the types and construction of ships as well as the regulations and specificity of sea transport by tankers for liquefied gases	EK_W03, EK_W02, EK_W04, EK_U05, EK_U07, EK_U10, EK_U02, EK_U04, EK_K03, EK_K01
EKP2	Knows the technical solutions of the structure of cargo tanks, the construction and equipment of cargo systems, safety systems as well as cargo control and calculation	EK_W03, EK_W02, EK_W04, EK_U05, EK_U07, EK_U10, EK_U02, EK_U04, EK_K03, EK_K01
EKP3	Knows the certification and inspection procedures for the safety systems of ships for transportation of liquefied gases	EK_W03, EK_W02, EK_W04, EK_U05, EK_U07, EK_U10, EK_U02, EK_U04, EK_K03, EK_K01

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		8th	
A	EKP1	Sea transport of gases, types of cargo and regulations for the transport of liquefied gases	15
	EKP1	Physico-chemical properties of typical cargo carried by gas tankers and the risks to human health and the environment arising from these properties	
	EKP1	Types of gas carriers and their ability to carry particular gases	
	EKP2	Requirements for the construction and equipment of tankers in the light of applicable conventions and regulations	
	EKP2	Gas tanker-specific design solutions	
	EKP2	Design solutions of cargo systems and atmosphere control in cargo tanks of gas tankers	
	EKP3	Gas tanker-specific certification, maintenance and inspections	
S	EKP3	Procedures for certification, maintenance and inspection of gas detection systems, sprinkler systems and water curtains.	15
	EKP3	Procedures for certification, maintenance and inspection of Emergency Shut Down valves of the cargo system and safety systems	
Total in the semester:			30

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	30	1
Self study	10	
Participation in final tests and exams apart from classes	2	
Total	42	

Assessment methods and criteria:

Grades	2	3	3.5–4	4.5 – 5
Grading method	Final written test, attendance control. Assessment possible using distance learning methods and techniques			
EKP1	Student has no elementary knowledge of the specifics of liquefied gas sea transport. Does not know the basic regulations and conditions relating to the transportation of liquefied gases by ships. Cannot list	Student has elementary knowledge of the specifics of liquefied gas sea transport. Knows the basic regulations and requirements for the transportation of liquefied gases by ships. Cannot list and	Student has elementary knowledge of the specifics of liquefied gas sea transport. Can describe the physical and chemical properties of cargo. Knows the basic regulations and requirements for the transportation of liquefied gases by ships.	Student has good knowledge of the specifics of liquefied gas sea transport. Can describe the physico-chemical properties of cargo and characterize the threats existing during the sea transport of petroleum products. Knows the basic regulations and requirements for the transportation of liquefied gases by ships. Can describe and

	and describe the basic types of gas carriers	describe the basic types of gas carriers	Can describe and characterize basic types of gas tankers	characterize basic types of gas tankers
EKP2	Does not know the basic requirements for the hull structure of gas carriers contained in the classification regulations and the IGC Code. Cannot describe the construction of the basic types of gas tankers cargo tanks. Does not know the configuration of cargo systems, inert gas and security systems	Can define the basic requirements for the hull structure of gas tankers included in the classification regulations and the IGC Code. Has elementary knowledge of the construction of basic types of cargo tanks of gas tankers. Can describe configuration of cargo systems, inert gas and security systems	Can define and characterize the basic requirements for gas tanker hull structure defined in the classification regulations. Has knowledge of the construction of basic types of gas cargo tanks. Can describe the configuration of cargo systems, inert gas, security systems and gas liquefaction systems	Can define and characterize the basic requirements for gas tanker hull structure defined in the classification regulations. Has knowledge of the construction of gas tankers cargo tanks. Can characterize the technology and materials used in the insulation of cargo tanks. Can describe the configuration of cargo systems, inert gas, security systems and gas liquefaction systems
EKP3	Cannot list and define the basic procedures for surveys, inspection and certification of gas tanker safety systems	Can list and define the basic procedures for maintenance, inspection and certification of gas tanker safety systems	Can characterize the basic procedures for the maintenance, inspection and certification of gas detection systems, spray and water curtains, emergency quick closing of cargo valves and gas tanker safety systems	Can characterize the basic procedures for the maintenance, inspection and certification of gas detection systems, spray and water curtains, emergency quick closing of cargo valves and gas tanker safety systems. Has knowledge of the testing instruments construction and knows the rules of use and handling of testers (gas mixtures for testing safety systems)

Teaching tools:

Type	Description
Projector	Auditorium classes in the form of multimedia presentations and films
Ship documentation	Technical and operational documentation of selected ship installations
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature

1. Chorowski M.: *Kriogenika. Podstawy i zastosowania.* IPPU Masta, 2007.
2. ABS Pacyfic Division: ABS Gas Carrier Course.
3. McGuire G., White B.: *Liquefied Gas Handling Principles on Ship and in Terminals*. SIGTTO, 2000.
4. Matyszczak M.: *Nowe rozwiązania techniczne zastosowane w systemach ładunkowych statków do przewozu skroplonego gazu ziemnego*. Nafta-Gaz 2012 Nr 2/2012.
5. IMO: International Code for the Construction & Equipment of Ships Carrying Liquefied Gases in Bulk.
6. Harris Syd: Fully Refrigerated LPG Carriers.

Complementary literature

1. Woolcott T.M.: *Liquified Petroleum Gas Tanker Practice*. 2nd ED, 2009.
2. SIGTTO. Liquefied Gas Carriers: Your Personal Safety Guide.
3. Witherbys Seamanship International: Tanker Safety Training (Liquefied Gas) Specialized Level 2007.

Course instructor:

Degree / title, name, surname, form of clas-ses	E-mail address	Teaching unit
Course supervisor:		
Marek Matyszczak, PhD Eng.	m.matyszczak@am.szczecin.pl	WM
Other teachers:		

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	**43.4**	Course:	**Operation of ships for the transport of liquefied gases**				
Major:		**Mechanics and Machine Building**	Specialisation:		**Marine Power Plant Operation**		
Studies cycle:		**First**	Form of studies:	**full-time**	Year of studies:	**4th**	Semesters:	**8th**
Course status:		**elective**	Course group:	**field-specific course**			

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	E	L	EL	S	P	SE	TW	PR	A	E	L	EL	S	P	SE	TW	PR	
8th	15	1		1		0.4					15		15		6					2
Total during studies											15		15		6					2

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Building of ships for the transportation of liquefied gases
2.	Ship machinery and equipment
3.	Fundamentals of automation and robotics
4.	Information technology
5.	Marine environment protection
6.	Management of the safe operation of the ship

Course objectives:

1.	Understanding the principles of operation of cargo systems, cargo pumps, gas compressors, cargo handling and calculation systems as well as ship safety systems for the transport of liquefied gases
2.	Acquiring the ability to carry out basic cargo operations

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Student knows the cargo handling systems, fittings and pipelines of cargo systems as well as the specificity and procedures of cargo operations	EK_W03, EK_W02, EK_W04, EK_U05, EK_U07, EK_U10, EK_U02, EK_U04, EK_K03, EK_K01
EKP2	Knows the principles of operation of compressors used in cargo systems, cargo pumps, their drives, inert gas installations and cargo cooling systems for ships for the transport of liquefied gases	EK_W03, EK_W02, EK_W04, EK_U05, EK_U07, EK_U10, EK_U02, EK_U04, EK_K03, EK_K01

EKP3	Knows the principles of operation and testing of detection systems, atmosphere control in tanks, security systems and load calculation systems	EK_W03, EK_W02, EK_W04, EK_U05, EK_U07, EK_U10, EK_U02, EK_U04, EK_K03, EK_K01
EKP4	Has the ability to carry out basic cargo operations for a ship for liquefied gases transport	EK_W03, EK_W02, EK_W04, EK_U05, EK_U07, EK_U10, EK_U02, EK_U04, EK_K03, EK_K01

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		8th	
A	EKP1	The specificity of loading / unloading procedures based on design features specific to gas tankers	15
	EKP1,3	Gas tanker cargo handling procedures and technical systems for their handling	
	EKP1,3	Pipelines and fittings used in gas tankers cargo systems	
	EKP1,2,3	Cargo handling systems (inert gas, sprinkler and water curtain system, ship-to-shore connection system)	
	EKP2	Operation of gas compressors used in cargo systems and in cargo cooling systems	
	EKP2	Operation of cargo pumps and their propulsion systems on gas tankers	
	EKP2	Operation of cargo cooling systems in cargo gas tanks for selected design solutions	
	EKP3,4	Operation of toxic gas detection installations and pressure control in the cargo tanks of a gas tanker	
	EKP4	Handling the control of the cargo amount in the gas tanker cargo tanks	
L	EKP1,2,4,3	Gas tanker loading operation	15
	EKP1,2,4,3	Gas tanker unloading operation	
	EKP1,2,4,3	Operation of pressure and temperature regulation of gas transported on a gas tanker	
	EKP1,2,4,3	Parallel cooperation of cargo pumps	
S	EKP1,2,4,3	Principle of operation and measurement capabilities of the radar system for monitoring and controlling the cargo level in the ship's tanks.	6
	EKP1,2,4,3	Systems for measuring and monitoring pressure and temperature of cargo in ship's tanks	
Total in the semester:			36

