Maritime University of Szczecin

Faculty of Marine Engineering

Courses in English for Erasmus Students

academic year 2015/2016

summer semester

Szczecin 2015

	Study program	Subject[1]	Teacher(s)	ECTS credits	Hours L/C/Lb/S/P
1	I-MiBM-ESO-23-sem.4	Introduction to Automation and Robotics	Ph. D Eng Lech Dorobczyński Ph. D Eng. Teresa Kurowska Ph. D Eng. Matyszczak	6	15/15/15/0/0 Exam

Related subjects :

Mathematics, Mechanics, Introduction to Electrical Engineering and Electronics.

Description:

The subject enables the student to acquire knowledge of:

- principles of operation and structures of linear continuous automatic control systems, characteristics of linear elements, forms of describing dynamic properties;
- principles of operations and structure of typical non-linear automatic control systems;
- basic components and control systems of robots.

Attending the lectures and classes in the subject, the student acquires skills related to:

- synthesis of a combinatory and sequential logic system;
- assessment of control process quality parameters;
- tuning in a control system to requirements.

Nb.	Topics and their contents	L	C	Lb	S
1.	***Basic concepts, including the division into linear and non-linear elements and systems.*** *Automatic control systems (stability, program, follow-up, extreme, adaptive, cascade, with feedback from preset values and disturbances); examples. Control systems and regulation systems. Dynamic and static characteristics. Description of static and dynamic properties of control objects. Automatic control elements (proportional, inertial, oscillating, derivative, integral). Characteristics of linear continuous controllers (P, I, PI, PD, PID**). Selection of controller setpoints. Control quality. Analysis of automatic control system work – Nyquist and Hurwitz stability criteria.*	8	15	–	–
2.	***Two-position control:*** *structure, quality indicators of control process, selection of setpoints.*	1	–	–	–
3.	***Three-position and step control:*** *system structures, selection of setpoints, parameters of control quality assessment.*	1	–	–	–
4.	***Automatic control of complex systems. Logic systems.***	2	–	–	–
5.	**Robot types** – characteristic features, main components. Description and construction, kinematics and dynamics of manipulators and robots; drives, pose-to-pose control, pose-to-pose/power-assisted control; servo-mechanisms. Introduction to robot programming.	3	–	–	–
6.	***Modeling of automatic control systems.***	–	–	4	–
7.	***Determination of characteristics and setpoints of continuous controllers*** *(P, I, PI, PD, PID).*	–	–	4	–
8.	***Testing of combinatory logic systems.***	–	–	4	–
9.	***Testing of sequential logic systems.***	–	–	3	–
	Total	**15**	**15**	**15**	**–**

[1] Subject will be started for ERASMUS+ students providing that minimum of 3 students will select this subject.

	Study program	Subject[2]	Teacher(s)	ECTS credits	Hours L/C/Lb/S/P
2	I-MiBM-ESO-24-sem.7L	Marine Automation and Measurements	Ph. D.Eng. Lech Dorobczyński Ph. D.Eng. Teresa Kurowska Ph. D.Eng .Marek Matyszczak	6	45/0/45/0/0 Exam

Related subjects :

Mathematics, Physics, Introduction to Electrical Engineering and Electronics, Introduction to Automatic Control and Robotics,

Description:

The subject enables the student to acquire knowledge of:

- measurement systems of basic physical quantities in the marine power plant automatic control; functions of measurement system components; principles of work and functions of controllers used in ship's power plant;
- general requirements and structure of power plant automatic control systems.

Attending the lectures and classes in the subject, the student acquires skills related to:

- checking for the correct controller setpoints in the power plant; analogue and digital converter and controller setpoints;
- tuning in systems to required parameters.

No	Topics and their contents	L	C	Lb	S
1.	***Control systems of piston diesel engines driving marine fixed pitch propellers:*** *structure, control stations, speed governor, engine start-up, engine safeguarding systems.*	8	–	–	–
2.	***Control systems of piston diesel engines driving marine controllable pitch propellers:*** *structure of propulsion control systems, structure of control systems of a ship's engine co-operating with controllable pitch propeller, reversing gear and its control systems, clutches and their control systems.*	8	–	–	–
3.	***Measuring converters.*** *Static and dynamic characteristics of measurement converters and other elements of the measurement path. Processing and recording of analogue and digital signals. Analysis of static and dynamic errors. Measurement converters of non-electric quantities (position, temperature, pressure, speed, force, moment), signal processing and standardization systems, digital form of a signal, A/D and D/A converters, signal teletransmission.*	4	–	–	–
4.	***Some marine controllers of non-electric quantities:*** *speed governors, presure controllers, temperature controllers, fuel viscosity controllers; structure of control systems, selection of setpoints, measurement components of systems for measuring water content in fuels and oils.*	5	–	–	–
5.	***Automatic control systems in the marine electric power plant:*** *automatic control of generating sets, automated marine electric power plants. Integrated control systems for power generation and distribution on ships, energy cogeneration systems.*	6	–	–	–
6.	***Working principle, construction and maintenance of auxiliary machinery automatic control systems:*** *auxiliary boilers, air compressors, fuel purifiers and filters, steering gear, deck and cargo handling machinery. Control and regulation systems of marine main boilers.*	8	–	–	–
7.	***Marine information systems:*** *alarm, operational, warning, diagnostic and statistic-logging. Applications of computer systems in marine automatic control.*	6	–	–	–
8.	***Analysis of control systems of piston diesel engines driving marine fixed pitch propellers.***	–	–	6	–
9.	***Analysis of control systems of piston diesel engines driving marine controllable pitch propellers.***	–	–	6	–
10.	***Testing of measurement converters:*** *analogue, digital, systems with analogue and digital converters.*	–	–	9	–
11.	***Testing of non-electric quantity controllers:*** *rotational speed, pressure, temperature, viscosity.*	–	–	12	–
12.	***Testing of electric power plant control systems.***	–	–	6	–
13.	***Testing of selected automatic control systems of marine machines and devices.***	–	–	3	–
14.	***Creation of marine information systems using industrial visualization programs.***	–	–	3	–
	Total	**45**	**–**	**45**	**–**

[2] Subject will be started for ERASMUS+ students providing that minimum of 3 students will select this subject.

