

MARINE ELECTRICAL ENGINEERING FACULTY

FACULTY of MARINE ELECTRICAL ENGINEERING
SECTION of ELECTRICAL ENGINEERING
GROUP of MARINE ELECTRO-AUTOMATION

PROGRAMME of STUDIES		
B.Sc. Programme	Faculty of Marine Electrical Engineering	
	Section:	Electrical Engineering
	Group:	Marine Electro-Automation

Unit responsible

1	Sports Department
2	Mathematics Department, Navigation Faculty
3	Physics Department, Mechanical Faculty
4	Marine Electrical Power Engineering Department, Electrical Faculty
5	Foreign Language Department
6	Ship Automation Department, Electrical Faculty
7	Management Department, Business Administration Faculty
8	Technology Fundamentals Department, Mechanical Faculty
9	Marine Radioelectronics Department, Electrical Faculty
10	Chemistry Department, Business Administration Faculty
11	Marine Propulsion Plant, Mechanical Faculty
12	Repair Technology Department, Mechanical Faculty

L – Lecture, T – Tutorial, Lab – Laboratory, P – Project

Fall semester (I)

No.	Course title/description	No. of hrs. in semester	ECTS points	Unit resp.
1	Mathematics <i>Description:</i> Complex numbers. Algebra. Differential and integral calculus-single variable. Vector calculus. Analytical geometry.	45 L 45 T	4 3	2
2	Physics Error calculus. Kinematics and dynamics. SHM. Waves. Energy conservation. Force field. Testing physical laws.	30 L 15 T 30 Lab	3 1 2	3
3	Theoretical Electrotechnics <i>Description:</i> Electric circuit theory. DC linear and nonlinear circuits. AC sine current theory and circuits.	45 L 30 T	4 3	4
4	Computer Science Fundamentals <i>Description:</i> Computer structure. Operation system. Programming codes – Assembler, Pascal, Delphi.	30 L	4	6
5	Material Science <i>Description:</i> Metals and alloys. Electrical Materials properties. Marine environment. Non-metallic materials. Corrosion.	30 L	2	4
6	Fundamentals of Machines Construction <i>Description:</i> Statics. Equilibrium conditions. Strength of	30 L 30 P	2 2	8

MARINE ELECTRICAL ENGINEERING FACULTY

	materials. Structural joints. Drive systems. Technical drawing. Tolerance and fitting.			
--	--	--	--	--

Summer semester (II)

7	Sports	30 T	0	1
8	Mathematics <i>Description:</i> Differential and integral calculus of multi-variable function. Integral transformation. Series. Selected numerical methods. Optimization.	45 L 30 T	3 2	2
9	Physics <i>Description:</i> Relativity theory. Early quantum theory. X-rays. Atom models. Spectrofotometry. Energy band theory. Laser. Nuclear physics. Radiation. Planck constant. Semiconductor.	30 L 30 T	2 2	3
10	Theoretical Electrotechnics <i>Description:</i> AC-sine current circuits. Multi-phase circuits. Periodic nonharmocic current. Transients. Use of MathCad. Thevenin theorem. Nonlinear component. Resonance. Harmonic analysis. Transient simulation.	45 L 30 T 30 Lab	4 2 2	4
11	Computer Science Fundamentals	45 Lab	4	6
12	Material Science	30 Lab	2	4
13	Fundamentals of Electronics and Power Electronics <i>Description:</i> Semiconductor and opto-electronic components. Diagnostics. Amplifiers. Stabilizers. Generators. Converters.	45 L	4	6
14	Metrology <i>Description:</i> Unit system. Measurement methods. Errors. Instruments. A/D converters. Digital instruments. Oscilloscope. Signal transmission. Microprocessor instruments.	30 L	3	4

Fall semester (III)

15	Sports	30 T	0	1
16	English	30 L	1	5
17	Mathematics <i>Description:</i> Probability calculus. Mathematical statistics. Reliability in system operation.	30 L 30 T	2 2	2
18	Theoretical Electrotechnics <i>Description:</i> Transients in electrical circuits. Distributed parameter circuits. Magnetic field and circuits. Electromagnetic field theory.	30 L 30 T	3 3	4
19	Electrical Machines <i>Description:</i> Basic principles. Components and materials. DC machines. Transformers. 3-phase transformers.	30 L	3	4
20	Digital Technique <i>Description:</i> Digital semiconductor IC. Number systems. Codes. TTL and CMOS technologies. Gates. Function blocks. Memory. I/O systems. Programmable systems and components.	30 L 30 T	3 2	6
21	Fundamentals of Electronics and Power Electronics <i>Description:</i> Workbench software. Simulation of various states and processes.	30 Lab	2	6
22	Metrology <i>Description:</i> Direct and indirect measurements. Linearization. Correction. Temperature, rotational velocity and stress measurement. Digital instruments.	30 L 30 T	3 2	4

MARINE ELECTRICAL ENGINEERING FACULTY

	Signal transmission.			
23	Electrical Equipment <i>Description:</i> Environment. Electrical equipment technical characteristics. Safe use consideration.	30 L	2	4
24	Marine Electrical Equipment Operation and Service <i>Description:</i> Standard power cable dimensions. Marine installation equipment. Cable installation technology. Mounting electric equipment and devices. Maintenance and diagnostics.	30 Lab	1	4
25	Ship Structure <i>Description:</i> General information of seagoing vessels. Law acts. Class societies. Ship main dimensions. Stability and buoyancy. Hull structure. Construction materials. Strength of materials. Structure joints. On board equipment and installations.	15 L	1	6

Summer semester (IV)

26	Sports	30 T	0	1
27	English	30 Lab	1	5
28	Electrical Machines <i>Description:</i> Asynchronous and synchronous machines. Specialized machines. Testing DC and AC machines.	30 L 45 lab	2 2	4
29	Fundamentals of Automatic Control <i>Description:</i> Basic terms. Mathematical models of linear systems. Operational calculus. Block diagrams. Quality criteria. Continuous PID controller. Correction of automatic control systems. Cascade automatic control.	30 L 15 T	2 2	6
30	Digital Technique	30 Lab	3	6
31	Fundamentals of Electronics and Power Electronics <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.	45 L	3	6
32	Metrology <i>Description:</i> Testing measurement lines and transducers	30 Lab	3	4
33	Ship Electrical Drives Control Systems <i>Description:</i> Equations of motion. Energy storing. Machinery characteristics – parameters, schemes, equations, power distribution, starting, braking, control.	30 L	3	6
34	Electrical Equipment <i>Description:</i> Protection equipment. Lighting. Batteries. Heating arrangement. Switches. Transformers. Machinery protection devices.	30 L 30 Lab	2 1	4
35	Ship Electrical Power Generation and Distribution <i>Description:</i> Basic Marine Electric Power Systems. Electrical Distribution Systems. Energy sources. Generators parallel operation. Generators synchronization.	15 L	2	4
36	Marine Propulsion Systems and Auxiliary Machinery <i>Description:</i> Classification. Steam-water cycle of turbine system. Main and auxiliary boilers. Main and auxiliary combustion engines. Pumps. Heat exchangers. Hydraulic systems. Steering gears. Environment protection.	45 L	4	11