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	36	2
Self study	10	
Participation in final tests and exams apart from classes	2	
Total	48	

Assessment methods and criteria:

Grades	2	3	3.5–4	4.5 – 5
Grading method	Auditorium classes - final written and oral exam. Simulator - practical and theoretical completion of all topics of exercises. Assessment possible using distance learning methods and techniques			
EKP1	Has no elementary knowledge of the construction and operation of cargo systems and is unable to list basic cargo procedures	Has elementary knowledge of the construction and operation of cargo systems and can list the basic loading procedures	Has basic knowledge of the construction and operation of cargo systems and is able to define basic cargo procedures	Can describe the structure and fittings of cargo systems, can explain the functions and principles of operation of safety and cargo handling systems and can characterize the basic cargo procedures
EKP2	Has no elementary knowledge of the construction and operation of compressors, cargo pumps and gas inert generators. Cannot explain the diagrams of the inert gas system and the selected load cooling system	Has elementary knowledge of the construction and operation of compressors, cargo pumps and gas inert generators. Can explain the diagrams of the inert gas system and the selected load cooling system	Has basic knowledge of the construction and operation of compressors, cargo pumps and gas inert generators. Can explain the diagrams of the inertgas system and the selected charge cooling system and characterize their functions	Has good knowledge of the construction and operation of compressors, cargo pumps and gas inert generators. Can explain the diagrams of the inertgas system and the selected charge cooling system, characterize their functions and discuss operating procedures
EKP3	Has no elementary knowledge of the structure and principles of operation and methods of testing gas detection systems. Cannot describe the devices and methods of atmosphere control in tanks. Cannot describe the structure and operation of radar systems for measuring the level of cargo in tanks and can not explain the principle of calculating the amount of cargo	Has elementary knowledge of the structure of gas detection systems. Is able to define the alarm thresholds and define the threats resulting from their exceeding. Can describe the devices and methods of atmosphere control in tanks. Can describe the configuration of radar systems for measuring the level of cargo in tanks and can describe the structure of the computer system for calculating the amount of cargo	Has elementary knowledge of the structure of gas detection systems. Is able to define the alarm thresholds and define the threats resulting from their exceeding. Can describe the devices and methods of atmosphere control in tanks. Can describe the configuration of radar systems for measuring the level of cargo in tanks and can describe the structure of the computer system for calculating the amount of cargo Knows the rules for calculating the amount of cargo	Has good knowledge of the structure of gas detection systems. Is able to define the alarm thresholds and define the threats resulting from their exceeding. Knows the methods of testing the system and measuring devices. Can describe the devices and methods of atmosphere control in tanks. Can describe and characterize the configuration of radar systems for measuring the level of cargo in tanks. Has knowledge of the operation of these systems and their calibration. Can characterize the structure of the computer system for calculating the amount of cargo and knows the rules of calculating the amount of cargo

EKP4	Has no elementary theoretical knowledge in the field of basic cargo operations procedures. During exercises on the simulator, student is not able to properly carry out basic cargo operations	Has elementary theoretical knowledge in the field of basic cargo operations procedures. During exercises on the simulator, student is able to correctly carry out basic cargo operations	Has basic theoretical knowledge in the field of basic cargo operations procedures. Knows the basic principles of safe cargo transfer. During exercises on the simulator, student is able to correctly carry out basic cargo operations	Has basic theoretical knowledge in the field of basic cargo operations procedures. Knows the basic principles of safe cargo transfer. During exercises on the simulator, student is able to correctly carry out basic cargo operations Has the ability to diagnose simulated failures and is able to solve the resulting problems

Teaching tools:

Type	Description
Projector	Auditorium classes in the form of multimedia presentations and films
Ship documentation	Technical and operational documentation of selected ship installations
Simulators	Simulator exercises regarding cargo operations on ships for liquefied gases transport
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. Chorowski M.: *Kriogenika. Podstawy i zastosowania*. IPPU Masta, 2007. 2. Witherbys Seamanship International: LNG Operational Practice, 2006. 3. McGuire G., White B.: *Liquefied Gas Handling Principles on Ship and in Terminals*. SIGTTO, 2000. 4. ABS Pacyfic Division: ABS Gas Carrier Course. 5. Woolcott T.M.: *Liquified Petroleum Gas Tanker Practice*. 2nd ED, 2009.
Complementary literature
1. IMO: International Code for the Construction & Equipment of Ships Carrying Liquefied Gases in Bulk. 2. Matyszczak M.: *Nowe rozwiązania techniczne zastosowane w systemach ładunkowych statków do przewozu skroplonego gazu ziemnego*. Nafta-Gaz 2012, Nr 2/2012. 3. Technical and Operation Documentation of LNG and LPG Ships.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Marek Matyszczak, PhD Eng.	m.matyszczak@am.szczecin.pl	WM
Other teachers:		

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	44.4	Course:	**Ecological aspects of gas tanker exploitation**				
Major:		**Mechanics and Machine Building**	Specialisation:		**Marine Power Plant Operation**		
Studies cycle:		**First**	Form of studies:	**full-time**	Year of studies:	**4th**	Semesters:	**8th**
Course status:		**elective**	Course group:	**field-specific course**			

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	T	L	E	S	P	SE	IP	PR	A	T	L	E	S	P	SE	IP	PR	
8th	15	1				0.7					15				10					1
Total during studies											15				10					1

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Building of ships for the transportation of liquefied gases
2.	Ship machinery and equipment
3.	Fundamentals of automation and robotics
4.	Information technology
5.	Theory and construction of the ship
6.	Marine environment protection
7.	Management of the safe operation of the ship

Course objectives:

1.	Getting to know international conventions and regulations on environmental protection regarding the specificity of ships for the carriage of liquefied gases as well as basic documentation and instructions related to environmental protection on the ship
2.	Understanding the effects of the impact of typical cryogenic gases transported by gas tankers on the environment, human health and ship structures
3.	Getting to know security systems and emergency procedures related to the prevention of environmental accidents

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Student knows the conventions and regulations as well as documentation and procedures regulating the environmentally safe operation of gas tankers	EK_W02, EK_U05, EK_U04,
EKP2	Knows the risks to the health of the crew, ship structure and the environment related to the transportation of liquefied gases on ships	EK_W02, EK_U05, EK_U04,
EKP3	Knows the methods of controlling the atmosphere of cargo tanks on ships carrying liquefied gases	EK_W02, EK_U05, EK_U04,
EKP4	Knows specialized devices and systems related to environmental protection as well as instruments and equipment for safety control installed on gas tankers	EK_W02, EK_U05, EK_U04,
EKP5	Knows the safety procedures applicable during ship-terminal cooperation during the preparation and conduct of cargo operations	EK_W02, EK_U05, EK_U04,

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		8th	
A	EKP1	The specificity of provisions published in conventions, documents and procedures regulating ecological aspects of gas carriers operation	15
	EKP2	Risks to the health of the crew and the environment related to the carriage of liquefied gases on ships	
	EKP3	The atmosphere of cargo tanks and methods of its control	
	EKP2,4	Security systems on gas tankers	
	EKP2,4	Specialist equipment on gas tankers related to environmental protection	
	EKP1,4,5	Procedures for the preparation of gas tanker cargo operations (ship-terminal cooperation)	
L	EKP2,3	Atmospheric composition monitoring during gas exchange operations in cargo tanks (procedures, conditions, restrictions)	10
	EKP2,4	Practical operation of the gas detection system (measurements, sequences, testing)	
	EKP4.5	Communication systems: telephone, fiber optic, ship - terminal pneumatic link (Ship - Shore Links). Operation and simulation of threats. Testing of the Emergency Shut Down System	
	EKP4	Practical operation of the Tank Protection System and Gas Combustion Unit	
	EKP1	Practical use of the "IGC code", "SMPEP", "Cargo Record Book"	
	EKP1	Practical use of "check lists" for typical gas tanker procedures	

	EKP1	Practical use of "MSDS" (gas descriptions - in terms of harmfulness and safety rules)	
	EKP1	Practical use of the "P&A Manual"	
	EKP1,4	Practical use of the "Ballast Management Manual"	
Total in the semester:			25

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	25	1
Self study	10	
Participation in final tests and exams apart from classes	2	
Total	37	

Assessment methods and criteria:

Grades	2	3	3.5–4	4.5 – 5
Grading method	Auditorium classes - written test at the end of the semester. Simulator - practical and theoretical completion of all topics of exercises. Assessment possible using distance learning methods and techniques			
EKP1	Student has no elementary knowledge of the legal regulations concerning the ecological aspects of gas tanker operation. Cannot list the basic conventions and documents regulating these issues	Has an elementary knowledge of the legal regulations relating to the ecological aspects of gas tanker operation. Can list the basic conventions and documents regulating these issues and define what threats they relate to	Has a basic knowledge of the conventions and documents regulating the ecological safety of gas tankers operation. Can describe selected issues included in the conventions assigned to typical ecological threats	Has a deep knowledge of the conventions and documents regulating the ecological safety of the operation of gas carriers. Can describe and interpret the regulations, recommendations and safety procedures
EKP2	Has no elementary knowledge of the physical and chemical properties of the gases transported. Is not able to name risks to crew health and life in the event of contact with cryogenic gases. Is unable to define the explosion hazard zones on the ship. Has no knowledge of the harmful effects of the transported gases on the environment	Has elementary knowledge of the physical and chemical properties of the gases transported. Can generally identify the main threats to human health from cryogenic gases. Can describe the location of explosion hazard zones on the ship	Has basic knowledge of the physical and chemical properties of the gases transported. Can define the conditions for the formation of flammable and explosive mixtures of transported goods. Can generally identify the main threats to human health from cryogenic gases. Can describe the location of explosion hazard zones on the ship	Has deep knowledge of the physical and chemical properties of the gases transported. Can define the conditions for the formation of flammable and explosive mixtures of transported goods. Can generally identify the main threats to human health from cryogenic gases. Can describe the location of explosion hazard zones on the ship Can describe the threats and damage resulting from the spill of liquefied gases on the ship's structures. Can determine the properties of LNG and LPG gas clouds released into the atmosphere and the threats they pose

EKP3	Has no elementary knowledge of the procedures and methods of monitoring the atmosphere in cargo tanks. Does not know the devices for measuring the composition of the atmosphere in tanks and is not able to describe the places and method of taking measurement samples	Has elementary knowledge of the purpose, procedures and methods of monitoring the atmosphere in cargo tanks. Can name the basic types of devices for monitoring the atmosphere in tanks. Can describe the methods of taking samples to check the atmosphere of tanks as well as know the location of the places where these samples are taken in ship systems	Has a basic knowledge of the procedures and methods of monitoring the atmosphere in cargo tanks. Is able to define for which operations related to the handling of cargo tanks their atmosphere composition is monitored. Can list and describe the principles of operation of basic types of devices for monitoring the atmosphere in tanks. Can describe the methods of taking samples to check the atmosphere of tanks as well as know the location of the places where these samples are taken in ship systems	Has good knowledge of the procedures and methods of monitoring the atmosphere in cargo tanks. Is able to define for which operations related to the handling of cargo tanks their atmosphere composition is monitored. Can determine how the results of measurements of the composition of the atmosphere in tanks affect the course of gassing, degassing, inerting and preparation of tanks for "free gas". Can list and describe the principles of operation of basic types of devices for monitoring the atmosphere in tanks. Can describe the methods of taking samples to check the atmosphere of tanks
EKP4	Has no elementary knowledge of the safety control instruments and equipment installed on gas tankers. Cannot list and specify the purpose of the basic systems: Gas Detection System, Emergency Shut Down System, Tank Protection System, Gas Combustion Unit	Has elementary knowledge of the safety control instruments and equipment installed on gas tankers. Can list and specify the purpose of the systems: Gas Detection System, Emergency Shut Down System, Tank Protection System, Gas Combustion Unit, water curtains	Has elementary knowledge of the safety control instruments and equipment installed on gas tankers. Can describe the structure and purpose of the systems: Gas Detection System, Emergency Shut Down, Gas Combustion Unit, Tank Protection System, water curtains	Has deep knowledge of the safety control instruments and equipment installed on gas tankers. Can describe the structure, know the principles of operation and the purpose of the systems: Gas Detection System, Emergency Shut Down, Gas Combustion Unit, Tank Protection System, water curtains . Is able to describe the basic methods of ship - terminal cooperation (Ship - Shore Link)
EKP5	Has no elementary knowledge of ship-terminal cooperation. Is not familiar with communication systems and safety connections between the ship and the terminal. Cannot describe the basic procedures to be followed during port operations	Has elementary knowledge of ship-terminal cooperation. Can describe how the ship is connected to the terminal. Knows the concept of Ship Shore Links. Can define what the term Emergency Shut Down means. Is able to describe the basic points of safety procedures	Has a basic knowledge of the cooperation between the ship and the terminal. Can define the rules of telephone, fiber-optic and pneumatic connections between the ship and the terminal. Can describe the structure of the Emergency Shut Down system. Knows basic safety procedures	Has deep knowledge about the cooperation between the ship and the terminal. Can define the rules of telephone, fiber-optic and pneumatic connections between the ship and the terminal. Can describe the structure of the Emergency Shut Down system. Knows the procedures for testing the Emergency Shut Down system. Knows the safety procedures and is able to define the basic requirements formulated in the "checklists" for the ship and the terminal

Teaching tools:

Type	Description
Projector	Auditorium classes in the form of multimedia presentations and films
Ship documentation	Technical and operational documentation of selected ship installations
Simulators	Classes carried out on simulators for systems selected in this programme for testing and analysis, procedures and emergency situations
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. International Convention for the Prevention of Pollution from Ships - MARPOL 1973/78.Consolidated text, 2007 together with Protocol 1978 and Protocol 1997, includes all amendments in force as of August 1, 2007. PRS Publishing House, 2007. 2. International Convention for the Safety of Life at Sea, 1974 (SOLAS 74), Includes 2005, 2006 and 2007 amendments. PRS Publishing House, 2009. 3. International Convention on the Control and Management of Ship's Ballast Water and Sediments, 2004 (BWM Convention). PRS Publishing House, 2006 4. The International Management Code for the Safe Operation of Ships and for Pollution Prevention and Revised Guidelines on the Implementation of the ISM Code. PRS Publishing House, 2009. 5. ISGOTT International Safety Guide for Oil Tankers and Terminals 5th. Author: ICS, OCIMF and IAPH Published: Editor Witherby Seamanship International 2006. 6. Double Hull Tankers. Editor - Witherby Seamanship International 2008. 7. Tanker Jetty Safety. Editor - Witherby Seamanship International 2007. 8. Ship / Shore Interface (IP no.16) Safe Working Practice for LPG and Liquefied Chemical Gas Cargoes, Editor - Witherby Seamanship International 1997. 9. Liquefied Gases Marine Transportation and Storage Author - Vaudolon, Alain. Editor - Witherby Seamanship International 2007. 10. Liquefied Gas Handling Principles on Ships and in Terminals 3rd Ed, Authors: McGuire & White Editor - Witherby Seamanship International 2000. 11. LPG Shipping Suggested Competency Standards SIGOTTO, Editor - Witherby Seamanship International 2008. 12. International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code), PRS Edition, 2001. 13. Kriogenika. Podstawy i zastosowania, Chorowski M., IPPU Masta, 2007. 14. LNG Operational Practice, Witherbys Seamanship International, 2006. 15. ABS Gas Carrier Course, ABS Pacyfic Division: Liquified Petroleum Gas Tanker Practice
Complementary literature
1. Technical and Operation Documentation of LNG and LPG Ships.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Marek Matyszczak, PhD Eng.	m.matyszczak@am.szczecin.pl	WM
Other teachers:		

Abbreviations:
A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	**45.4**	Course:	**Work safety on gas tankers**				
Major:		**Mechanics and Machine Building**	Specialisation:		**Marine Power Plant Operation**		
Studies cycle:		**First**	Form of studies:	**full-time**	Year of studies:	**4th**	Semesters:	**8th**
Course status:		**elective**	Course group:	**field-specific course**			

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	E	L	EL	S	P	SE	TW	PR	A	E	L	EL	S	P	SE	TW	PR	
8th	15	1E				1					15				15					2
Total during studies											15				15					2

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Building of ships for the transportation of liquefied gases
2.	Ship machinery and equipment
3.	Fundamentals of automation and robotics
4.	Information technology
5.	Marine environment protection
6.	Management of the safe operation of the ship

Course objectives:

1.	Acquiring knowledge in the field of: safety and safety management, risk related to the properties of the transported cargo, fire detection and fighting, and emergency procedures

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Student knows the issues related to the properties of gases transported in cargo tanks of gas carriers, such as toxicity, explosiveness and their impact on human health, with particular emphasis on the principles of first aid	EK_W02, EK_U05, EK_U04,
EKP2	Knows the systems of detecting and fighting fires on the ship	EK_W02, EK_U05, EK_U04,
EKP3	Knows the SMS requirements for safety and ship safety management	EK_W02, EK_U05, EK_U04,
EKP4	Knows the procedures of "risk assessment" when undertaking hazardous works, procedures for granting permits for special works and devices for controlling explosive and toxic cargo, and knows the procedures and systems used in critical situations	EK_W02, EK_U05, EK_U04,

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		8th	
A	EKP1	Selected issues concerning the flammability, toxicity and explosiveness of gases transported in cargo tanks of gas tankers	15
	EKP1	The influence of typical gases on human health and the principles of providing medical first aid	
	EKP2	Fire protection Gas tankers, extinguishing agents and fire detection and fighting systems	
	EKP3	Procedures and guidelines for safe operation of gas tankers installations	
	EKP3	Ship Safe Operation Management (ISM code)	
	EKP4	Instruments and equipment for the control of toxicity, explosiveness and atmosphere in confined spaces	
	EKP4	Permission procedures for special works	
	EKP4	Risk Assessment for undertaking dangerous work	
	EKP4	Contingency plans and emergency procedures	
S	EKP4	Working principle and testing of the gas detection system. Portable devices for determining the explosiveness, toxicity and composition of the atmosphere in confined spaces	15
	EKP4	Rules of conduct in a critical situation, procedures, contingency plans, strategies for dealing with such situations	
Total in the semester:			30