	Study program	Subject[3]	Teacher(s)	ECTS credits	Hours L/C/Lb/S/P
3	I-MiBM-ESO-27-sem.7L	Use of fuels and lubricants	Ph. D.Eng. Paweł Krause	1	30/0/0/0/0

Related subjects :

Mathematics, Physics, Technical Thermodynamics, Technical Chemistry,

Description:

The subject enables the student to acquire knowledge of:

- concepts of density, viscosity, calorific value and self-ignition properties of petroleum products and their practical use in marine power plant operation;
- effect of petroleum product viscosity and its relation to temperature and pressure on the problem of fuel composition, lubrication of slide bearings, flow resistance in pipelines, gravitational sedimentation, effectiveness of centrifugal purifiers, fuel atomization in the engine/boiler combustion chamber, combustion process and quality, fuel consumption, carbon deposits, wear of engine parts, engine failure rate, turbine and waste-heat boiler contamination;
- effect of the crude oil composition and refining method on fuel self-ignition properties;
- methods for the determination of self-ignition properties of distillate and residual fuels;
- effect of catalyst particles on fuel purification methods and the resultant engine performance;
- structure of residual fuels and problems with their stability;
- parameters describing fuel properties and their influence on marine power plant operation (temperatures (of): flash point, setting point, pumpability, turbidity, cold filter plugging; water content, sulphur content, vanadium content, incineration residue, carbon residue);
- types and classification of marine fuels by viscosity and by quality;
- principles and method of making use of the classification society supervision of marine fuel quality;
- effect of friction on phenomena occurring in shipboard mechanisms;
- effect of lubricating oil viscosity on phenomena occurring in the lubricated device;
- ISO oil viscosity classification, SAE viscosity classes of engine oils, quality classification of lubricating oils;
- oil function in a trunk-piston engine and related quality requirements;
- effect of base oil production method and type of upgrading additives on the properties of the final product;
- oil requirements for shipboard use, principles of oil care during operation;
- changes taking place in oil during operation and factors affecting its ageing;
- properties of greases and their choice for various applications.

Attending the lectures and classes in the subject, the student acquires skills related to:

- use of ASTM, ISO/PN tables while calculating the density of petroleum products;
- calculation of fuel densities at various temperatures;
- calculation of fuel supply, choice of purifier water disk and identification of tank sounding errors;
- use of the viscosity-temperature chart, tables, slide rules and viscosity-temperature conversion formulas, and the assessment of errors and reliability of calculating methods;
- checking the correctness of operation of viscosity controllers;
- prevention of fuel stability loss and methods of fuel stability determination by the ASTM filter paper method.
- determination and assessment of water content in fuel or oil by shipboard methods;
- determination of petroleum product viscosity by shipboard methods;
- interpretation of fuel / lube oil laboratory analysis results;
- sampling fuels and lube oils for lab analysis;
- choice of oils for various shipboard applications;
- use of equipment and installation for lube oil care;
- choice of greases for various shipboard applications.

No	Topics and their contents	L	C	Lb	S
1	***Density:*** *a) definition of density, density versus specific gravity, relative density, SI, CGS, British and US units related to petroleum products;* *b) relationship between petroleum products density and temperature and pressure, ASTM tables, ISO/PN tables and the scope of use, conversion of fuel density for various temperatures, method of determining the coefficient α;* *c) knowledge of petroleum product density in shipboard practice: knowledge of actual fuel density during bunkering, method of calculating fuel mass in storage tanks of the ship, tank sounding errors, choice of purifier water disk, fuel density*	2	–	–	–

[3] Subject will be started for ERASMUS+ students providing that minimum of 3 students will select this subject.