Fall semester (V)

MARINE ELECTRICAL ENGINEERING FACULTY

37	Sports	30 T	0	1
38	English	30 Lab	1	5
39	Fundamentals of Automatic Control <i>Description:</i> Direct digital control. PID controllers. Nonlinear system analysis. 2- and 3-position automatic control systems. Optimization.	15 L 30 Lab	1 2	6
40	Fundamentals of Electronics and Power Electronics <i>Description:</i> TCAD software. Rectifier system simulation. Controller simulation. Testing power electronics components. Power electronics system diagnostics.	30 Lab	2	6
41	Ship Electrical Drives Control Systems <i>Description:</i> Transient state of electric machine. Drive system with DC machine. DC motor automatic control systems. Marine and industrial applications.	30 L	2	6
42	Ship Electrical Power Generation and Distribution <i>Description:</i> Emergency systems. Voltage control. Short circuit current. Power system operation. Power distribution and losses. Testing synchronous generator. Testing electrical equipment.	30 L 30 Lab	3 3	4
43	High Voltage Technology <i>Description:</i> Ionization. Stresses in dielectric. Insulation. Gas and liquid dielectrics. Insulation system strength. Marine HV insulation systems.	30 L	2	4
44	Microcomputer Control Systems <i>Description:</i> Basic structures. Standards. Microprocessor structure and operation. Logics, memory, transmission, basic operations. Microcomputer. Parallel I/O. D/A and A/D converters. Digital I/O programming.	15 L 15 Lab	1 1	6
45	Ship Automatic Control Systems <i>Description:</i> Ship as a control object. Automation range. Class rules. Integrated system. Generator synchronization. Shaft generator control. Emergency generator control. Diagnostics.	30 L	2	6
46	Navigation Instruments <i>Description:</i> Logs – operation, structure. Gyrocompass – theory, structure, deviations. Autopilot – operation, structure. Class rules. Echosounders – structure, range of operation, signal recording.	30 L	2	6
47	Marine Electrical Equipment Operation and Service <i>Description:</i> DC machine diagnostics. Asynchronous and synchronous machine diagnostics. Electrical machines repair. Technical electric drawings - reading and using.	30 Lab 15 P	1 1	4
48	Marine Propulsion Systems and Auxiliary Machinery <i>Description:</i> Boiler supply, fuel supply, cooling , lubrication, steamer bilge-and-ballast system, fire fighting, sanitary installation service. Mechanical engineer on watch. Black-out procedure. Testing rotary pumps, piston compressor, heat exchanger. Combustion engine operation.	30 L 30 Lab	2 2	11
49	Mechanical Workshop Training	30 Lab	1	12
50	Ergonomics and Safety of Work <i>Description:</i> Man-artifact relations. Reliability. Risk analysis. Stress. Ergonomic diagnostics. Legal acts. Electrical network influence. Means of protection. Safety with electric network and equipment. Chemical agents. Microwaves. Safety zones.	30 L	1	6/11

MARINE ELECTRICAL ENGINEERING FACULTY

Summer semester (VI)

51	On board training	6 months	30	4/6/ 11
----	--------------------------	----------	----	------------

Fall semester (VII)

52	English	45 L	2	5
53	Fundamentals of Automatic Control <i>Description:</i> Electric and electronic automation components and equipment. Pneumatic and hydraulic components and equipment. Servomechanisms. Applications.	30 L	3	6
54	Metrology <i>Description:</i> Explosion – conditions, parameters, classification. Endangered area. Means of protection. Spark danger – conditions, standards. Measurement systems. Class rules. Testing spark-safe measurement systems. Testing programmable converters in spark-safe systems. Galvanic barrier.	15 L 15 Lab	1 1	4
55	Ship Electrical Drives Control Systems <i>Description:</i> AC machine control methods. AC motor control systems. Ship diesel-electric propulsion systems.	30 L 45 Lab	2 2	6
56	High Voltage Technology <i>Description:</i> Testing static and impact electric strength of air. Dielectric loss measurement.	30 Lab	2	4
57	Microcomputer Control Systems <i>Description:</i> Computer controlled measurement and control systems. Programmable controllers. Software use and creation. Applications – GE Fanuc and Siemens S7 controllers.	30 L 45 Lab	2 2	6
58	Ship Automatic Control Systems <i>Description:</i> Engine remote control. Hydraulic and electric governors. Adjustable propeller remote control system. Air and fuel supply, supercharging, lubrication, cooling and other applications.	30 L	3	6
59	Ship Deck Equipment <i>Description:</i> Hydraulic systems fundamentals. Deck cranes. Windlass and mooring machinery. Boat davit. Cargo handling systems in tankers. Hatch covers. Ship stern, side and bow gates.	30 L 15 T	2 1	6
60	Navigation Instruments <i>Description:</i> Testing pressure log and electromagnetic log. Testing gyrocompasses. Testing Rate of Turn. Compass. liquid testing. Echosounder demo.	30 Lab	1	6
61	On board Communications Equipment <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.	15 L 15 Lab	1 1	9
62	Marine Electrical Equipment Operation and Service <i>Description:</i> Class society. Class rules. Marine Administration Board. Periodic survey and repair. An electric installation documents. Responsibilities.	15 L	1	4
63	Marine Refrigeration Systems <i>Description:</i> Ship refrigeration systems. Compressors and heat exchangers. Air conditioning. Refrigerated containers. Automatic refrigeration control. Diagnostics.	30 L	2	11

MARINE ELECTRICAL ENGINEERING FACULTY

64	B.Sc. Thesis Seminar <i>Description:</i> Logic structure of B.Sc. thesis. Goal definition. Source search. Partial and final presentation.	15 T	1	4/6
----	---	------	---	-----

Summer semester (VIII)