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	30	2
Self study	15	
Participation in final tests and exams apart from classes	15	
Total	60	

Assessment methods and criteria:

Grades	2	3	3.5–4	4.5 – 5
Grading method	Written credit at the end of the semester, checking class attendance. Assessment possible using distance learning methods and techniques			
EKP1	Student does not know the physico-chemical properties of gases transported in cargo tanks. Does not know how to proceed and provide first aid in the event of contamination with these gases	Has an elementary knowledge of the physico-chemical properties of gases transported in cargo tanks. Knows their effects on human health Knows how to proceed and provide first aid in the event of contamination with these gases	Can define and characterize the flammability, explosiveness and toxicity of gases carried in cargo tanks. Knows the impact of transported gases on human health. Knows how to proceed and provide first aid in the event of contamination with these gases	Can define and characterize the flammability, explosiveness and toxicity of gases carried in cargo tanks. Can indicate the alarm thresholds of explosiveness and toxicity and knows the rules of their measurement. Has knowledge of the safe handling of cryogenic substances and systems. Knows the influence of transported gases on human health. Knows how to proceed and provide first aid in the event of contamination with these gases
EKP2	Does not know fire detection systems, cannot describe the construction of ship fire protection installations. Has no elementary knowledge of extinguishing agents and firefighting equipment as well as fire fighting procedures for gas tankers	Has a basic knowledge of fire detection systems and is able to describe the construction of ship fire protection installations. Has a satisfactory knowledge of extinguishing agents and firefighting equipment as well as procedures for fighting fires on gas carriers	Knows the construction of fire detection systems and is able to describe and characterize the construction of ship fire protection installations. Has a satisfactory knowledge of extinguishing agents and firefighting equipment, and is able to discuss fire fighting procedures in the aspect of various levels of ship hazard	Knows the construction of fire detection systems and is able to describe and characterize the construction of ship fire protection installations. Also knows the basic principles of their exploitation. Has knowledge of extinguishing agents and firefighting equipment, and is able to discuss fire fighting procedures in the aspect of various levels of ship hazard
EKP3	Has no knowledge of the safety and ship safety management requirements and procedures. Is unable to define the basic guidelines contained in IGC CODE, in the IMO regulations, and is also unable to discuss the basic assumptions set out in the ship's safety system manuals	Has an elementary knowledge of the requirements and procedures for safety and ship safety management. Can list the basic guidelines for gas transport in bulk contained in IGC CODE and IMO regulations. Can also discuss the instructions of the ship's safety system	Has knowledge of the safety and ship safety management requirements and procedures. Can list and interpret the basic regulations for the carriage of gas in bulk included in IGC CODE and IMO regulations. Can also discuss the instructions of the ship's safety system	Has knowledge of the safety and ship safety management requirements and procedures. Is able to list and interpret the basic rules and construction and equipment requirements for ships carrying gas in bulk included in IGC CODE and IMO regulations. Can also discuss the instructions of the ship's safety system and knows the recommendations of classification societies regarding the safe operation of gas tankers and chemical tankers
EKP4	Does not know the structure and operation of the gas detection system. Is not familiar with portable devices for measuring the explosiveness, toxicity and composition of the atmosphere in tanks. Is unable to	Knows the structure and operation of the gas detection system. Is familiar with portable devices for measuring the explosiveness, toxicity and composition of the atmosphere in tanks. Is able to define the rules for obtaining	Knows the structure, principle of operation and methods of testing the gas detection system. Is familiar with portable devices for measuring the explosiveness, toxicity and composition of the atmosphere in tanks. Can define the	Knows the structure, principle of operation and methods of testing the gas detection system. Knows the structure and methods of using portable devices for measuring the explosiveness, toxicity and composition of the atmosphere

	define the rules for obtaining permits for special works on the ship. Does not know the rules for creating risk assessment procedures for hazardous work. Is also unable to explain emergency procedures and contingency plans	permits for special works on the ship. Knows the rules for creating risk assessment procedures for hazardous work. Has elementary knowledge of the procedures used in critical situations	rules of obtaining permits for special works and can give the basic rules for the organization of such works on the ship. Knows the rules for creating risk assessment procedures for hazardous work. Can explain the procedures used in critical situations and has a general understanding of the rules of conduct in such situations	in tanks. Can define the rules of obtaining permits for special works and can give the basic rules for the organization of such works on the ship. Knows the principles of creating risk assessment procedures for hazardous work and can, based on these procedures, indicate correct actions. Can explain the procedures used in critical situations and has a general understanding of the rules of conduct in such situations

Teaching tools:

Type	Description
Projector	Auditorium classes in the form of multimedia presentations and films
Ship documentation	Technical and operational documentation of selected ship installations
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature
1. Chorowski M.: *Kriogenika. Podstawy i zastosowania*. IPPU Masta, 2007. 2. Witherbys Seamanship International: LNG Operational Practice, 2006. 3. McGuire G., White B.: *Liquefied Gas Handling Principles on Ship and in Terminals*. SIGTTO, 2000. 4. ABS Pacyfic Division: ABS Gas Carrier Course. 5. Woolcott T.M.: *Liquified Petroleum Gas Tanker Practice.* 2nd ED, 2009. 6. IMO: International Code for the Construction & Equipment of Ships Carrying Liquefied Gases in Bulk. 7. SIGTTO: Liquefied Gas Carriers; Your Personal Safety Guide 2002. 8. SIGTTO: Crew Safety Standards and Training for Large LNG Carriers, 2003. 9. SIGTTO: Liquefied Gas Fire Hazard Management, 2004.
Complementary literature
1. Technical and operational manuals for selected ships.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Marek Matyszczak, PhD Eng.	m.matyszczak@am.szczecin.pl	WM
Other teachers:		

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

Computer control systems for a marine power plant

General information about the course:

No.:	42.5	Course:	Programming of control systems				
Major:	**Mechanics and Machine Building**	Specialisation:		**Marine Power Plant Operation**			
Studies cycle:	**First**	Form of studies:	**full-time**	Year of studies:	**4th**	Semesters:	**8th**
Course status:	**elective**	Course group:	**field-specific course**				

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	T	L	E	S	P	SE	IP	PR	A	T	L	E	S	P	SE	IP	PR	
8th	15	1		2							15		30							1
Total during studies											15		30							1

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Information technology, Fundamentals of automation and robotics, Fundamentals of electrical engineering and electronics, Ship electrical engineering

Course objectives:

1.	Getting to know the software tools for programming PLC controllers
2.	Acquiring the ability to write a control program for a PLC controller
3.	Learning the principles of testing a PLC control program

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Student can program PLC controllers	EK_W05, EK_U05, EK_U07, EK_U01
EKP2	Can test the correctness of the written control program	EK_W05, EK_W05, EK_U05, EK_U07

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		8th	
A	EKP 1.2	Functional and object-oriented programming with the use of selected languages: C ++, Java, Python.	15
	EKP1	Principles of programming simple programs for a PLC controller in a selected programming language	
	EKP2	Principles of testing programs for the PLC controller	
L	EKP1,3	Basics of functional and object-oriented programming, syntax and structure of programming languages: C ++, Java, Python.	30
		Programming controllers (GE Fanuc, Siemens, SAIA, Mitsubishi) for the implementation of adjustment and control tasks	

Total in the semester:	45

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	**Estimated number of hours to complete the activity**	**ECTS points**
Total hours	45	1
Self study	5	
Participation in final tests and exams apart from classes	2	
Total	52	

Assessment methods and criteria:

Grades	**2**	**3**	**3.5–4**	**4.5 – 5**
Methods of evaluation	Assessment of the knowledge and skills during laboratory classes. Assessment possible using distance learning methods and techniques			
EKP1	Student cannot write a program for a PLC controller to perform a simple task	Can write a program for a PLC controller in order to perform a simple control task	Can write a program for a PLC controller in order to carry out a control task with few conditions, makes a small number of errors	Can write an error-free program for a PLC controller in order to carry out an extensive control task
EKP2	Cannot indicate errors in the PLC control program	Can only indicate some errors in the PLC control program	Can point out most errors in the PLC control program	Can identify most errors in the PLC control program and interpret them

Teaching tools:

Type	**Description**
Computers	PC computers with Windows operating system and Internet access; computer projector
Software	software for PLC controllers, Python IDE (e.g. Jupyter Notebook, Anaconda, PyCharm), Java IDE (e.g. Eclipse, NetBean, InteliJ IDEA), Development environment for C / C ++ / C # languages (e.g. Visual Studio, CLion)
Laboratory equipment	PLC controllers (GE Fanuc, SAIA, Siemens, Mitsubishi)
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature

1. Cadenhead R., Liberty J.: *C++ w 24 godziny*. Helion, Gliwice 2017.
2. Jamro M.: *Struktury danych i algorytmy w języku C#. Projektowanie efektywnych aplikacji*. Helion, Gliwice 2019.
3. Reitz K., Schlusser T.: *Przewodnik po Pythonie. Dobre praktyki i praktyczne narzędzia*. Helion, Gliwice 2018
4. Schildt H.: *Java. Przewodnik dla początkujących*. Wydanie VII. Helion, Gliwice 2018.
5. Flaga S.: *Programowanie sterowników PLC w języku drabinkowym*. Wydawnictwo BTC, Legionowo 2010.