	versus calorific value, density and self-ignition properties of fuels (basics).				
2	***Viscosity:*** *a) viscosity as a measure of internal friction in fluids, general definitions of dynamic and kinematic viscosity, SI and CGS units, most common units of conventional and relative viscosity, viscosity conversions;* *b) concept of nominal viscosity of fuels, viscosity classification of fuels (disadvantages);* *c) dependence of petroleum product viscosity on temperature, viscosity-temperature chart for fuels - restricted use and reliability, methods of using tables, slide rules and conversion formulas;* *d) fuel mixtures: viscosity, purpose, chart and its restricted use;* *e) importance of viscosity for: slide bearing lubrication, fuel flow resistance in pipelines, gravitational sedimentation, effectiveness of purifiers and fuel atomization in the combustion chamber of a diesel engine – effect of viscosity on micro- and macrostructure of atomized fuel, combustion process and its quality;* *f) viscosity controllers of residual fuel fed into engines, control of viscosity measurement correctness.*	3	–	–	–
3	***Effect of diesel fuel production method on their major operational properties:*** *a) crude oil as a mixture of hydrocarbons and non-hydrocarbons, conservative and destructive processing of crude oil, effect of crude oil composition and processing method on the fuel fraction composition of hydrocarbons and post-distillate and post-cracking residues, production of distillate and residual fuels;* *b) importance of hydrocarbon fraction composition for self-ignition properties of fuels, importance of ignition delay for the correct performance and long lifecycle of the engine, determination of self-ignition properties of distillate and residual fuels: cetane number, cetane index, Diesel index, CCAI, CII;* *c) case of using remainders of catalytic cracking for composing residual fuels;* *d) structure of fuels, causes and effects of stability loss, prevention of stability loss, stability margin, determination of TSE and TSP, shipboard fuel stability determination by ASTM filter paper method.*	2	–	–	–
4	***Contaminants in marine fuels and other essential parameters describing fuel properties:*** *a) flash point, fire prevention safety requirements, allowed non-compliance;* *b) setting* point, pumpability temperature, turbidity temperature, cold filter plugging temperature*;* *c) water content: sources of water from fuel, effects of water presence in fuel, separation of water from fuels, fuel-water emulsions for engine fuel supply;* *d) sulphur content in fuels depending on crude oil origin and processing method, formation of SO_2 during combustion, factors affecting the degree of converting SO_2 into SO_3 , effect of sulphur compounds in exhausts on the dew point, methods of preventing sulphuric corrosion;* *e) vanadium content: origin of vanadium compounds in fuel, vanadium (high-temperature) corrosion – consequences and prevention;* *f) incineration residue;* *g) carbon residue, Conradson number.*	4	–	–	–
5.	***Fuel classification and quality standards – exam of fuel quality:*** *a) clasification of fuel oils: light (diesel) and heavy fuels, viscosity classification of heavy fuel oils - no connection with quality, reasons for introducing ISO fuel classification;* *b) fundamentals and principles of ISO marine fuels classification and specification;* *c) testing of marine fuels quality, fuel sampling procedure, fuel parameters determined.*	2	–	–	–
6.	***Friction and lubrication:*** *a) significance of friction in mechanical engineering (mechanical efficiency of machines, heat release, surface wear), methods of reducing the friction coefficient, hydrodynamic lubrication, relationship between max load and friction coefficient of a slide bearing and various design and operational factors;* *b) viscosity of bearing-lubricating oil – relation between minimum/maximum oil viscosity and the degree of complexity and load of the lubricated device.*	2	–	–	–
7.	***Viscosity classification of lubricating oils:*** *a) ISO oil viscosity classification;* b) *SAE oil viscosity classification.*	2	–	–	–
8.	***Functions of lubricating oil in the internal combustion engine and possibilities fulfilling them by oils.***	4	–	–	–

9.	***Production of lubricating oils:*** *a) base oils obtained from refined distillates of crude oil, properties of base oil resulting from oil refining method: viscosity index, oxidation stability, thermal stability, synthetic oils -oxidation and thermal stability;* *b) upgrading additives;* *c) characteristic requirements for oils used in ships (turbine oils, gear oil, hydraulic, compressor, propeller shaft, heating and fish processing machine oils).*	3	–	–	–
10.	***Engine lubricating oil in use – operational contamination of engine oil:*** *a) alkaline additives, definition of the base number (BN), importance of BN value for engine operation, BN selection of fresh oil, BN changes in oil used in an engine, factors accelerating the BN decrease value and BN stability level, maximum value of BN decrease;* *b) oil oxidation (ageing) –viscosity increase, formation of organic acids,resins and asphalts, oil darkening;* *c) oil evaporation – losses from lube oil circulation, viscosity increase;* *d) oil contamination – types, sources and effects;* *e) testing of oil properties for its operational use;* *f) oil sampling procedure;* *g) interpretation of oil physical-chemical analysis results, limit values of determined parameters, interpretation of oil spectral analysis results;* *h) oil care in operation: filtration, centrifugal purification, refreshing – selection of the suitable devices at power plant design stage and recommendations for use – typical errors.*	2	–	–	–
11.	***Quality classes of lubricating oils*** *a) quality classification of lube oils as a result of operational experience – general requirements;* *b) quality classifications of engine oils: API, ACEA, MIL-L, engine makers' classifications.*	2	–	–	–
12.	***Greases:*** *a) definition of grease, its advantages, structure and composition;* *b) major properties of grease: consistency, drop point, lubricity, resistance to water washing, corrosion protection, effect on non-ferrous metals, varnish coatings and sealing materials;* *c) effect of a thickener on grease properties, ISO classification of plastic greases;* *d) principles of grease selection for given application, methods of transferring grease to various friction nodes;* *e) identification of greases and detection of mechanical impurities, range of greases used in shipping, synthetic greases.*	2	–	–	–
	Total	**30**	**–**	**–**	**–**

	Study program	Subject[4]	Teacher(s)	ECTS credits	Hours L/C/Lb/S/P
4	I-MiBM-ESO-31-sem.7L	Refrigeration and Air Conditioning	Ph. D.Eng Grzegorz Kidacki	4	30/0/25/5/0

Related subjects :

– Mathematics, Physics, Engineering Graphics, Technical Thermodynamics.

Description:

The subject enables the student to acquire knowledge of:

- thermodynamic principles of refrigeration and air conditioning installation operation;
- technology of food storage and climatic comfort;
- solutions to refrigeration and air conditioning installations used in shipbuilding;
- construction of refrigeration and air conditioning devices;
- automatic control of refrigeration and air conditioning devices;
- operation/maintenance and repairs of refrigeration and air conditioning devices;
- trials and acceptance of refrigeration and air conditioning installations as required by classification societies.

Attending the lectures and classes in the subject, the student acquires skills related to:

- identification of refrigeration and air conditioning installation concept / design based on documentation reading and visual inspection of the actual installation.
- start-up, trials, regular operation (checking pressures, temperatures, relative humidity, electric current intensity, noise, etc.) and shutdown of refrigeration and air conditioning installations;
- periodical maintenance: replenishing coolants and cooling media, filling up or replacement of lube oil, venting, frosting, detection and stopping of leaks, dewatering of the installation;
- periodic repairs of refrigeration and air conditioning devices;
- control of measuring and signaling devices operation;
- inspection and regulation of refrigeration and air conditioning automatic control;
- advantages of refrigeration and air conditioning installations monitoring;
- identification and the right response in installation failures;
- documenting the operation/maintenance of refrigeration and air conditioning installations;
- following the principles resulting from ecological criteria for the storage and recycling of coolants, cooling media, oils; checks for leaks.