65	English	45 Lab	2	5
66	Fundamentals of Automatic Control	30 Lab	3	6
67	Ship Automatic Control Systems	45 Lab	4	6
68	Ship Refrigeration Systems <i>Description:</i> Testing refrigeration installation. Adjusting efficiency of refrigeration compressor. Adjusting thermostatic valve parameters. Testing evaporator under variable load.	15 Lab	2	11
69	Environment Protection <i>Description:</i> Sources of pollution and contamination. International and national legal acts. Oil spilling elimination. Environment-friendly systems of garbage disposal.	15 L	2	10
70	Economics <i>Description:</i> Production costs. Market mechanisms. Consumer behavior. GNP. Money. Banking. Job market, unemployment. Inflation. State budget and tax policy. Micro- and macroeconomics.	30 L	2	7
71	Management <i>Description:</i> Strategies. Management in production and service area. Product and service – marketing. Company management. Organization, manufacturing and labor processes. Planning. Case studies.	30 L	2	7
72	B.Sc. Thesis Seminar <i>Description:</i> Logic structure of B.Sc. thesis. Goal definition. Source search. Partial and final presentation.	15 T	13	4/6

GROUP of COMPUTER CONTROL SYSTEMS

PROGRAMME of STUDIES		
B.Sc. Programme	Faculty of Marine Electrical Engineering	
	Section:	Electrical Engineering
	Group:	Computer Control Systems

Unit responsible

1	Sports Department
2	Mathematics Department, Navigation Faculty
3	Physics Department, Mechanical Faculty
4	Marine Electrical Power Engineering Department, Electrical Faculty
5	Foreign Language Department
6	Ship Automation Department, Electrical Faculty
7	Management Department, Business Administration Faculty
8	Technology Fundamentals Department, Mechanical Faculty
9	Marine Radioelectronics Department, Electrical Faculty
10	Chemistry Department, Business Administration Faculty

MARINE ELECTRICAL ENGINEERING FACULTY

L – Lecture, T – Tutorial, Lab – Laboratory, P – Project

Fall semester (I)

No.	Course title/description	No. of hrs. in semester	ECTS points	Unit resp.
1	Mathematics <i>Description:</i> Complex numbers. Algebra. Differential and integral calculus- single variable. Vector calculus. Analytical geometry.	45 L 45 T	4 3	2
2	Physics Error calculus. Kinematics and dynamics. SHM. Waves. Energy conservation. Force field. Testing physical laws.	30 L 15 T 30 Lab	3 1 2	3
3	Theoretical Electrotechnics <i>Description:</i> Electric circuit theory. DC linear and nonlinear circuits. AC sine current theory and circuits.	45 L 30 T	4 3	4
4	Computer Science Fundamentals Computer structure. Operation system. Programming codes – Assembler, Pascal, Delphi.	30L	4	6
5	Material Science <i>Description:</i> Metals and alloys. Material electrical properties. Marine environment. Non-metallic materials. Corrosion.	15 L 15Lab	1 1	4
6	Fundamentals of Machines Construction <i>Description:</i> Statics. Equilibrium conditions. Strength of materials. Structural joints. Drive systems. Technical drawing. Tolerance and fitting.	30 L 30 P	2 2	8

Summer semester (II)

7	Sports	30 T	0	1
8	Mathematics <i>Description:</i> Differential and integral calculus of multi-variable function. Integral transformation. Series. Selected numerical methods. Optimization.	45 L 30 T	3 2	2
9	Physics <i>Description:</i> Relativity theory. Early quantum theory. X-rays. Atom models. Spectro-photometry. Energy band theory. Laser. Nuclear physics. Radiation. Planck constant. Semiconductor.	30 L 30 T	2 2	3
10	Theoretical Electrotechnics <i>Description:</i> AC-sine current circuits. Multi-phase circuits. Periodic non-harmocic current. Transients. Use of MathCad. Thevenin theorem. Nonlinear component. Resonance. Harmonic analysis. Transient simulation.	45 L 30 T 30 Lab	4 2 2	4
11	Computer Science Fundamentals <i>Description:</i> Operation system. Spreadsheet. Power Point. C programming code. Computer graphics. Object-oriented programming.	45 Lab	4	6
12	Fundamentals of Electronics <i>Description:</i> Semiconductor and opto-electronic components.. Diagnostics. Amplifiers. Stabilizers. Generators. Converters.	45 L	4	6
13	Metrology <i>Description:</i> Unit system. Measurement methods. Errors.	30 L	3	4

MARINE ELECTRICAL ENGINEERING FACULTY

	Instruments. A/D converters. Digital instruments. Oscilloscope. Signal transmission. Microprocessor instruments.			
14	Computer Programming Fundamentals <i>Description:</i> Software engineering. Data structure. Delphi and C++ Borland codes. Data bases.	15L	2	6

Fall semester (III)

15	Sports	30T	0	1
16	English <i>Description:</i> Grammar levels I and II. Basic vocabulary. Primary conversation.	30 Lab	2	5
17	Mathematics <i>Description:</i> Probability calculus. Mathematical statistics. Reliability in system operation.	30 L 30 T	3 2	2
18	Theoretical Electrotechnics <i>Description:</i> Transients in electrical circuits. Distributed parameter circuits. Magnetic field and circuits. Electromagnetic field theory.	30 L 30 T	3 3	4
19	Electrical Machines <i>Description:</i> Basic principles. Components and materials. DC machines. Transformers. 3-phase transformers.	30 L	3	4
20	Digital Technique <i>Description:</i> Digital semiconductor IC. Number systems. Codes. TTL and CMOS technologies. Gates. Function blocks. Memory. I/O systems. Programmable systems and components.	30 L 30 T	3 2	6
21	Fundamentals of Electronics <i>Description:</i> Workbench software. Simulation of various states and processes.	30 Lab	2	6
22	Metrology <i>Description:</i> Direct and indirect measurements. Linearization. Correction. Temperature, rotational velocity and stress measurement. Digital instruments. Signal transmission.	30 L 30 T	3 2	4
23	Computer Programming Fundamentals <i>Description:</i> Practicing Delphi and C++. Dynamic data exchange. DB programming	30 Lab	2	6

Summer semester (IV)

24	Sports	30 T	0	1
25	English	30 Lab	1	2
26	Electrical Machines <i>Description:</i> Asynchronous and synchronous machines. Specialized machines. Testing DC and AC machines.	30 L 30 Lab	2 2	4
27	Fundamentals of Automatic Control <i>Description:</i> Basic terms. Mathematical models of linear systems. Operational calculus. Block diagrams. Quality criteria. Continuous PID controller. Correction of automatic control systems. Cascade automatic control.	30 L 15 T	3 1	6
28	Digital Technique <i>Description:</i> Simulation software. Combined circuits. Gates. Sequence circuit synthesis. Integrated counters and registers. Digital system diagnostics.	15 L 30 Lab	1 2	6
29	Fundamentals of Power Electronics <i>Description:</i> Working conditions of power components.	30 L 15 L	2 1	6