6. Kasprzyk J.: *Programowanie sterowników przemysłowych*. Wydawnictwa Naukowo-Techniczne, Warszawa 2006.	
Complementary literature	
1. Company technical documentation for controllers from GE-Fanuc, Siemens, SAJA, Mitsubishi. 2. Schildt H.: *Java. Kompendium programisty*. Wydanie X. Helion, Gliwice 2019.	

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Jarosław Duda, PhD Eng.	j.duda@am.szczecin.pl	WMiE
Other teachers:		

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	**43.5**	Course:	**Algorithms and data structures**				
Major:	**Mechanics and Machine Building**	Specialisation:		**Marine Power Plant Operation**			
Studies cycle:	**First**	Form of studies:	**full-time**	Year of studies:	**4th**	Semesters:	**8th**
Course status:	**elective**	Course group:	**field-specific course**				

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	E	L	EL	S	P	SE	TW	PR	A	E	L	EL	S	P	SE	TW	PR	
8th	15	1		0.7		0.3					15		10		5					2
Total during studies											15		10		5					2

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Information technology, Fundamentals of automation and robotics, Fundamentals of electrical engineering and electronics, Ship electrical engineering

Course objectives:

1.	Learning the utility software and acquiring the skills of writing a program
2.	Getting to know the rules of testing a controller program

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Student knows data structures in programming	EK_W05, EK_U05, EK_U07, EK_U01
EKP2	Is able to use data structures for writing a program	EK_W05, EK_W05, EK_U05, EK_U07
EKP3	Can test the correctness of the written control program	EK_W05, EK_W05, EK_U05, EK_U07

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		8th	
A	EKP1	Traditional data structures: lists, queues, stacks, and heaps	15
	EKP1	Trees and operations on tree structures	
	EKP1	Set-based data types, dictionaries and priority queues with the methods of their implementation	
	EKP1	Oriented and non-oriented graphs. Iterative algorithms. Recursive procedures.	
	EKP1	Algorithm design techniques, local search and dynamic programming. Memory management	
L	EKP1,2	Practical use of data structures.	10

		Generic types. Anonymous functions.	
		Advantages and dangers of recursive procedures.	
S	EKP 1.3	Digital Twins technology - digital simulation of real objects.	5
Total in the semester:			30

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	30	2
Self study	25	
Participation in final tests and exams apart from classes	3	
Total	58	

Assessment methods and criteria:

Grades	**2**	**3**	**3.5–4**	**4.5 – 5**
Methods of evaluation	Assessment of the knowledge and skills during laboratory classes. Assessment possible using distance learning methods and techniques			
EKP1	Student cannot write a program	Can write a program in order to perform a simple control task	Can write a program in order to carry out a control task with few conditions, makes a small number of errors	Can write an error-free program in order to carry out a complex task
EKP2	Cannot point out errors in the program	Can only point out some errors in the program	Can point out most of the errors in the program	Can identify most errors in the program and interpret them

Teaching tools:

Type	Description
Computers	PCs with Windows or Linux operating system and Internet access; computer projector
Software	software for PLC controllers, Python IDE (e.g. Jupyter Notebook, Anaconda, PyCharm), Java IDE (e.g. Eclipse, NetBean, InteliJ IDEA), Development environment for C / C ++ / C # languages (e.g. Visual Studio, CLion)
Laboratory equipment	PLC controllers (GE Fanuc, SAIA, Siemens, Mitsubishi)
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature

1. Flaga S.: *Programowanie sterowników PLC w języku drabinkowym*. Wydawnictwo BTC, Legionowo 2010.
2. Kasprzyk J.: *Programowanie sterowników przemysłowych*. Wydawnictwa Naukowo-Techniczne, Warszawa 2006.
3. Cadenhead R., Liberty J.: *C++ w 24 godziny*. Helion, Gliwice 2017.
4. Jamro M.: *Struktury danych i algorytmy w języku C#. Projektowanie efektywnych aplikacji*. Helion, Gliwice 2019.

5. Reitz K., Schlusser T.: *Przewodnik po Pythonie. Dobre praktyki i praktyczne narzędzia*. Helion, Gliwice 2018 6. Schildt H.: *Java. Przewodnik dla początkujących*. Wydanie VII. Helion, Gliwice 2018.
Complementary literature
1. Company technical documentation for controllers from GE-Fanuc, Siemens, SAJA, Mitsubishi. 2. Schildt H.: *Java. Kompendium programisty*. Wydanie X. Helion, Gliwice 2019.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
		WMiE
Other teachers:		

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	44.4	Course:	**Distributed control systems**				
Major:		**Mechanics and Machine Building**	Specialisation:		**Marine Power Plant Operation**		
Studies cycle:		**First**	Form of studies:	**full-time**	Year of studies:	**4th**	Semesters: **8th**
Course status:		**elective**	Course group:	**field-specific course**			

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	T	L	E	S	P	SE	IP	PR	A	T	L	E	S	P	SE	IP	PR	
8th	15	1.75				1					25				15					2
Total during studies											25				15					2

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Information technology, Fundamentals of automation and robotics, Fundamentals of electrical engineering and electronics, Ship electrical engineering

Course objectives:

1.	Getting to know the properties and functions of hardware components of computer systems for regulation, control, measurement and supervision
2.	Getting to know the properties of computer industrial networks
3.	Learning the basic principles of mathematical description of discrete systems

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Student knows the principle of work, components, structures, properties and peculiarities of digital automatic control systems	EK_W05, EK_U05, EK_U07, EK_U01, EK_U01, EK_U05
EKP2	Knows the methods of mathematical description of digital systems	EK_W05, EK_U05, EK_U07, EK_U01
EKP3	Knows modern computerized ship automation systems	EK_W02

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Semester:		8th	

A	EKP1,2	Differential equations, Z-transformation and discrete transfer function of one-dimensional automation elements, control objects and regulators. Block diagram of a discrete control system. Digital PID controllers. The role of individual impact of PID regulation	25
	EKP1	Implementation and operation of individual blocks of the regulator. Selection of controller settings. Implementation and operation of integration limitation. Realization and operation of shock-free switching manual / automatic operation. Quality of regulation. Analysis of the stability of a discrete automatic control system	
	EKP1	Computer serial interfaces (RS 232C, RS 422, RS 423, RS 485) and parallel interfaces	
	EKP1	Structures and properties of computer networks. Transmission media. Layered model of a computer network. Industrial computer networks - Profibus (PA, DP), Modbus, DeviceNet, LonWorks. Ethernet	
	EKP1,3	Real-time control and regulation - hardware and software requirements	
	EKP1,3	Singularities of distributed regulation and control systems	
	EKP3	Examples of computer automation systems in marine applications (bulk carriers, gas carriers, ferries, ships with dynamic positioning - drilling, cable carriers, oil rigs)	
S	EKP2	Application of difference equations, Z-transformation and discrete transfer function of one-dimensional automation elements, control objects and regulators. Block diagram of a discrete control system. Digital PID controllers. The role of individual impact of PID regulation	15
	EKP1,3	Real-time control and regulation - hardware and software requirements	
	EKP1,3	Studying singularities if distributed regulation and control systems	
Total in the semester:			25

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	**Estimated number of hours to complete the activity**	**ECTS points**
Total hours	40	2
Self study	15	
Participation in final tests and exams apart from classes	5	
Total	60	

Assessment methods and criteria:

Grades	**2**	**3**	**3.5–4**	**4.5 – 5**
Grading method	Continuous assessment (current preparation for classes and activity); mid-term written tests, mid-term oral tests, final written test, final oral test, written exam, oral exam, attendance control. Assessment possible using distance learning methods and techniques			
EKP1	Student cannot list the components of the computer and digital regulation and control system	Can list the components of a computer and digital regulation and control system	Is able to list, define properties and characteristic parameters of computer and digital regulation and control systems	Can list, define properties and functions of local and distributed control systems and digital control

EKP2	Does not know the rules of mathematical description of discrete elements	Knows the rules of mathematical description of discrete elements	Can solve an easy problem in the field of discrete systems	Freely solves difficult computing problems in the field of discrete systems
EKP3	Does not know the functions of an exemplary computerized ship automation system	Knows the functions of an exemplary computerized ship automation system	Can describe the structure, functions and properties of any (discussed in the lecture) computerized ship automation system	Can compare and analyze computerized ship automation systems of different companies

Teaching tools:

Type	Description
Computers	PC computers with Windows operating system and Internet access; computer projector
Software	MATLAB with the appropriate libraries
Laboratory station.	Computer / digital control system
Platforms for e-Learning	A platform or application that enables a synchronous and asynchronous interaction between students and academic teachers and other lecturers

References:

Core literature

1. Brzózka J.: *Regulatory cyfrowe w automatyce*. MIKOM, Warszawa 2002.
2. Szafarczyk M., Śniegulska-Grądzka D., Wypysiński R.: *Podstawy układów sterowań cyfrowych i komputerowych*. PWN MIKOM, Warszawa 2007.
3. Mielczarek W.: *Szeregowe interfejsy cyfrowe*. Helion, Gliwice 1993.
4. Łukasik Z., Seta Z.: *Programowalne sterowniki PLC w systemach sterowania przemysłowego*. Politechnika Radomska, Radom 2001.
5. Grega W.: *Metody i algorytmy sterowania cyfrowego w układach scentralizowanych i rozproszonych*. AGH, Kraków 2004.
6. Zydorowicz T.: *PC i sieci komputerowe*. PLJ, Warszawa 1993.
7. Krzyżanowski R.: *Układy mikroprocesorowe*. MIKOM, Warszawa 2004.