No	Topics and their contents	L	C	Lb	S
1.	***Refrigeration and its Applications in Ships:*** *methods of refrigeration and types of refrigeration devices, use of refrigeration on ships, refrigeration chain, introduction to food storage technology.*	2	–	–	–
2.	***Refrigerating circuits and systems used in sea-going ships:*** *thermodynamics of refrigeration cycle, coolants, cooling media, lube oils, circuits with overcooling of liquid coolant and superheating of steam coolant on the suction side, circuits with several levels of evaporation temperatures, one - and two-stage compression circuits, circuits with direct and indirect refrigeration, circuits with pressurized / pump / gravity feeding.*	3	–	–	–
3.	***Auxiliary installations:*** *suction of steam coolant, discharge of liquid coolant, coolant replenishment, oil replenishment, safety installation, outboard discharge of coolant, venting, pressure adjustment, dewatering of coolant, recuperation and degassing of oil, thermodynamic and electrical defrosting, hot glycol defrosting.*	3	–	–	–
4.	***Refrigeration compressors and units:*** *piston, screw and spiral compressors and units – construction, capacity regulation, variable compression coefficient, oil functions; cooling power and propulsion power as a function of compressor operating parameters.*	3	–	–	–
5.	***Refrigerating equipment:*** *requirements for heat exchangers, condensers, air coolers, liquid coolers, dryers and drying units, ammonia and freon oil separators, oil degassers in freon installations, coolant and oil tanks, air venting, regenerative heat exchangers, inter-stage coolers, coolant pumps.*	3	–	–	–
6.	***Co-operation of the compressor with other devices of the refrigerating system:*** *compressor co-operating with an evaporator and expansion valve, compressor-condenser co-operation, changes in the co-operating setpoint in the refrigerating device at various operating states and faults.*	1	–	–	–

[4] Subject will be started for ERASMUS+ students providing that minimum of 3 students will select this subject.

7.	***Automation of refrigerating equipment and installations:*** *coolant feeding, condenser water valves, refrigeration chambers, refrigerating units, co-operation of refrigerating units and chambers, automated compressor suction and discharge.*	1	–	–	–
8.	***Heat balance of the refrigerating plant:*** *components of heat balance of refrigerating chambers, selection of basic refrigerating devices.*	2,5	–	–	–
9.	***Operation/maintenance of refrigerating plants****: general operational principles of installations, current and periodic maintenance, symptoms, causes, consequences of various irregularities, operational procedures (replenishment of coolant, oil, air venting, dewatering, locating and repair of leaks, defrosting, start-up after long shutdown, installation shutdown.*	3	–	–	–
10.	***Marine ventilation and air-conditioning systems:*** *introduction to air conditioning, air treatment in air conditioning, air conditioning systems and devices, automation of air conditioning devices, marine power plant ventilation, holds ventilation, operation of air conditioning and ventilation systems.*	2	–	–	–
11.	***Specialized ships:*** *fishing vessels, ferries, container ships, LNG / LPG tankers.*	2	–	–	–
12.	*Ship's ventilation installations, fire prevention*	1	–	–	–
13.	***Refrigerated containers:*** *typical container refrigerating units, construction and operation*	2	–	–	–
14.	*Safe handling of refrigerating equipment*	0,5	–	–	–
15.	*PRS regulations on refrigeration*	1	–	–	–
16.	*Diagrams of refrigeration installations.*	–	–	2	–
17.	*Automatic control settings at test beds.*	–	–	4	–
18.	*Construction and work of refrigerating compressors and refrigerating equip-ment.*	–	–	4	–
19.	*Testing of heat-transfer coefficient of the refrigerating chamber.*	–	–	4	–
20.	*Operation of refrigerated food store.*	–	–	4	–
21.	*Heat balance of the refrigerated food store and freezer.*	–	–	4	–
22.	*Testing of the air conditioning unit.*	–	–	3	–
23.	*Refrigerated store installation.*	–	–	–	3
24.	*Ship's air conditioning installation.*	–	–	–	2
	Total	**30**	**–**	**25**	**5**

	Study program	Subject[5]	Teacher(s)	ECTS credits	Hours L/C/Lb/S/P
5	I-MiBM-ESO-32-sem.5L	Marine Power Plants I[6]	Prof. Ph. D.Eng. Tadeusz Borkowski Ph. D.Eng.. Jarosław Myśków MSc Eng. Przemysław Kowalak	4	30/0/0/30/0 Exam

Related subjects :

– Mathematics, Physics, Mechanics, Engineering Graphics, Technical Thermodynamics., Marine Automatic Control and Measurents, Use of Fuels and Lubricants, Marine Piston Engines, Marine Boilers.

Description:

The subject enables the student to acquire knowledge of:

- basic solutions and principles of engineroom watchkeeping;
- fundamentals of power plant energy management;
- introduction to the construction and principles of operation of diesel and auxiliary power plants;
- basic solutions of steam power plant systems.

Attending the lectures and classes in the subject, the student acquires skills related to:

- reading and interpretation of pipeline installation diagrams.
- operation of diesel and auxiliary power plants.