MARINE ELECTRICAL ENGINEERING FACULTY

	Tyristors. Triacs. Power transistors. Power converters. Rectifiers. Safety arrangements of thyristor and transistor systems. Active and passive power.			
30	Metrology <i>Description:</i> Testing measurement lines and transducers. Thermocouple. Differential photo-detector. Analog measurement line.	15 Lab	2	4
31	Computer Aided Design <i>Description:</i> Review of the design software. Matlab - Simulink, Real Time Workshop. Identification. Design and simulation of various electric circuits	30 L 30 P	2 2	6
32	Signal Conversion and Transmission <i>Description:</i> Determined and random signals. DFT&FFT. Signal sampling. Filtering. Voice and view conversion. Distortions. Signal processors.	30 L 15 T	2 1	6
33	Microprocessor Technology <i>Description:</i> Microcontroller architecture. Instruction list. Assembler and linker. Data transmission bus. Programming in C.	30 L 30 P	2 2	6
34	Computer Networks <i>Description:</i> Reference models. Network topology. Protocols. Software. Network administration.	15 L	2	4

Fall semester (V)

35	English	30 Lab	1	1
36	Fundamentals of Automatic Control <i>Description:</i> Direct digital control. PID controllers. Nonlinear system analysis. 2- and 3-position automatic control systems. Optimization.	30 Lab	3	6
37	Microprocessor Technology <i>Description:</i> Configuring network card. Creating www. File and mail transmission. Web pages.	30 Lab	3	6
38	Computer Networks <i>Description:</i> Network card programming. Network Computer network. Www. E-mail.	30 Lab	3	6
39	Electric Power Technology <i>Description:</i> Primary energy sources. Synchronous generators. Power plants. Transmission losses. Electric power system protection. Work safety.	30 L 15 Lab	2 1	4
40	Programmable Controllers <i>Description:</i> Measurement & control systems. GE Fanuc controller configuration. Logic and time -related programming. Digital lock. Program structure. Applications.	30 L 45 Lab	3 4	6
41	Electric Power System Automation <i>Description:</i> Central and local level automatic systems. Reliability. Automatic protection arrangements. Diagnostics.	30 L	2	6
42	Drive Systems <i>Description:</i> Static and dynamic properties. Control system requirements.	30 L	2	6
43	Computer Systems <i>Description:</i> System structure. System properties management. Network operation systems. SQL code. Concentrated and distributed structure.	30 L	2	9
44	Micro - Computer Control Systems <i>Description:</i> Computer controlled measurement and control systems. Programmable controllers. Software use	15 L 15 Lab	2 1	6

MARINE ELECTRICAL ENGINEERING FACULTY

	and creation. Applications. – GE Fanuc and Siemens S7 controllers.			
45	Ergonomics and Safety of Work <i>Description:</i> Man-artifact relations. Reliability. Risk analysis. Stress. Ergonomic diagnostics. Legal acts. Means of protection. Safety with electric network and equipment. Chemical agents. Microwave. Safety zones.	30 L	1	6/4

Summer semester (VI)

46	English	30 Lab	1	1
47	Electric Power System Automation <i>Description:</i> Automatic-controlled single and parallel generators operation. Automatic and manual power plant control. Automatic control of marine machinery. Power plant monitoring.	30 Lab	3	6
48	Drive Systems <i>Description:</i> Basic parameters of a drive system. Determination static characteristics of an .AC and DC drive systems. Programmable controller implementation	30 Lab	3	6
49	Industrial Computer Networks <i>Description:</i> Network architecture and components. Communication and access protocols. Communication management.	30 L 15 Lab	3 1	6
50	Computer Systems <i>Description:</i> Computer system management. Network operation systems. Protection and security of computer systems. Data bases. SQL code.	15 Lab	1	9
51	Discrete Control Automation Systems <i>Description:</i> Synthesis of discrete systems. Petri networks. SFC modeling method. PLC controllers in discrete systems. Stateflow Matlab tools for discrete systems.	30 L	3	6
52	Microprocessor-based Measurement Systems <i>Description:</i> Mathematical model of an measurement line. Software and hardware vs. accuracy. Measurement algorithms. Calibration. Data visualization and testing of measurement systems.	15 L	2	4
53	Automatic Control System Devices <i>Description:</i> Transducers, converters, amplifiers, controllers. Pneumatic and hydraulic system components. Industrial robots.	15 L	2	6
54	Measurement and Control Systems <i>Description:</i> Structure and configuration of the measurement and control systems. Software. Data acquisition. Intelligent transducers. Interfaces. Communication protocols. Data processing.	15 L	2	4
55	Digital Communications Systems <i>Description:</i> Block structures. Information sources. Analog and digital modulation. Coding. Transmission with feedback. Integrated networks. Fiber-optic telecommunication. Mobile and satellite radio-communications.	30 L 15 Lab	2 1	9
56	Economics <i>Description:</i> Production costs. Market mechanisms. Consumer behavior. GNP. Money. Banking. Job market, unemployment. Inflation. State budget and tax policy. Micro- and macroeconomics.	30 L	2	7
57	Management	30 L	2	7

MARINE ELECTRICAL ENGINEERING FACULTY

	<i>Description:</i> Strategies. Management in production and service area. Product and service – marketing. Company management. Organization, manufacturing and labor processes. Planning case studies.			
58	B.Sc. Thesis Seminar <i>Description:</i> Logic structure of B.Sc. thesis. Goal definition. Source search. Partial and final presentation.	15 T	2	6/4

Fall semester (VII)