Complementary literature

1. Kaczorek T.: *Teoria sterowania i systemów*. PWN, Warszawa 1999.
2. Kaczorek T.: *Podstawy teorii sterowania*. WNT, Warszawa 2005.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Jarosław Duda, PhD Eng.	j.duda@am.szczecin.pl	WMiE
Other teachers:		

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	45.5	Course:	Data transmission protocols				
Major:		**Mechanics and Machine Building**	Specialisation:		**Marine Power Plant Operation**		
Studies cycle:		**First**	Form of studies:	**full-time**	Year of studies:	**4th**	Semesters: **8th**
Course status:		**elective**	Course group:	**field-specific course**			

Semester	Number of weeks in the semester	Number of hours per week / block									Number of hours in a semester									ECTS
		A	T	L	E	S	P	SE	IP	PR	A	T	L	E	S	P	SE	IP	PR	
8th	15	0.7		0.7							10		10							1
Total during studies											10		10							1

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Information technology, Fundamentals of automation and robotics, Fundamentals of electrical engineering and electronics, Ship electrical engineering

Course objectives:

1.	Teaching the principles of configuring modern intelligent converters
3.	Teaching the principles of configuring modern digital regulators

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Student knows the principles of work, components, structures, properties and peculiarities of intelligent automation elements	K_W01, K_U01, K_U02, K_U07, K_U09, K_U14, K_U16

Detailed learning outcomes for the subject:

No.	Specific learning outcomes	EKP relation	A	E	L	EL	S	P	SE	TW	PR	Notes
SEKP1	Knows common data transmission protocols	EKP1	x		x							
SEKP1	Performs the configuration of the intelligent converter and the multi-functional controller	EKP1	x		x							

Programme content:

Form of classes	EKP relation	Implemented content	Number of hours
Year of studies:		8th	

A	SEKP1	Data transmission environments. Internet protocols for wired and wireless transmission. Ethernet and WLAN technology.	10
	SEKP1	Protocols used in industrial automation. HART protocol, Modbus protocols, Profibus.	
	SEKP1	Diagnostic data transmission protocols.	
	SEKP1	Possibility of shaping measurement signals and characteristics for the automation system. Analog and digital standard signals. FOXBORO intelligent transducers.	
	SEKP1	Intelligent positioners. Possibility of shaping signals and characteristics in the execution loop by intelligent positioners	
	SEKP3	Programming of multifunctional controllers. Development trends of modern intelligent automation devices	
	Total:		10
L	SEKP1	Testing the capacity of transmission networks and their resistance to interference	10
	SEKP1	Application of intelligent measuring transducers. Possibility of shaping measurement signals and characteristics for the automation system. Analog and digital standard signals. HART protocol	
	SEKP3	Programming of multifunctional controllers. Programming of multifunctional controllers from the operator's panel of the controller itself and from the computer. Development trends of modern intelligent automation devices	
	Total:		10
Total during the year:			20

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Total hours	20	1
Self study	10	
Participation in final tests and exams apart from classes	5	
Total	35	

Assessment methods and criteria:

Grades	**2**	**3**	**3.5–4**	**4.5 – 5**
Grading method	Continuous assessment (current preparation for classes and activity); final written test, attendance control. Assessment possible using distance learning methods and techniques			
EKP1	Student cannot explain the concept: smart device	Knows what intelligent automation devices are and how to configure such devices	Can configure a device under the supervision of the teacher	Is able to independently and correctly configure a smart device

Teaching tools:

Type	Description
Computers	PC computers with Windows operating system and Internet access; computer projector
Laboratory equipment	Intelligent converters by FOXBORO, APLISENS
	Intelligent positioners by FOXBORO, ZAPOL
	Digital controllers by SIEMENS, OMRON, Lumel
Platforms for e-Learning	Possible use of distance education and distance learning methods

References:

Core literature
1. Kwaśniewski J.: *Wprowadzenie do inteligentnych przetworników pomiarowych*. WNT, Warszawa 1993. 2. Trybus L.: *Regulatory wielofunkcyjne*. WNT, Warszawa 1992. 3. Brzózka J.: *Regulatory cyfrowe w automatyce*. Wydawnictwo MIKOM, Warszawa 2002. 4. Kuźnik J.: *Regulatory i układy regulacji.* Script of the Silesian University of Technology, Gliwice 2002.
Complementary literature
1. Łęski J.: *Systemy neuronowo-rozmyte.* WNT, Warszawa 2008. 2. Company technical documentation for OMRON and Siemens regulators.

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Jarosław Duda, PhD Eng.	j.duda@am.szczecin.pl	WMiE
Other teachers:		

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

PRACTICAL TRAINING

General information about the course:

No.:	**46**	Course:	**Basic vocational practice / Internship (standards of the Polish Ministry of Education and Science)**				
Major:	**Mechanics and Machine Building**	Specialisation:	**Marine Power Plant Operation**				
Studies cycle:	**First**	Form of studies:	**full-time**	Year of studies:	**2nd, 3rd**	Semesters:	**3rd, 5th**
Course status:	**mandatory**	Course group:	**Internship**				

Semester	Number of weeks in year	The number of weeks in the block									Number of weeks in the semester									ECTS
		A	E	L	EL	S	P	SE	TW	PR	A	E	L	EL	S	P	SE	TW	PR	
2nd	4									4									4	8
3rd	5(6*)									2(3*)									2(3*)	
4th										3									3	6
5th	3									3									3	
Total during studies																			12(13*)	14

*For practical trainings carried out on ferries number of hours is presented as the time spent on the vessel and the value in bracket denotes practical training time of practical training calculated by the Maritime Office for ships operated by consecutively exchanging crews or parts of crews in the so-called shift system, based on entries in the seaman's book, covering the period of one shift.

Notes:

Practical trainings in 2nd and 3rd semesters, and 4th-5th semesters constitute two separate blocks of trainings, some of which are carried out in workplaces providing research, construction and renovation services, or working in the field of construction and operation of technical devices related to the field of study. These practical trainings can also take place in production or repair yards, or in marine engine manufacturing plants. The rest of the practical training block is carried out in the machinery department of the training and research vessel, on ferries or sea vessels that meet the requirements of the convention. The scope and sequence of practical training results from the organizational structure, the possibilities of the Workplace, as well as the current availability of training in land-based facilities or on vessels. In order to ensure maximum flexibility of students' access to practical trainings, they are settled in blocks fully at the end of the third and fifth semester.

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Up-to-date health certificate confirming that there are no health obstacles for completing the training

Course objectives:

1.	Training and obtaining basic certificates necessary for practical trainings
2.	Acquainting with life and work on a ship, general familiarization with the ship work system, teaching basic seafaring skills, shaping personal qualities necessary for working at sea
3.	Developing basic skills and behaviors needed in the future profession

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Student has practical skills and behavior needed to work as an engineer in an industrial plant related to the field of study	EK_U04, EK_K01
EKP2	Has basic seafaring skills, knows the specific work of engine crews of sea-going ships and everyday life on board	EK_U04, EK_K03, EK_K02,
EKP3	Shows shaped personal qualities necessary for working at sea	EK_U07, EK_U04, EK_U05, EK_K02

Program content specific to the workshop part:

Form of classes	EKP relation	Implemented content	Number of weeks
Semester:		2nd	4
		4th	3
PR	EKP1	**Construction or maintenance supervision department**: – constructor work; – cooperation between the constructor and the ship's crew; – ship docking; – organization and coordination of outfitting or renovation works; preparation and testing of a tethered vessel	
	EKP1	**Quality control department**: – starting machines and devices by the manufacturer's service; – delivery and acceptance tests; delivery and acceptance, and post-repair documentation	
	EKP1	**Outfitting or renovation departments**: 3.1. Hull department in the production yard. 3.2. Main engine assembly or repair department. 3.3. Auxiliary engines assembly or repair department. 3.4. Engine room auxiliary mechanisms assembly or repair department. 3.5. Shaft line assembly or repair department. 3.6. Pipelines and tanks assembly or repair department. 3.7. On-board equipment assembly or renovation department. – Principles of laying pipeline routes in hull sections. – Preparation for the assembly or repair of machines. – Disassembly and cleaning of machine elements. – Measurement and verification of parts. – Methods of repair and regeneration of parts. – Selection of spare parts. – Assembly and assembly control. – Preparation for tests. Tests after assembly or renovation	
	EKP1	**Main propulsion engines assembly and testing department**: – Main drive motors assembly process. – Tests and handover procedure. – Delivery and acceptance documentation	
	EKP1	**Auxiliary engines assembly and testing department**: – Auxiliary drive motors assembly process.	