No	Topics and their contents	L	C	Lb	S
1.	***General knowledge.*** *Concepts of marine propulsion plant, propulsion system, electric power plant. Classification of marine power plants.*	2	–	–	–
2.	***Basic installations of marine power plants and their operation.*** *Functions and classification of installations, schematic diagrams, fundamentals of construction and operation. Construction of the installations: bilge, ballast, fuel / lubricant transfer and purification, refrigeration, compressed air, steam-water, exhaust gas, sanitary water and technical water.*	2	–	–	–
3.	***Construction and operation of installations of auxiliary diesel engines.*** *Introduction to the construction and operation of installations: fuel / lubricant supply, cooling and compressed air.*	2	–	–	–
4.	***Performance requirements for power plants and their impact on design solutions used in marine power plants.***	2	–	–	–
5.	***Energy balance of the marine power plant.*** *Efficiency of a power unit. General propulsion efficiency and its components. Energy efficiency of the power plant and ways to increase it. Power supply systems in diesel power plants.*	2	–	–	–
6.	***Installations in diesel power plants.*** *a) Cooling installation: cooling of slow / medium speed engine cylinders, selection of pumps and coolers, role of the equalizing tank, engine heating, system air venting, effect of vacuum evaporator on system operation, water control and treatment, flushing of the installation; piston cooling with fresh water or lube oil, cooling of injectors with fresh water, lube oil or fuel oil, characteristics of seawater installation, parameter regulation, disadvantages of central cooling installations, methods of their optimization, selection of pumps, central coolers and flow intensity.* *b) Fuel installations: effect of fuel properties on the construction and operation of the system; bunkering, storage and transfer of fuel, protection against fuel overflow, storage, discharge and utilization of fuel wastes; methods of marine fuels purification, selection and maintenance of settling tanks, purifiers, use of non-conventional methods of fuel purification and treatment; atmospheric and pressurized system of fuel supply installation, return tank function, fuel heating and viscosity control before the engine, auxiliary boiler feeding installation.* *c) Lubricating installations: circulating lubrication of diesel engines; cylinder lubrication; circulating lubrication of the gear, turbochargers and propeller shafts; engine oil purification installations, optimization of purifier efficiency and of number of multiple centrifuging*	16	–	–	–

5 Subject will be started for ERASMUS+ students providing that minimum of 3 students will select this subject.

[6] Please note that only Marine Power Plant I or Marine Power Plant II can be choose during 1 semester. The subjects are realized simultaneously and the content of Marine Power Plant I or equivalent at the home University is obligatory to participate in Marine Power Plant II.

	of circulating oil at continuous purifier work, semi-flow filtration. *d) Compressed air installation: air demand for engine start-up, selection of main and auxiliary air receivers, selection of main, emergency and auxiliary compressors, problems of system control, troubleshooting and operation.* *e) Steam-water installations: conventional steam-water installation, ship's steam balance, selection of auxiliary boilers, factors affecting waste heat boiler efficiency and efficiency control, oil-fired boiler combined with waste heat boiler (economizer), diagrams of steam, condensation and feeding installations, installation components; principles of steam-water installation operation; deep heat recovery, sources of waste heat and its possible uses, effect of system design on fulfilling the energy demand of the power plant, diagrams of single- and bi-pressure systems, integrated systems, working parameters of systems, feed water heating and steam superheating.*				
6.	*f)* Bilge installations*: selection of bilge pumps, schematic diagrams of the bilge system, protection of rooms against flooding, selection and distribution of bilge wells, strainers and sediment traps, emergency suction of power plant bilges, oily water management, oil separation from bilge water.* *g) Ballast installations: selection of ballast pumps, system diagram, ballast tank pumping and stripping.* *h) Sanitary installations: requirements and demand for potable and sanitary water; water for domestic purposes and toilet flushing, water - filling up, storage and treatment; production of fresh water in vacuum evaporators; diagrams of sanitary systems, construction and operation of sanitary systems.* *i) Exhaust gas installation: basic factors of toxic compounds formation in exhaust gases; characteristics of toxic components of exhausts; installation requirements; use of exhausts for steam generation; diagrams of the installation and characteristics of basic components; block diagrams and work of the installation; principles of operating and effect of the installation technical condition on the work of marine engines; possibilities of reducing emissions by marine engines; technical requirements concerning exhaust gas emission; methods and design solutions of the installation for treatment of exhaust gases from marine engines and boilers.*	16	–	–	–
7.	***Systems of steam power plants.*** *Classification and functions of steam power plant installations; diagrams of steam-water circuits, main steam system, auxiliary inlet steam system, auxiliary outlet steam system, condensation systems, feeding systems; fuel / lubrication / distillation installations.*	4	–	–	–
8.	***Marine power plant simulator: construction and operation, start-up and handling of the simulator programs:*** *procedures of installation and devices handling, graphical symbols, parameters and their notations, possibilities of introducing setpoints, functional operation of working and control devices. Functioning of marine class A / UMS power plant. Characteristics of operational states of the marine power plant; acquaintance with ship's power plant arrangements to the extent enabling the beginning of the procedures of starting up installations and machines.*	–	–	–	2
9.	***Power plant start-up procedures from the cold condition;*** *types of generator and alternator drives; general principles of generating sets co-operation; safe operation of generating sets; operating modes of generating sets, single and parallel operation of generating sets; preventive actions limiting the occurrence of faults and after fault or irregularities identification in the operation of a generating set.*	–	–	–	4
10.	***Cooling installations – seawater:*** *installation design, working parameters , methods of start-up and supervision during work and shutdown.*	–	–	–	4
11.	***Engine cooling installations – fresh water:*** *working parameters of the seawater installation; operating modes – control: manual and automatic; engine heating, air venting, switching on and off the seawater evaporator; safeguards and priorities in correct parameters of installation work.*	–	–	–	2
12.	***Compressed air installation:*** *installation design, preparation for work; setting of working parameters; protection of correct working parameters; operation of air compressors during ME manoeuvres and passage at sea.*	–	–	–	2
13.	***Steam-water installation – start-up preparation:*** *preliminary preparation of the installation for first start-up of cold boiler; protection system of boiler operation; methods of introducing in the feeding system of the boiler; methods of oil-fired boiler preparation for start-up; adjustment of settings in the combustion system.*	–	–	–	4
14.	***Steam-water installation – start-up, supervision at work and shutdown:*** *heating the boiler from cold state; preliminary start-up process - manual mode; operating factors of changing fuel type: DO and HFO; supervision of the boiler at work – manual, semi-automatic and automatic operation of boiler functional systems; oil-fired boiler-economizer co-operation, selection of settings. Boiler preparation for shutdown.*	–	–	–	4