59	Discrete Automatic Control Systems <i>Description:</i> Modeling the discrete automatic control systems. Design and simulation of the selected systems.	15 P	2	6
60	Microprocessor-based Measurement Systems <i>Description:</i> Measurement line identification in a multifunctional instrument. Measurement algorithms. Calibrator. Communication with the external systems.	15 Lab	2	4
61	Automatic Control System Devices <i>Description:</i> Testing P, PI, PD, PID controllers ² . Temperature control system with 2-position controller. Testing an industrial robot. Tele-manipulator simulation.	30 Lab	3	6
62	Measurement and Control Systems <i>Description:</i> Graphical environment. Measurement system software. Data acquisition systems. Serial and parallel interface. data processing. Network configuration.	15 Lab	2	4
63	Interference Counter-measures <i>Description:</i> Electromagnetic compatibility. Interference sources. Systems with increased interference resistance. Interference filtration. Electromagnetic compatibility measurement.	15 L 15 Lab	2 1	9
64	High Voltage Technology Fundamentals <i>Description:</i> Ionization and de-ionization processes. Forming electrical strain. Gas dielectric strength. Electric strength of the air and liquids. Strength of the insulation systems. Over-voltage. Estimation of the thunder danger. Protection against thunder.	30 L	2	4
65	Uninterruptible Power Supply <i>Description:</i> Structure of the uninterruptible power systems. Emergency power supply. Applications.	15 L	2	6
66	Environment Protection <i>Description:</i> Sources of pollution and contamination. International and national legal acts. Oil spilling elimination. Environment-friendly systems of waste disposal.	15 L	2	10
67	B.Sc. Thesis Seminar <i>Description:</i> Logic structure of B.Sc. thesis. Goal definition. Source search. Partial and final presentation.	15 T	12	4/6

GROUP of ELECTRO - AUTOMATION

PROGRAMME of STUDIES		
M.Sc. Programme	Faculty of Marine Electrical Engineering	
	Section:	Electrical Engineering
	Group:	Electro – Automation

MARINE ELECTRICAL ENGINEERING FACULTY

Unit responsible

1	Ship Automation Department, Electrical Faculty
2	Marine Electrical Power Engineering Department, Electrical Faculty
3	Humanities Department, Business Administration Faculty
4	Commodity Science Department, Business Administration Faculty

L – Lecture, T – Tutorial, Lab – Laboratory, P – Project

Fall semester (I)

No.	Course title/description	No. of hrs. in semester	ECTS points	Unit resp.
1	Mathematics – Optimization Methods <i>Description:</i> Linear programming. Nonlinear limitless and limited optimization. Dual Lagrange problem. Nonlinear optimization software.	15 L 15 T	2 1	1
2	Theoretical Electrotechnics <i>Description:</i> User software. Linear circuit theory. Transients. Computer-aided nonlinear circuit analysis.	30 L 30 Lab	2 1	2
3	Computer-Aided Design <i>Description:</i> Software review. Matlab-Simulink. RTW.	30 L 30 Lab	2 1	1
4	Automatic Control Methods <i>Description:</i> Multi-dimension systems. Controlability. Modal control. Experts systems. Fuzzy control. Matrix and differential games.	30 L 15 Lab	2 1	1
5	Digital Signal Processing Fundamentals <i>Description:</i> Signal and process classification. Determined and random signals. DFT. FFT. Processing efficiency. Sound and picture processing.	30 L 15 Lab	2 1	1
6	Special Electric Machines <i>Description:</i> Great – power asynchronous machines. Synchronous machines. Limitations. AC machine design – magnetic and electric circuit calculation. Efficiency.	30 L 15 P	1 1	2
7	Measurement, Control and Diagnostic Systems <i>Description:</i> Measurement system configuration. Function blocks. Serial and parallel data transmission. Virtual instruments. Diagnostics. Software. Applications.	15 L 30 Lab	1 1	2
8	Signal Processors in Drive Systems <i>Description:</i> General requirements. Processor system structure. Analysis of selected system. Visualisation software. Measurements. Program for PI two-position governor.	30 L 15 lab	2 1	1
9	Power Electronic Systems <i>Description:</i> Review of PIC and IPM circuits. Semiconductor instrument protection. Current, voltage and rotation velocity measurement. Software design.	15 L	2	1
10	Electrical Power Plants <i>Description:</i> Marine Energy Conversion Systems. Energy generation. Cost optimization. Electric systems on various vessels.	30 L 15 Lab	1 1	2
11	Computer Networks <i>Description:</i> ISO OSI reference model. Signals and transmission media. Network capacity. Management. Exemplary network in shipbuilding industry.	15 L	2	2
12	Electrical Equipment	15 L	1	2

MARINE ELECTRICAL ENGINEERING FACULTY

	<i>Description:</i> Static and dynamic applications. Switches. Distribution boards. Space division, types of danger.	15 lab	1	
--	--	--------	---	--

Summer semester (II)

13	Ship Steering Automation <i>Description:</i> Ship dynamic properties identification. Course control. Steering mechanism. Steering over a given trajectory. Dynamic stabilizing systems. Heel stabilization. Collision avoidance.	15 L 15 Lab	2 1	1
14	Artificial Intelligence Methods <i>Description:</i> Method review. Neural networks. Backward error propagation. Fuzzy sets. Genetic algorithms.	15 L 15 P	2 2	1
15	European Union <i>Description:</i> EU activity review. Economic and political cooperation. EU structure. Adaptation process.	15 L	1	3
16	Quality Systems <i>Description:</i> Quality management. ISO 9000 standards. Quality system documentation. System implementation.	15 L	1	4
17	M. Sc. Thesis Seminar <i>Description:</i> Research methodology. Logical structure of the thesis. References. Presentation.	30 T	21	1/2

MARINE ELECTRICAL ENGINEERING FACULTY

SECTION of ELECTRONICS & COMMUNICATIONS SYSTEMS

PROGRAMME of STUDIES		
B.Sc. Programme	Faculty of Marine Electrical Engineering	
	Section:	Electronics & Communications Systems
	Group:	Marine Electronics Digital Radio Communication Systems

Unit responsible

1	Department of Sports
2	Department of Mathematics, Faculty of Navigation
3	Department of Physics, Mechanical Faculty
4	Department of Management, Business Administration Faculty
5	Department of Marine Radio Electronics, Electrical Faculty
6	Department of Foreign Language
7	Department of Ship Automation, Electrical Faculty
8	Department of Navigation, Navigation Faculty

L – Lecture, T – Tutorial, Lab – Laboratory, P – Project

Fall semester (I)

No.	Course title/description	No. of hrs. in semester	ECTS points	Unit resp.
1	Mathematics <i>Description:</i> Vector space. Complex numbers. Linear algebra. System of linear equations. Linear transformations. Differential & integral calculus. Series. Ordinary differential equations.	45 L 45 T	4 3	2
2	Physics <i>Description:</i> Measurements and their processing. Kinematics and dynamics of a rigid body. Free and forced vibration. Wave propagation. Field theory fundamentals. Quantum theory. Physical properties of liquids and solids.	30 L 15 T	3 1	3
3	Computer Science Fundamentals <i>Description:</i> Data types and structures. Data processing algorithms. Programming languages, Pascal, Delphi. Program codes. Applications.	15 L 15 Lab	2 2	7
4	Computer Operation <i>Description:</i> DOS and Windows operation systems. Basic tools MS Word, MS Excel, Power Point. Network access via Windows. E-mail; file transfer; www.	30 Lab	3	4
5	Computer Programming <i>Description:</i> Algorithms and codes. Program types in C++	30 L 15 Lab	3 1	5
6	Analogue Circuits and Signals <i>Description:</i> Electromagnetic laws. Circuit components and sources. Kirchhoff laws. LSS networks. Selected elements of circuit theory. Basic s-variable domain theorems.	30 L 30 T	3 3	5

