

## MARINE ELECTRICAL ENGINEERING FACULTY

PROGRAMME of STUDIES		
B.Sc. Programme	Faculty of Marine Electrical Engineering	
	Section:	Electrotechnics

**Fall (winter) semester**  
(September-January)

Course title/description	ECTS points	Sem.
<b>English</b> <i>Description:</i> Grammar review: to be, to have, there is, numbers, pronouns, adjectives, possessives, nouns, plural, using different tenses. Communicating in simple everyday situations. English phonetics basics. Fundamentals of engineering classification. Electrics and Electronics - basic vocabulary. Electronic diagrams: Joining information from the diagrams and the texts, electric symbols. Basics of mathematics (matrix, integrals, differential calculus etc.).	3	3
<b>Materials engineering I</b> <i>Description:</i> Conductivity, dielectric constant, magnetic permeability. Classification of electrical materials. Conducting materials. Conductivity of metals. Semiconducting materials. Semiconductors. Dielectric materials. Dielectric materials polarization. Dielectric constant. Dielectric strength. Durability of dielectric materials. Combustibility. Classification and applications of dielectric materials. Magnetic materials. Diamagnetic, paramagnetic and ferromagnetic.	1	1
<b>Geometry and engineering graphics</b> Overview of basic AutoCAD functions and tools. Creating a project in AutoCAD Electrical and discussing the basic functions and tools required for working in this environment. Creating a project in AutoCAD Electrical, inserting a drawing table, inserting a ladder, and creating wire connections between individual points, inserting components and drawing wire connections between them	2	1
<b>Digital Circuits Theory and Technology I</b> <i>Description:</i> Numeration systems and codes. Theory of digital circuits. Basic digital circuits. Digital signals and gates, logical symbols. Analysis and synthesis of combinational circuits and sequential circuits. Realization of combinational and sequential circuits. Functional blocks of the average scale of integration. Synthesis of a typical synchronous and asynchronous circuits.	3	1
<b>Fundamentals of electrotechnics II</b> Three phases circuits. Non sinusoidal voltage and current waveforms, harmonic analyses, Dirichlet's conditions, Fourier series, Parseval's theorem, The transient in D.C and A.C circuits, Laplace transform, inverse Laplace transforms, a solution of differential equations (operational method). Transmission lines, basic phenomena and quantities, phase delay, wavelength, velocity of propagation, current and voltage relationships	6	3
<b>Electromagnetic Field Theory</b> <i>Description:</i> Basic formulas and theorems of the vector analysis. Coulomb's law, and the definition of the values of the electric field for point charges. Electrical and magnetic phenomena. Theory of Magnetic circuits. Mutual coils. Method for determining characteristic quantities of electric and magnetic field. Gauss law and Ampere's law for the simple symmetric cases. Biot-Savart law. Maxwell's equations.	3	3
<b>Metrology II</b> <i>Description:</i> Temperature sensors, differential photodetector, analog and programmable transducers, converters, 4-20mA standard, HART transmitters, measurement channels and their application for selected non-electrical quantities measurements, diagnostics of the measurement channels.	2	3
<b>Computer-aided engineering calculations II</b> <i>Description:</i> Implementation of a series of programming tasks in MATLAB, Simulink, and MATLAB-Grader environments	2	3