15.	***Fuel installations – transfer, purification and engine supply:*** *working parametes in the installation; preparation of the installation for start-up; methods of HFO / DO purification; supervision of fuel transfer and purification; prevention of tank overflow and spills; preparation of the ME fuel installation for start-up; switching from DO to HFO and vice versa. Working parameters of the installation.*	–	–	–	2
16.	***Lubricating installations:*** *transfer installations; engine lubrication circulation; circulating tanks, circulating pumps, coolers, filters, temperature regulators, safeguards; preparation of the installation for start-up, supervision during engine running, working parameters; installation of circulating oil purification; installations of cylinder lubrication.*	–	–	–	2
17.	***Electric power system:*** *operation of the power system in various operating states of the ship. Adjustment of generating sets work to varying demand for power. Operation of the power system in emergency situations. Use of PTO and PTI systems and a turbogenerator for co-operation with generating sets driven by piston engines. Energy management of the power plant dependent on operational needs.*	–	–	–	2
18.	***Start-up and running of the slow speed main engine:*** *preparation for start-up, verification of related installations standby; actions taken during the start-up, running with no load and gradual increase of the load; operation of ME control programs and protection systems; applying specific methods of engine manoeuvres.*	–	–	–	2
	Total	**30**	**–**	**–**	**30**

	Study program	Subject[7]	Teacher(s)	ECTS credits	Hours L/C/Lb/S/P
6	I-MiBM-ESO-32-sem.7L	Marine Power Plants II[8]	dr inż. Tadeusz Borkowski dr inż. Jarosław Myśków mgr inż. Przemysław Kowalak	4	15/0/0/30/0 Exam

Related subjects :

– Mathematics, Physics, Mechanics, Engineering Graphics, Technical Thermodynamics, Marine Automatic Control and Measurements, Use of Fuels and Lubricants, Marine Piston Engines, Marine Boilers.

Description:

The subject enables the student to acquire knowledge of:

- principles of selecting ship's propulsion systems, their characteristics and possibilities of using these characteristics in operation.

Attending the lectures and classes in the subject, the student acquires skills related to:

- assessment of the selection of ship propulsion systems.
- assessment of the effect of operating factors on the behaviour of the propulsion system in terms of reliability of power supply.

No	Topics and their contents	L	C	Lb	S
1.	***Ship's resistance characteristics:*** *hull resistance, factors affecting ship's operating resistance, relation between ship resistance and speed; towing power, contractual speed, effect of ship's speed and sailing conditions on: fuel consumption, main propulsion and power load.*	2	–	–	–
2.	***Layout diagram of main engines:*** *rated load of the engine, layout diagram of slow speed engines; load limits of engines and operating factors affecting these limits, maximum overloads of main engines.*	1	–	–	–
3.	***Engine-propeller co-operation:*** *matching of the diesel engine - propeller system, design margin of engine power output and speed in the direct system of propeller drive, selection of rated engine load; systems with controllable pitch propeller; dis/advantages of controllable pitch propellers; working range of diesel engine - controllable pitch propeller system; gear systems, selection of gear ratio of multi-spin reduction gear.*	2	–	–	–
4.	***Energy demand and efficiency of the marine power plant:*** *power system efficiency; energy demand for ship's propulsion; demand for electric power and heat; general energy efficiency of the power plant and ways to increase it.*	1	–	–	–
5.	***Modern solutions in propulsion-energy systems with shaft generators and methods of their operation/maintenance.***	1	–	–	–
6.	***Waste heat recovery, overview of modern solutions and principles of their operation***	1	–	–	–
7.	***Ship propulsion systems and their operation:*** *overview of modern propulsion systems and propellers; propeller characteristics; hydrodynamic characteristics; ship propulsion characteristics; engine layout diagram; engine-propeller-hull co-operation at steady speed and speed changes in various sailing conditions*	2	–	–	–
8.	***Work of the propulsion system during manoeuvres – Robinson curves.***	2	–	–	–
9.	***Principles of economical operation of marine power plants.***	1	–	–	–
10.	***Operation of a marine power plant in emergency conditions.***	1	–	–	–
11.	***Modern marine power plants – development trends. New solutions of power plant systems.***	1	–	–	–
12.	***Construction and working principle of ME remote control system:*** *structure of remote control system for propulsion system; basic functions performed from specific control stations; engine protection devices: „slow-down", „shut-down"; dangerous and maximum load limits; principles of increasing and decreasing engine loads; engine manoeuvring.*	–	–	–	2

[7] Subject will be started for ERASMUS+ students providing that minimum of 3 students will select this subject.

[8] Please note that only Marine Power Plant I or Marine Power Plant II can be choose during 1 semester. The subjects are realized simultaneously and the content of Marine Power Plant I or equivalent at the home University is obligatory to participate in Marine Power Plant II.