MARINE ELECTRICAL ENGINEERING FACULTY

Summer semester (II)

7	Sports	30 T	0	1
8	Mathematics <i>Description:</i> Limit and continuity of multi-variable function. Partial derivatives. Double, triple integral. Extremes of multivariable functions. Complex variable functions. Power series. Laplace transformation.	30 L 30 T	2 2	2
9	Probability Theory and Random Signals <i>Description:</i> Basic concepts. Discrete and continuous random variables. Probability parameters. Distribution functions. Functions of random variables.	15 L	3	5
10	Physics <i>Description:</i> Condensed phase physics. Electric and optical properties of solids. Metal-metal, metal-semiconductor and semiconductor-semiconductor joints. Laser.	15 L 15 Lab	2 1	3
11	Electrodynamics <i>Description:</i> Scalar and vector field. Gradient, divergence, rotation. Electro-magnetic field theory. Laplace & Poisson equations. Principle of energy conservation.	15 L 15 T	2 2	5
12	Computer Programming <i>Description:</i> Object-oriented programming with C++ Builder. Environment description. Top menu and tools. Components. Standard control components.	15 L 30 Lab	1 2	4
13	Electronic Measurement Fundamentals <i>Description:</i> Theory of errors. Magneto-electric meters. Oscilloscope. Digital meters. Digital frequency measurement. Variable voltage and non-linear distortion measurement.	30 L	3	5
14	Materials and Components <i>Description:</i> Resistive materials and components. Safety principles. Bridge measurements of RLC components. Magnetic material properties.	15 L 15 lab	1 1	5
15	Semiconductor Components <i>Description:</i> Semiconductor components. Opto-electronic components. Jointless components. Transistor parameters determination. Catalogues of components.	30 L 30 T	2 2	5
16	Analogue Circuits and Signals <i>Description:</i> Distribution theory. Inverse Laplace, Fourier and Hilbert transformations. Circuit analysis. Operational transmittance. Algebraic stability criteria. Signal analysis. Spectral analysis. Non-linear and semi-linear systems.	30 L 15 T	3 1	5

Fall semester (III)

17	English	30 Lab	1	6
18	Sports	30 T	0	1
19	Probability Theory and Random Signals <i>Description:</i> Random variable series. Markov chain. Random vectors. Correlation. Real and complex random process. Correlation function. Random process simulation. Noise in electric circuits.	30 L 30 T	2 2	5
20	Numerical Methods <i>Description:</i> Series applications. Numerical methods of linear algebra. FFT. Non-linear equation system solution.	15 L 30 Lab	1 2	5

MARINE ELECTRICAL ENGINEERING FACULTY

	Numerical integration. Differential equations.			
21	Electronic Measurement Fundamentals <i>Description:</i> Current, voltage, resistance, frequency and phase shift measurement using magnetolectric instruments. Digital measurements. Use of AC and DC bridges.	30 Lab	3	5
22	Design and Implementation Technology <i>Description:</i> Organisation of electronic production process. Design principles. Manufacturing and assembling. Use of CAD and other computer tools. Ergonomics. Reliability.	30 L	2	5
23	Semiconductor Components <i>Description:</i> Testing basic components. Impulse behaviour of semiconductor components. Testing opto-electronic components.	30 Lab	3	5
24	Analogue Circuits and Signals <i>Description:</i> Spectral analysis of periodic signals. Time- and frequency characteristics. Periodic excitation. Stability. Non-linear circuits.	30 Lab	1	5
25	Digital Technique <i>Description:</i> Number systems. Boolean algebra. Combined and sequence system synthesis.	30 L 15 T	3 1	5
26	Digital Signal Processing Fundamentals <i>Description:</i> Discrete time systems. Time domain – impulse response. Difference equations. Frequency characteristics. DFT. CPS systems. Signal processors.	30 L	3	5
27	Electronic Systems <i>Description:</i> Working conditions of active linear components. Amplifier. Wide-band amplifier analysis. Active filters. Linear voltage stabilisers.	30 L 30 T	2 2	5
28	Opto-electronics <i>Description:</i> Opto-electronic system. Radio- and photometry. Radiation. Polarisation. Laser. Detectors. Fibre optics. Radiation structure. Fibre optic radiation amplifier.	15 L	2	5

Summer semester (IV)

29	English	30 Lab	1	6
30	Sports	30 T	0	1
31	Design and Implementation Technology <i>Description:</i> Computer-aided design of printed circuits. Manufacturing process.	30 Lab	2	5
32	Digital Technique <i>Description:</i> Digital system design. Development trends. System testing. Simulation. Using SPICE software.	15 L 30 Lab	1 2	5
33	Digital Signal Processing Fundamentals <i>Description:</i> Digital filtering. FIR & IIR discrete filter. FSK modulation. Sine generators. DTFM tone generator.	30 Lab 15 P	3 1	5
34	Microprocessor Technology <i>Description:</i> Microprocessor architecture. Memory. Design procedures. Programming technology. Applications.	30 L	2	5
35	Electronic Systems <i>Description:</i> Phase-and-amplitude condition of signal generation. Generators. Non-linear range. Amplitude, phase and frequency modulators and demodulators. Mixers.	30 L 15 T	3 1	5
36	Opto-electronics	15 Lab	1	5

MARINE ELECTRICAL ENGINEERING FACULTY

	<i>Description:</i> Light source testing. Fibre-optics testing. Distance transducer testing. Testing opto-electronic detectors. PLZT modulator testing.,			
37	Electromagnetic Field Theory <i>Description:</i> Wave equation. Wave propagation. Polarisation, reflection and diffraction.	30 L 15 T	3 1	5
38	Telecommunications Signals and Networks <i>Description:</i> Statistical properties of information. Coding & compression. Modulation. Time and spectral characteristics. Digital signal transmission.	30 L 15 T	3 1	5
39	Radio Technology <i>Description:</i> Radio system. Wave range. Antenna. Wave propagation. Radio transmitter and receiver. Modulation and demodulation. Coding & decoding. Radio modem. Radio LAN.	15 L 15 T	1 1	5
40	Automation Fundamentals <i>Description:</i> System description. Continuous objects. Transformation. Stability. Identification. Control quality. Static and dynamic accuracy. Multi-level control. Discrete control. PID governor. Filters. Adaptive, fuzzy and robust control.	30 L	2	7