		– Tests and handover procedure. – Delivery and acceptance documentation – Chassis dynamometer	
	EKP1	**Diesel engine fuel equipment production and regeneration department**: – Machining of injection apparatus for diesel engines. – Modern machining methods	
	EKP1	**Design and R&D department** : – Main and auxiliary engines documentation – Vibration tests of shafts and hulls of marine engines	
	EKP1	**Pipeline and tank manufacturing department**: – Construction and production of SO and SP pipelines	
	EKP1	**Heavy machining departments**: – Processing of main engine fuselage assemblies. – Processing of heads and sleeves	
	EKP1	**Light machining departments**: – Processing of heads and sleeves. – Processing of sliding bearings. – Processing of pistons and rings. – Main shaft and camshaft machining processes. – Guide processing processes. – Processes of machining of connecting rods and piston rods	

Programme content specific to the marine part:

Form of classes	EKP relation	Implemented content	Number of weeks
Semester:		3rd	2(3*)
		5th	3
PR	EKP2,3	**Watches and machinery duty in port and at sea** Roles and duties of individual members of the engine and deck crew. Basic control and maintenance activities of the power plant and the ship. Safety rules for the operation of mechanical and electrical devices. Taking and handover of sea and port watches. A tour of the power plant, control of the operating parameters of engines and mechanisms. Basic service and maintenance works on machinery and on-board equipment. Keeping a machine journal. Assistance in reception and handover of fuels and oils. Assistance in reception and handover of supplies. Cleaning and inventory works in the machinery department. Getting to know the basic terms and phrases as well as the nomenclature used on the ship	
	EKP2,3	**Maneuvers** Organization of work in the power plant during port maneuvers and anchoring. Preparing the power plant for maneuvers. Principles of starting and stopping power plant mechanisms Improving orientation and training the ability to assess the condition of mechanisms. Principles of maneuvering with the main engine. Rules of conduct in emergency situations	

	EKP2,3	**Lifeboat and rescue training** Exercise alarms, improvement of alarm activities, improvement of practical and theoretical knowledge related to the safety of life and work at sea	
	EKP2,3	**Fire protection** Improving the ability to use fire protection equipment. Rules of behavior during a fire in the power plant. Exercise fire alarms Fire prevention in the power plant and on the ship during operation and repairs. Duties of the crew during fire alarms. Construction and arrangement of fire protection installations and handheld equipment. Sealing the power plant, emergency shutdown of ventilation and mechanisms, fuel quick-closing valves	
	EKP2,3	**Service and maintenance works** Improving the ability to use mechanical tools. Basic rules for disassembly and assembly of devices, pressurized tanks, electrical devices. Principles of cleaning filters, fuel and lubricating oil centrifuges. Rules for the selection of materials, maintenance and cleaning agents	
	EKP2,3	**Ship power plant installations** Basic elements of power plant and general vessel installations, principles of construction and arrangement of devices. The role of individual devices and installations. Principles of ongoing service, technical condition assessment. Independent operation of the fire protection system and bilge-ballast system. Emergency pumping of bilge	
	EKP2,3	**Machines and devices in marine power plants** The role of individual mechanisms in the operation of a ship and power plant. Principles of current assessment of the operating condition of machines and devices: pumps, fuel centrifuges, air compressors and cooling compressors, auxiliary boiler, bilge water separator, ship waste disposal devices, fans, fresh water production devices. General construction of air-conditioning, steering equipment and cold stores	
	EKP2,3	**Marine engines** Purpose, main working units of marine engines. Rules for starting and decommissioning marine engines. Principles of constant control and assessment of ship engine operation condition. Work related to the maintenance of the main and auxiliary engines during standstill. Principles of technical supervision of the operation of marine engines	
	EKP2,3	**Ship electrical engineering** Main and emergency sources of energy. Principles of construction and arrangement of devices in GTR, ATR and local switchboards. Principles of safe operation of live devices. Reading the operating parameters and condition of electrical devices. Internal and alarm communication devices, power plant telegraph, rudder position indicator, emergency lighting. Preparation and start-up of the emergency generator. Emergency means of internal communication	
	EKP2,3	**Ship structure** Basic dimensions and sizes of the ship. Hull structure: types of connections, bond systems, nomenclature. Construction of a double bottom, watertight bulkheads, tanks and cofferdams. Closing and opening watertight doors: basic and emergency. Safety rules for opening tanks	
	EKP2,3	**Maritime communications**	

		Radiotelephony correspondence: distress communications, distress signals, distress call, distress notification, port, coastal and internal communications. Ship-to-ship communication	
	EKP2,3	**English language** Using technical documentation in English. Reading the manuals for the devices. Searching for information on the causes of devices incorrect operation in the technical documentation. Basic phrases and commands in communication between the members of the machine crew and the power plant - bridge. Machine log book, oil record book, ISM code, classification and safety documents. Rules for preparing part orders and correspondence with the service	
	EKP2,3	**Occupational health and safety** Safe organization of work in the power plant. Work in stormy conditions and at heights. Safe handling of lifting equipment, slings and ropes when transporting loads in the power plant, on board and ashore	

Self-study in the first block of practical trainings:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Classes with direct participation	6(7*)	8
Self study	n/a	
Participation in final tests and exams apart from classes	n/a	
Total	200-240h	

Self-study in the second block of practical trainings:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Classes with direct participation	6	6
Self study	n/a	
Participation in final tests and exams apart from classes	n/a	
Total	180-190h	

Methods and criteria for assessing the practical training in the workshop part:

Grades	Pass without evaluation.			
Methods for evaluation	Credit on the basis of: "Internship credit report" filled in by the practical training supervisor, "Report on land practical training" prepared by the practical training supervisor. Assessment possible using distance learning methods and techniques			
EKP2				

Assessment methods and criteria in the sea part:

Grades	Pass without evaluation.

Methods for evaluation	Credit based on: entry of the captain and the chief engineer of the ship in the student's practical training book			
EKP3, EKP4				

Teaching tools:

Type	Description
The actual technical object - sea ship	All aspects of the broadly understood operation of a modern sea-going vessel

References:

Core literature
1. Operation and maintenance documentation of the vessel on which the practical training was carried out
Complementary literature

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Other teachers:		

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

No.:	47	Course:	**Semestral internship (STCW standards)**				
Major:		**Mechanics and Machine Building**	Specialisation:		**Marine Power Plant Operation**		
Studies cycle:		**First**	Form of studies:	**full-time**	Year of studies:	**3rd**	Semesters:	**6th**
Course status:		**mandatory**	Course group:	**Practical training**			

Semester	Number of weeks in the semester	The number of weeks in the block									Number of weeks in the semester									ECTS
		A	E	L	EL	S	P	SE	TW	PR	A	E	L	EL	S	P	SE	TW	PR	
6th	15									15									15	30
Total during studies																			15	30

Notes:

Practice on sea-going ships in the engineering department or practice in the construction, repair or maintenance of marine machinery departments in shipyards, production plants, mechanical workshops, on stationary offshore platforms or on ships without their own propulsion, with a practice book, report, subject to passing by an examination committee.

The practical training must be carried out in accordance with the procedures in force at the Maritime University of Szczecin, and included in the Quality Management System in the part concerning full-time students.

For students with maritime diplomas, the dean may recognize the practice of sailing (during the studies) documented with an entry in the seaman's book (or a sailing record) as equivalent to that required by STCW standards.

If the practical training is carried out in shipyards, production plants, mechanical workshops, on stationary marine platforms or on ships without their own propulsion, detailed program content will be developed individually due to the need to take into account the specificity of the practical training place .

Prerequisite knowledge, skills and other competences (if applicable to the course):

1.	Set of documents and certificates of completion of relevant courses required by international regulations when embarking into the machinery department of a sea-going vessel

Course objectives:

1.	Developing practical skills related to the independent and safe conduct of the engineering watch on a sea-going vessel or supervision of the operation of machines and devices typical for workplaces related to maritime economy
2.	Practical familiarization of students with the specificity of work in a marine power plant, the conditions prevailing there, the risks associated with the profession of a marine mechanic officer or the work of production plants, mechanical workshops, on stationary sea platforms or on ships without their own propulsion
3.	Gaining experience in working in a team of people, often international

Course outcome:

No.	Description	EK codes for the field of study
EKP1	Can independently safely supervise the operation of machinery and equipment typical for marine power plants or supervise the operation of machinery and equipment typical for shipyards and workplaces related to maritime economy	EK_U05–EK_U04, EK_K01–EK_K02
EKP2	Can assess the technical condition and operate machines and devices typical for a marine power plant or shipyard, production plants, mechanical workshops, stationary sea platforms or ships without their own propulsion	EK_U05–EK_U04, EK_K01–EK_K02
EKP3	Student can cooperate in an international team of several people	EK_U05–EK_U04, EK_K01–EK_K02
EKP4	Understands non-technical aspects and effects of operation: marine power plants, shipyards, production plants, mechanical workshops, etc. and the impact of their operation on the environment. Knows the practical methods of reducing their negative effects on the environment	EK_U05–EK_U04, EK_K01–EK_K02

Programme content:

<table>
<tr><th>Form of classes</th><th>EKP relation</th><th>Implemented content</th><th>Number of weeks</th></tr>
<tr><td colspan="2">Semester:</td><td colspan="2">6th</td></tr>
<tr><td rowspan="3">PR</td><td>EKP1,2</td><td>1. General characteristics of the vessel
1.1. Basic data: name, call sign, register number and home port, ship type, shipowner data.
1.2. Ship dimensions and capacities.
1.3. Main propulsion, auxiliary engines and boilers, type of fuel consumption, steering gear, vessel performance.
1.4. Navigation and radio communication equipment.
1.5. Life-saving equipment</td><td rowspan="3">15</td></tr>
<tr><td>EKP1,2,3,4</td><td>2. Ship's power plant
2.1. Plan of tanks with description, capacity.
2.2. Sea water system - construction, operation, maintenance.
2.3. Fresh water system - construction, operation, maintenance.
2.4. Fuel system - construction, operation, maintenance.
2.5. Lubricating oil system - tests, operation, service.
2.6. Compressed air system - construction, operation, service.
2.4. Fuel system - construction, operation, service.
2.8. Sanitary sewage system - construction, operation, service.
2.9. Steam-water system - construction, operation, service.
2.10. Preparing the power plant for movement - description</td></tr>
<tr><td>EKP1,2,3,4</td><td>3. Ship engines
3.1. Main engine - characteristics.
3.2. Construction of ME functional systems.
3.3. ME supporting systems - service.
3.4. Preparing the ME for movement.
3.5. Start-up and override of the ME.
3.6. Maneuvering withe the ME.</td></tr>
</table>

		3.7. ME supervision while in motion. 3.8. Generating sets - construction, operation, maintenance. 3.9. Construction of GS functional systems. 3.10. Systems supporting GS - construction, operation, service. 3.11. Preparation for work and start-up of the generator set. 3.12. Equipment and rules of operating a ship power plants, parallel co-operation of generating sets. 3.13. Supervision of generating sets while in motion. 3.14. Emergency aggregate - construction, operation; service. 3.15. Equipment and operating principles of ATR. 3.16. Lifeboat engines - construction, operation, service. 3.17. Internal combustion engines of working boats - construction, operation, service. 3.18. Internal combustion engines of portable pump units - construction, operation, service	
	EKP1,2,3,4	**4. Ship mechanisms and equipment** 4.1. Bilge water oil separator - construction, operation, service. 4.2. Principles of safe operation of the bilge-ballast system. 4.3. Centrifuges - structure, operation, service, regulation. 4.4. Evaporator - structure, operation, operation, capacity control, distillate treatment. 4.5. Adjustable screw - construction, operation, service, adjustment. 4.6. Steering gear - structure, operation, service, regulation. 4.7. Auxiliary and main boilers - construction, operation, maintenance, regulation. 4.8. Refrigerated provision installations - construction, operation, maintenance, regulation. 4.9. Refrigerated cargo hold installations - construction, operation, maintenance, regulation. 4.10. Ship air conditioning - construction, operation, service, regulation. 4.11. Garbage and petroleum waste incinerator - construction, operation, maintenance, regulation. 4.12. Bow thruster - structure, operation, maintenance, regulation. 4.13. Lifeboat cranes and slips - construction, operation, maintenance, adjustment. 4.14. Anchor and mooring winches - construction, operation, maintenance, regulation. 4.15. Cranes and booms - construction, operation, service, regulation. 4.16. Pumps and cargo systems - construction, operation, maintenance, regulation	
	EKP1,2,3	**5. Ship automation** 5.1. Main drive operation and optimization. 5.2. Automation of supervision over the control of the power plant operation. 5.3. Ship power plant automation. 5.4. Automation of the fuel and oil centrifugation system. 5.5. Boiler automation	
	EKP1,2,3	**6. Repairs of mechanisms and devices during the practical training** 6.1. Engine repairs. 6.2. Pump repairs. 6.3. Compressor repairs. 6.4. Turbocharger repairs. 6.5. Valve repairs. 6.6. Safety rules during renovation works in the power plant	

	EKP1,2,3,4	**7. Fire-fighting and explosion-proof equipment of the ship** 7.1. Fire detection and alarm installation - construction and operation. 7.2. Water-hydrant installation - construction, service. 7.3. General power plant extinguishing installations - construction, operation. 7.4. Local fire extinguishing installations in the power plant - construction, operation. 7.5. Sealing the power plant, emergency shutdown of mechanisms and ventilation, remote closing of valves. 7.6. Oil mist detector in the crankcase of engines - construction, service. 7.7. Loading systems for holds and containers - construction, service. 7.8. Emergency fire protection devices - construction, service. 7.9. Inert gas system of cargo tanks - construction, maintenance	
	EKP1,2,3,4	**8. Safe operation of ship installations** 8.1. Operating and emergency pumping of bilges. 8.2. Ballast pumping. 8.3. Transport of fuels and oils. 8.4. Bunkering of fuels and oils	
Total weeks per semester:			15

Self study:

When calculating the number of self-studying hours, the following should be taken into account: reading course literature, preparing for laboratory classes, preparing project documentation, preparing for project classes, preparing for final tests and exams.

Form of activity	Estimated number of hours to complete the activity	ECTS points
Weeks of classes	15	30
Self study	1	
Participation in final tests and exams apart from classes	3 h	
Total	16 weeks + 3 hours	

Assessment methods and criteria:

Grades	2	3	3.5–4	4.5 – 5
Methods of evaluation	Submission of the practical training journal, reports and passing the exam before the examination board. Assessment possible using distance learning methods and techniques			
EKP 1,2,3,4	Student did not submit the practical training log or the practical training log was not compliant with STCW requirements. / Has not submitted a seagoing service report made in accordance with the instructions received. / Practical knowledge regarding the construction and operation, carrying out repairs of engine gym systems, machinery and marine equipment selected by the examination committee, described in the report is insufficient	Student has submitted a properly completed practical training log as required by the STCW convention. / Has submitted a seagoing service report made in accordance with the instructions received. / Demonstrated basic practical knowledge in the field of construction and operation, carrying out repairs selected by the examination committee of power plant systems, machinery and marine equipment described in the report	Student has submitted a properly completed practical training log as required by the STCW convention. / Has submitted a seagoing service report made in accordance with the instructions received. / Demonstrated good practical knowledge in the field of construction and operation, carrying out repairs selected by the examination committee of engine gym systems, machines and marine devices described in the report	Student has submitted a properly completed practical training log as required by the STCW convention. / Has submitted a seagoing service report made in accordance with the instructions received. / Demonstrated broad practical knowledge in the field of construction and operation, carrying out repairs selected by the examination committee of power plant systems, machinery and marine equipment described in the report

Teaching tools:

Type	Description
The actual technical object - seagoing vessel, shipyard, manufacturing facility or workshop	All aspects of the broadly understood operation of a modern seagoing ship or shipyard, production plant or workshop

References:

Core literature
1. Operation and maintenance documentation of the vessel on which the practical training was carried out
Complementary literature

Course instructor:

Degree / title, name, surname, form of classes	E-mail address	Teaching unit
Course supervisor:		
Other teachers:		

Abbreviations:

A - lectures (auditorium), T – tutorials, L - laboratory classes,
S - simulator, SE - seminar, P - project,
E - e-Learning, IP – interim paper, PR – practical training.

General information about the course:

<table>
<tr><td>No.:</td><td>48</td><td>Course:</td><td colspan="6">Bachelor level diploma thesis</td></tr>
<tr><td colspan="2">Major:</td><td>Mechanics and Machine Building</td><td colspan="2">Specialisation:</td><td colspan="4">Marine Power Plant Operation</td></tr>
<tr><td colspan="2">Studies cycle:</td><td>First</td><td>Form of studies:</td><td>full-time</td><td>Year of studies:</td><td>4th</td><td>Semesters:</td><td>8th</td></tr>
<tr><td colspan="2">Course status:</td><td>mandatory</td><td>Course group:</td><td colspan="5"></td></tr>
</table>

Class schedule during studies

The subject of the diploma thesis is assigned after the 5th semester, but not later than one year before graduation (§28(6) of the Regulations of the Maritime University of Szczecin). About 300 hours of the student's own work under the supervision of the supervisor and 10 ECTS credits are planned for completion of the work. The procedure for appointing a supervisor and a thesis reviewer is specified in the Regulations of the Maritime University of Szczecin. The given number of hours (not included in the study plan) is an estimated number predicted to be student's own work, including all activities related to the preparation and defense of the thesis.

Relation to other courses:

– to all vocational subjects, in particular to the diploma subjects;
– diploma seminar.

Requirements for the diploma thesis

The substantive content of the diploma thesis should focus on solving a specific engineering problem using the knowledge gained throughout the studies. In accordance with the terms of awarding the professional title of engineer, in their diploma thesis the student must demonstrate the ability to:

– correctly formulate and solve technical problems on the basis of general and specialist knowledge (in relation to engineering thesis, no special originality of solutions is required);
– conduct their own literary studies;
– use modern computer techniques necessary in the work of an engineer;
– link the elements of research with engineering practice, especially with maritime economy;
– interpretation and critical approach to the obtained results.

The work cannot be accepted for defense unless set task is specified and solution documented. Documentation is reduced to a systematic presentation of the course of analyzes and calculations, the course of designing the experiment, as well as a description of the computer software used. Fulfillment of the above requirements is confirmed by the supervisor of the promoter and the reviewer of the works.

The assessment of the diploma thesis and the course of the diploma examination can be carried out using a platform or an application enabling synchronous interaction between the candidate and the examination board.