<b>Electrical Machines I</b> <i>Description:</i> Introduction to electric machines theory; basic principles and concepts, design elements, construction materials, definitions and classification. DC and AC machines; structure, principle of operation, basic characteristics, exploitation properties. Transformers; structure, basis of operation, 3-phase transformers, exploitation properties.	2	3
<b>Electronics and Power Electronics II</b> <i>Description:</i> Working conditions of power components. Thyristors. Triacs. Power transistors. Power converters. Rectifiers. Safety arrangements of thyristor and transistor systems. Active and passive power.	4	3
<b>Microprocessor Control Systems II</b> <i>Description:</i> Microcontrollers programming in C language. Typical components of the microprocessor system. Data buses: RS 232, RS 422, RS 485, I2C, CAN, USB. 16 and 32-bit microcontrollers.—Evaluation microprocessor system. Compiling and linking of programs in C. Microcontroller ports. Self-realization of complex program using the previously known components.	2	3
<b>Fundamentals of Control Engineering II</b> <i>Description:</i> Dynamic correction of control systems. Composite control systems. Digital control systems. Non-linear control systems. Extremal regulation. Optimal control. Adaptive control. Game control.	2	3
<b>High Voltage</b> <i>Description:</i> Technic and Engineering. Ionization and deionization processes. Nature and forming of electric stresses, insulation configurations. Break-down strength of gases, solid and liquid dielectrics, discharge development, partial discharges. Exploitation insulation systems. Inner and outer over voltage characteristic, atmospheric discharges, overvoltage and lighting protection.	2	3
<b>Power System Control &amp; Automation II</b> Visualization of ship power system. SCADA Systems, PLC programming. Simple computation, data processing computers, wired type & stores programmed type computers, computer control (AI, AO, DI, DO). Application of computers on merchant ships for performance monitoring & maintenance data.	1	5
<b>Programmable Logic Controllers II</b> <i>Description:</i> Combinational logic, sequential logic. Digital control systems. Sequential control, Moore and Mealy machine, process controlled and time controlled systems. Description of control systems: states, system variable, transitions, output functions. Control system synthesis. Programming of drive control, system testing by DC motors and 3-phase drives.	1	5
<b>HMI Engineering</b> <i>Description:</i> HMI destination and application. HMI communication basics: HMI-PC, HMI-PLC. Editing and presentation of PLC variables on HMI. Lamps, Numeric and Message Displays. Switches, keypads. Screens, graphics, functional switches. Alarm windows, animation, scripts. Examples: interfaces for wave generator, drive control. Synthesis of an control system with PLC, touch panel.	1	5
<b>Ship Electrical Drives Control Systems II</b> <i>Description:</i> Equations of motion. Energy storing. Machinery characteristics – parameters, schemes, equations, power distribution, starting, braking, control. Drive system with DC and AC machine. DC and AC motor automatic control systems. Marine and industrial applications. Ship diesel-electric propulsion systems.	3	5
<b>Ship Electrical Power Generation and Distribution</b> <i>Description:</i> Marine electrical power plants. Shaft generators. Synchronization and work in parallel of ship's generators. Ship voltage regulators. Protection of ship generators. Emergency power plants. Systems of electrical energy transmission and distribution on ships. Functions and structure of ship switchboards. Ship cables. Power management systems on ships. Main electric propulsion.	2	5

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<b>Marine Power System - Control &amp; Automation</b> <i>Description:</i> Automation of Ship Electrical Power Plant and Auxiliary systems. Diesel generators. Shaft generator. Turbo generator. Shore supply. Emergency generator. Main switchboard. Emergency switchboard. Consumers. Feeders. Earth Monitoring etc.	1	5
<b>Electronavigational Equipment</b> <i>Description:</i> GPS, DGPS, EGNOS -theory, errors, gyrocompasses – theory, structure, deviations, logs – theory, structure echosounders – structure, range, integrated bridge systems, azipods - structure, applications, exemplary marine devices of all equipments	3	5
<b>Marine Communication Equipment</b> <i>Description:</i> Radionavigation, communications and technical systems. GMDSS. Emergency. Antennas. Radio and telephone communications on ship. Automatic telephone operator. EPIRB. Transceiver. Satellite communications terminals. Signals.	2	5
<b>Marine Electric Equipment Maintenance</b> <i>Description:</i> Specifics of the operation and diagnostics. Conduct operational and diagnostic methodology. Standard power cable dimensions. Marine installation equipment. Cable installation technology. Mounting electric equipment and devices. Maintenance and diagnostics. DC machine diagnostics. Asynchronous and synchronous machine diagnostics. Electrical machines repair.	3	5
<b>Ship's Monitoring Systems and Instrumentation</b> <i>Description:</i> Types of engine room and deck monitoring systems. Measurement and executive line used in monitoring and control systems. Sensors. Transducers analog and programmable (HART). Diagnostic, repairing, calibration, commissioning of measuring temperature, pressure, level etc. Electronic ship's fire monitoring systems.	3	5
<b>Computer Area Network</b> <i>Description:</i> Origins of computer networks. Organization of the ISO OSI reference model. The signals in the network and transmission media. Network topologies. Hardware resources and organization of the network. The basic properties of selected local networks. IEEE 802 Standards. Ethernet, types, media, methods of access to the communication channel. Upper layer protocols, TCP / IP stack. Network operating systems and utilities. Network administration. Safety.	2	7
<b>Explosion Protection Engineering</b> <i>Description:</i> Nature of flammable materials. Gas, dust grouping. Temperature codes. Ship's hazardous area (gas, dust). Types of explosion-proof protection for electrical equipment, particularly: Ex d, Ex e, Ex p, Ex i. Combined (hybrid) methods of protection. Wiring systems. Maintenance of electrical equipment in hazardous area. IECEx versus ATEX and North America approach. Ex certificates. Intrinsically safe systems for measurement and control.	2	7
<b>Power Conditioning Systems</b> <i>Description:</i> Overview of the conditioning, methods and systems. Introduction to theory of instantaneous power. Series and shunt compensators. DVR systems. Passive, active and hybrid systems. Reserve and uninterruptible power supply systems - classification, structure and the functional possibilities. Energy storage systems.	2	7

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