13.	***Start-up and running of the medium speed main engine:*** *procedure of ME preparation for start-up; actions relating to engine start-up, idle running and load increase; work of control programs and ME protection systems; applying specific methods of engine manoeuvres.*	–	–	–	2
14.	***Supervising ship's main engines in operation:*** *engine working parameters and indicators; determination of engine power – how to make and use indicator characteristics in everyday engine operation. Determination of engine work parameters.*	–	–	–	2
15.	***Layout diagram of main engines:*** *operating limits of minimum and maximum engine loads. Operating factors affecting these limits. Allowable ME overloads.*	–	–	–	2
16.	***Engine-propeller co-operation:*** *selection of engine operating load; characteristics of optimal propulsion efficiency of the system with controllable / fixed pitch propeller; effect of sailing conditions on ship propulsion characteristics.*	–	–	–	4
17.	***Energy efficiency aspects of the marine power plant:*** *method of preparing the energy balance of marine power plant; general assessment of marine power plant efficiency and methods of increasing it.*	–	–	–	2
18.	***Operation of propulsion-power systems with shaft generators:*** *shaft generator – PTO and PTI systems; selection and operation of the propulsion system with controllable / fixed pitch propeller and shaft generator.*	–	–	–	4
19.	***Co-operation between ME and heat recovery devices:*** *principles of ME co-operation with economizer, seawater evaporator, system of heat recovery from turbocharging air; procedure of start-up, changing loads, and shutdown of heat recovery devices in operation.*	–	–	–	2
20.	***Ship's propulsion systems and their operation:*** *operating characteristics of propellers and methods of creating such characteristics; engine-propeller co-operation. Work of the propulsion system at constant speed and during acceleration/reduction.*	–	–	–	4
21.	***Principles of economical operation of marine power plants:*** *use of propulsion characteristics; ship's draft changes; effect of restricted water depth; deterioration of hydro-meteorological conditions and of technical hull and propeller condition; forecasting fuel consumption and limited fuel reserve; selection of ship's economical (service) speed; quay trial; determination of ship's thrust force.*	–	–	–	4
22.	***Operation of a marine power plant in emergency conditions,*** *ME work in emergency states; taking safety measures during watchkeeping and procedures in fire risk or negative events, in the fuel system in particular; engineroom patrol; actions to be taken when threat or negative events are found, emergency procedures, non-standard actions;*	–	–	–	4
	Total	**15**	**–**	**–**	**30**

	Study program	Subject[9]	Teacher(s)	ECTS credits	Hours L/C/Lb/S/P
7	I-MiBM-ESO-35-sem.5L	Marine Environment Protection	dr inż. Piotr Treichel	1	30/0/0/0/0

Related subjects :

– Physics, Technical Chemistry,

Description:

The subject enables the student to acquire knowledge of:

- basic concepts of sea ecology, types of pollutants produced on board ship, quantitative analysis of pollution sources;
- international, regional and national legal regulations concerning the prevention of pollution at sea;
- principles of construction and operation of shipboard environment protection equipment used on motor ships and tankers.

Attending the lectures and classes in the subject, the student acquires skills related to:

- handling environment protection equipment, such as oil separators, sewage treatment plants and incinerators.
- performing basic chemical analyses to ascertain the correct work of environment protection devices.
- keeping oil record book and waste and sewage records.

No	Topics and their contents	L	C	Lb	S
1.	**Characteristics of the ship as a polluter. Types and quantities of pollution,** effect of specific pollutants on the marine environment. Conservation of biocenosis affected by pollutants: oils, chemicals, waste and garbage.	4	–	–	–
2.	***Legal protection of marine waters from pollution by ships, Conventions:*** *MARPOL, DUMPING, HELCOM and the Act on prevention of sea pollution by ships; present legal state and monitoring of compliance with the conventions; ship documentation relating to the marine environment protection.*	4	–	–	–
3.	***Prevention of marine pollution by oils.***	4	–	–	–
4.	***Prevention of pollution by harmful substances carried in bulk.***	4	–	–	–
5.	***Harmful substances carried in packages.***	2	–	–	–
6.	***Prevention of sea pollution by wastes.***	4	–	–	–
7.	***Prevention of sea pollution by garbage.***	4	–	–	–
8.	***Prevention of atmospheric pollution by toxic components in exhausts from ship engines, boilers and incinerators, methods of reducing toxic emissions.***	4	–	–	–
	Total	**30**	**–**	**–**	**–**

[9] Subject will be started for ERASMUS+ students providing that minimum of 3 students will select this subject.

	Study program	Subject[10]	Teacher(s)	ECTS credits	Hours L/C/Lb/S/P
8	I-MiBM-ESO-36-sem.7L	Operation of Marine Power Plant Machinery	dr inż. Antoni Wiewióra dr inż. Piotr Treichel	2	12/0/0/24/0

Related subjects :

Applied Computer Science, Technical Thermodynamics, Marine Electrical Engineering or Introduction to Electrical Engineering and Electronics, Introduction to Automation and Robotics, Marine Automation and Measurements, Marine Piston Engines, Marine Boilers, Marine Power Plants.

Description:

The subject enables the student to acquire knowledge of: arrangement of machines and devices in the engineroom; principles of safe starting and stopping of power plants machines / devices;work organization in the engineroom; routine actions during watch takeover and keeping.

Attending the lectures and classes in the subject, the student acquires skills related to:

- reading power plant diagrams; reparation and start-up of power plant machines and devices siłowni; calculation of engine power;; measurement of fuel consumption; collecting data on power plant operation indicators and making the energy balance;keeping the engine log book.