GROUP OF MARINE ELECTRONICS

PROGRAMME of STUDIES		
B.Sc. Programme	Faculty of Marine Electrical Engineering	
	Section:	Electronics & Communications Systems
	Group:	Marine Electronics

Fall semester (V)

41	English	30 Lab	1	6
42	Sports	30 T	0	1
43	Microprocessor Technique <i>Description:</i> Micro-controller I/O line service. RAM. Keyboard. Display. Serial and parallel transmission. A/D and D/A converters. Real-time clock. Basic programs.	30 Lab 15 P	2 1	5
44	Electronic Systems <i>Description:</i> Transistor in amplifier. Amplifier thermal stability. Differential amplifier. Power amplifier. Linear DC stabiliser. LC and RC generators. Difference multiplier. Phase loop. Operational amplifier.	30 Lab	3	5
45	Microwave Technique <i>Description:</i> Electromagnetic wave guiding. TEM guides. Wave-guides. Adjustment problems. Dispersion matrix. Resonators. Passive structures.	30 L	3	5
46	Automation Fundamentals <i>Description:</i> Dynamic component testing. Jump- and frequency characteristics. Stability. Identification. Quality and accuracy. Stable and transient states. Impulse and extreme control systems. Two-variable control system.	30 Lab	1	7
47	Microelectronics <i>Description:</i> Production processes. Monolithic IC. Thin- and thick layer hybrid systems. SMD technology. Testing IC. ASIC and CMOS systems. Microprocessors. VLSI systems.	30 L	3	5

MARINE ELECTRICAL ENGINEERING FACULTY

48	Semiconductor Power Devices <i>Description:</i> Semiconductor materials. Selected power components. Comparison of electric and thermal properties. Measurement techniques. Development trends.	30 L	3	5
49	VHF Components and Systems <i>Description:</i> Telecommunication and navigation system components. Wave-guides. VHF diodes and transistors.	15 L	2	5
50	Computer Networks <i>Description:</i> Network architecture. Media and cable structure. ISO. IEEE and other standards. LAN service. Ethernet. Modems. Internet. Servers. Client software.	15 L 15 lab	1 1	5
51	Operating Systems <i>Description:</i> Computer system architecture. Operating system structure. Process and memory management. I/O system. UNIX. File conversion programs. System administration	15 L 15 lab	2	5
52	Non-electric Magnitude Measurements <i>Description:</i> Transducers and measurement methods. Strain-gages. Temperature, distance and ROT measurements.	15 L	1	5
53	Antennas and Wave Propagation <i>Description:</i> Antenna in radio communication system. Radiation structures. Transmission and reception antennas.	15 L	2	5
54	Radio Communication Equipment <i>Description:</i> Transmitters and receivers. Frequency synthesis. DDS. HF amplifiers. Microprocessor controlled transmitters and receivers. Terminals, fax, telex, DSC.	45 L	4	5

Summer semester (VI)

55	English	30 Lab	2	6
56	Components and Systems Modelling <i>Description:</i> Basic terms. Model properties. Microscopic models. Discretization. Difference methods. Software. Modelling techniques. Applications.	15 L 45 Lab	1 2	5
57	Semiconductor Power Devices <i>Description:</i> Characteristics. Basic device testing	15 Lab	2	5
58	Electric Energy Conversion Systems <i>Description:</i> Structure and classification. Connectors. Passive subsystems and components. Inductive components. Rectifiers. Stabilisers. Control and protection. Power supply system design. Standards.	30 L	2	5
59	VHF Components and Systems <i>Description:</i> Symmetric and non-symmetric line design. DP and PP filters. Transistor amplifier. Software tools for designing.	15 P	2	5
60	Non-electric Magnitude Measurements <i>Description:</i> Testing selected transducers. Temperature, rpm and strain measurements.	15 Lab	1	5
61	Measurement and Control Systems <i>Description:</i> System structure and organisation. Preliminary conversion of the measured signal. I/O devices.	15 L	2	5
62	Microcomputer – based Control Systems <i>Description:</i> Automatic control principles. Programmable controllers. I/O systems. A/D and D/A converters. Integrated survey and control systems. Programming	15 L	2	7

MARINE ELECTRICAL ENGINEERING FACULTY

	techniques.			
63	Antennas and Wave Propagation <i>Description:</i> Electromagnetic field. Linear and directional antenna. Computer –aided design. HF disturbance. Range prediction.	15 Lab	1	5
64	Radio Communication Equipment <i>Description:</i> Generators. Synthesiser testing. Testing LF conditioning systems. Fax transmission. UKF FM transmission. Band and sensitivity measurement. Blocking cross modulation.	45 Lab	3	5
65	Marine Radio Communication Systems <i>Description:</i> GMDSS concept. Marine mobile ground and satellite radio service. GMDSS station equipment. MF/HF/VHF marine transceiver. Safety precautions.	30 L	3	5
66	Radio Navigation Equipment <i>Description:</i> Mapping. Location and radio-navigation facilities. Measurement systems. Incoming signal location. TRANSIT, GPS, GNSS. Anti-collision problems.	15 L	2	8
67	Navigation Instruments <i>Description:</i> Gyrocompass theory. Classification rules on gyrocompass. Logs, principles of operation, types, and calibration. Echo sounder structure, signal recording, and accuracy. Autopilot as a PID governor, properties.	15 L	2	7
68	International Radio Communication Rules <i>Description:</i> General characteristics. Frequency ranges. Priorities. Emergency systems; GMDSS. SAR. Shore-based system procedures. Alarm frequencies protection. NBPD procedures. Satellite communications. Legal aspects.	30 L	2	5
69	Ship Structure <i>Description:</i> Ship types. Rules of classification. Quality and safety. Basic dimensions. Hull structure division. Stability and buoyancy. Construction materials. Hull strength. Structure joints. Water tightness. Marine equipment.	15 L	1	7

Fall semester (VII)