No	Topics and their contents	L	C	Lb	S
1.	**Basic concepts of technical diagnostics.**	2	–	–	–
2.	**Diagnostic models,** diagnostic methods.	2	–	–	–
3.	**Diagnostics of a diesel engine:** assessment of mechanical and thermal loads of the piston-cylinder unit, evaluation of the combustion chamber tightness, assessment of piston-cylinder liner unit operating conditions, evaluation of cylinder liner wear and piston rings condition. Diagnostics of the turbocharging system, condition assessment of air filter, air compressor, air cooler, turbocharger; diagnostics of fuel injection process, combustion assessment; diagnostics of bearings, measurements of bearing temperature and journal trajectory.	4	–	–	–
4.	**Diagnostics of steam boilers and turbines.**	2	–	–	–
5.	**Diagnostics hydraulic pumps and devices.**	1	–	–	–
6.	**Overview of diagnostic systems in use.**	1	–	–	–
7.	***Operating power plant machines/devices of the simulator:*** *general principles for the preparation and start-up of power plant machinery; use of check list; control of the parametetrs in preparation and start-up of the device or system.*	–	–	–	2
8.	***Measuring/control equipment; alarm system, control of operating machinery and systems;*** *description of measurement-control instruments for the mesasurement of: temperatures, pressures, levels, flow intensity, engine speed, torque, power, voltage, intensity, frequency. Demonstration of instruments operation in power plant systems.*	–	–	–	2
9.	***Actions relating to watch keeping and takeover:*** *actions taken while taking over the watch in the power plant: time for watch takeover and inspection of all working machines, auxiliary machinery and systems, recording the deviations from standard values, identification of causes; check and control of the engine log book; watch takeover procedure.*	–	–	–	4
10.	***Detection of faults in ME, auxiliary engines, boilers and other machines of the power plant:*** *use of modern diagnostic methods and trend analysis of changes in recorded working parameters; identification and locating of ME faults: fuel equipment, piston-cylinder unit, fuel charge exchange and turbocharging system, piston-crank unit; identification and repair of auxiliary engine faults; identification and repair of faults in working devices of power plant installations, fuel and oil purifiers, compressors, pumps, heat exchangers, filters etc.*	–	–	–	8
11.	***Operation of propulsion systems in marine power plants:*** *procedures in emergency states of functional systems of main and auxiliary propulsion engines; limits of effective power of propulsion engines in various operational conditions and situations; operation of marine power plants in abnormal climatic conditions.*	–	–	–	4

[10] Subject will be started for ERASMUS+ students providing that minimum of 3 students will select this subject.

12.	***Selected problems of marine power plant operation in:*** *bulk carriers, tankers, container ships, fishing and passenger vessels; characteristic operational states connected with the specific cargo carried and performed functions of the ship.*	–	–	–	4
	Total	**12**	**–**	**–**	**24**

	Study program	Subject[11]	Teacher(s)	ECTS credits	Hours L/C/Lb/S/P
9	I-MT-EO-25-sem.4	Hydraulic Drives	dr inż. Grzegorz Kidacki	2	15/0/15/0/0

Related subjects :

– Mathematics, Physics, Technical Thermodynamics, Fluid Mechanics, Use of Fuels and Lubricants.

Description:

The subject enables the student to acquire knowledge of:

- basic types of hydraulic drive systems used in shipbuilding;
- types of pumps, engines and hydraulic cylinders;
- theoretical basis of hydraulic drive operation;
- bases for hydraulic drive calculations;
- major hydraulic drive systems, application, dis/advantages;
- power and working speed control in hydraulic drives, incl. volume / throttle and step control;
- graphic symbols, notations and diagrams of systems;
- basic hydraulic systems of steering gear, thrusters and controllable pitch propellers;
- basic hydraulic systems of anchoring-mooring euipment, deck cranes, hatch closing and opening gear;
- classification society requirements concerning filters and filtration of hydraulic working media;
- requirements for safe and correct handling and operation of marine hydraulic systems.

Attending the lectures and classes in the subject, the student acquires skills related to:

- preparation of hydraulic systems for work, filling the system with a working medium, air venting and flushing of the hydraulic system;
- start-up and handling of hydraulic systems;
- assessment of system operation based on measured parameters;
- power and working speed control of the drive;
- assessment of technical condition of the hydraulic system, pumps, engines, equipment.

No	Topics and their contents	L	C	Lb	S
1.	***Basic types of hydraulic drive systems**, closed and open systems, hydraulic pumps and motors, equipment.*	3	–	–	–
2.	***Theoretical fundamentals of hydraulic drive work**, basic calculations, calculation of driving power of the hydraulic system.*	4	–	–	–
3.	***Power and working speed control in hydraulic drive systems**, volume control, throttle regulation and step regulation.*	3	–	–	–
4.	***Basic hydraulic systems of electro-hydraulic steering gear, thrusters, controllable pitch propellers.***	3	–	–	–
5.	***Filters and filtration of the working fluid in hydraulic systems.***	2	–	–	–
6.	***Hydraulic installation diagrams.***	–	–	1	–
7.	***Hydraulic system - handling and working parameters assessment.***	–	–	2	–
8.	***Calculations of the power of engines driving pumps in hydraulic systems, steering gear and anchoring machinery.***	–	–	4	–
9.	***Calculations of the propulsion power of a hydraulic system**, system losses, energy balance.*	–	–	4	–
10.	***Determination of the volume control characteristics.***	-	–	2	–
11.	***Determination of the throttle control characteristics.***	–	–	2	–
	Total	**15**	**–**	**15**	**–**

[11] Subject will be started for ERASMUS+ students providing that minimum of 3 students will select this subject.

	Study program	Subject	Teacher(s)	ECTS credits	Hours L/C/Lb/S/P
10	Not applicable	Maritime English	To be decided	1	0/30/0/0/0
	Students will have to pass the entrance test to check their language skills. Depending on results of the test student will be directed to the appropriate group.				

	Study program	Subject	Teacher(s)	ECTS credits	Hours L/C/Lb/S/P
11	Not applicable	Basics of polish language and culture	To be decided	1	0/30/0/0/0
	The scope of knowledge to be mastered: Having attended the scheduled lectures and classes the student should **know** how to interact on topics related to Polish culture, everyday life, geography, etc., basic phrases in Polish. **be able** gain awareness on the linguistic and cultural specificity Poland; to start communicate with basic Polish phrases. Subjects: Language; Geographical areas; Historical background to today's Poland; Education; Travelling and traditions; Political framework; Everyday living				

Vocabulary

(A)	Lectures:	The lecturer teaches students interrelated contents of a subject based on his / her knowledge, using various teaching methods.
(C)	Classes:	knowledge and skills are acquired by solving computing problems. The teacher directs students and supervises the classes.
(L)	Laboratories:	knowledge and skills are acquired by performing practical or experimental work. The teacher directs students and supervises the lab classes. Students do practical work or make experiments.
(P)	Project:	The work relates to engineering developments and seeking solutions to technical problems.