70	English	30 Lab	4	6
71	Electric Energy Conversion Systems <i>Description:</i> Impulse voltage source design.	15 P	2	5
72	Measurement and Control Systems <i>Description:</i> Data acquisition. Transducers. Low-pass filtration. A/D conversion. Testing analogue and digital cards. Use of LABVIEW. RS232 and IEC 625 interfaces.	15 Lab	3	5
73	Marine Systems Automation <i>Description:</i> Marine power supply system automation. Class rules. Generator starting. Testing automation systems. Kongsberg-Norcontrol system. Combustion engine remote control.	30 L	2	7
74	Marine Radio Communications Systems <i>Description:</i> GMDSS documents. DSC. NBPD. INMARSAT. MF/HF/VHF station. EPIRB. Emergency communications.	30 Lab	3	5
75	Radio Navigation Equipment <i>Description:</i> Radar operation and testing. Radar power supply. Radar transponder. Testing ARPA. Loran C receiver operation. GPS operation. VHF locators.	15 Lab	2	5
76	Navigation Instruments	15 Lab	2	5

MARINE ELECTRICAL ENGINEERING FACULTY

	<i>Description:</i> Gyrocompasses. Pressure log. Electromagnetic log. Echo sounders. Autopilot.			
77	Summer and Semester On Board Training	3-4 months	10	5/7/8

Summer semester (VIII)

78	English	30 Lab	4	6
79	Economics <i>Description:</i> Production costs. Market. Customer behaviour. Manufacturing theory. GNP. Money. Banking. Job market. Budget and tax policy. Micro- and macroeconomics.	30 L	2	4
80	Management <i>Description:</i> Strategy. Organisation, production and service. Product and marketing. Company structure. Organisation, production and labour.	30 L	2	4
81	Marine Systems Automation <i>Description:</i> Digital PID controllers. Main engine automatic remote control. Refrigeration automation. Oil separator.	15 Lab	2	7
82	B.Sc. Thesis Seminar <i>Description:</i> General instruction. Defining goal and method. References. Appendices. Final presentation.	30 T	20	5

GROUP OF DIGITAL RADIO COMMUNICATION SYSTEMS

PROGRAMME of STUDIES			
B.Sc. Programme	Faculty of Marine Electrical Engineering		
	Section:	Electronics & Communications Systems	
	Group:	Digital Radio Communication Systems	

Fall semester (V)

82	English	30 Lab	1	6
83	Sports	30 T	0	1
84	Microprocessor Technique <i>Description:</i> Micro controller I/O and port service. RAM. EEPROM. Real time clock. Displays. Keyboard. Serial and parallel transmission. A/D and D/A converters. Basic programs. Microprocessor systems.	30 Lab 15 P	2 1	5
85	Electronic Systems <i>Description:</i> Transistor amplifier. Temperature stability. Differential amplifier. Power amplifier. Linear DC stabiliser. LC and RC generators. Difference multiplier. Phase loop.	30 Lab	3	5
86	Microwave Technique <i>Description:</i> Electromagnetic wave guiding. TEM guides. Wave-guides. Adjustment problems. Dispersion matrix. Resonators. Passive structures.	30 L	3	5
87	Automation Fundamentals <i>Description:</i> Jump- and frequency characteristics. Stable and transient states. Dynamic stability. Identification. Quality and accuracy. Impulse and extreme control. Two-variable system.	30 Lab	1	7
88	Communication Systems	30 L	3	5

MARINE ELECTRICAL ENGINEERING FACULTY

	<i>Description:</i> Analogue communication system. Amplitude, phase and frequency modulation. Noise immunity. Digital communication system. Transmission performance. Digital modulations. Coding. PCM, DM, DPCM. Block codes. Hamming code.			
89	Digital Filters and Signal Processing <i>Description:</i> Digital filters. Discrete Fourier transformation. Digital analysis of stochastic processes. Spectrum. Convolution.	30 L	3	5
90	Radio Transmission <i>Description:</i> Information-carrying signals. Pre-modulation signal processing. Frequency generation and synthesis. Modulators. HF, UHF and MF amplifiers. Transmitter measurements.	15 L	2	5
91	Radio Reception <i>Description:</i> Receiver properties. Noise analysis. Mixers. Synthesisers. Detectors.	15 L	2	5
92	VHF Components and Systems <i>Description:</i> VHF communication system. VHF technologies. Wave-guides. VHF diodes and transistors. VHF active systems. Multi-state modulators.	30 L	2	5
93	Wave Propagation <i>Description:</i> Radio wave propagation, conditions and parameters. Friis' equation. Global and satellite communication. Urban and in-building propagation.	15 L	2	5
94	Computer Networks <i>Description:</i> DAN, LAN, MAN, WAN. Media and cable structure. Network architecture. ISO, IEEE and other standards. Ethernet. Modems. Internet. Servers. Client software. Data security.	30 L	3	5
95	Operation Systems <i>Description:</i> Computer system structure. Operating system structure. Process and memory management. I/O system. UNIX. File conversion programs. System administration.	15 L	2	5

Summer semester (VI)

96	English	30 Lab	2	6
97	Communication Systems <i>Description:</i> AM and FM modulation testing. Testing signals. FSK model study, PSK model testing. CR-16 operation. Hamming code coder/decoder testing.	30 Lab	2	5
98	Digital Filters and Signal Processors Design of selected filter type.	15 P	2	5
99	Radio Transmission Techniques <i>Description:</i> Pattern generator measurements. Frequency synthesiser. Modulator HF amplifier. HF linear power amplifier. Distortion measurements.	15 Lab	1	5
100	Radio Reception Techniques <i>Description:</i> AM and FM receiver sensitivity and frequency band measurements. Distortion dumping. Blocking and cross-modulation resistance. Efficiency of automatic gain control.	15 Lab	1	5
101	VHF Components and Systems <i>Description:</i> generators and measurement instruments. Standing wave in rectangular wave-guide. Passive elements. System design software. Applications.	15 Lab 15 P	1 1	5
102	Wave Propagation	15 P	2	5

MARINE ELECTRICAL ENGINEERING FACULTY

	<i>Description:</i> Electromagnetic field intensity. Computer - aided field prediction. Range calculation. HF distortion measurements.			
103	Antenna Technique <i>Description:</i> Radiating structures. Antenna parameters. Dualism. Antenna systems. Measurement technique.	30 L	2	5
104	Computer Networks <i>Description:</i> LAN and Ethernet cable structure. Fibre optics. Network equipment. Customer software. Internet. www. Servers. UNIX administration.	30 Lab	1	5
105	Operating Systems <i>Description:</i> UNIX. File conversion programs. I/O redirecting. Stream conversion. Multi-program operation. Process, memory and I/O management.	30 Lab	1	5
106	Fibre Optics Communications <i>Description:</i> Propagation in fibre optic leads. Sources, detectors, optical transmitters and receivers. Passive elements. Amplifiers. Modulation. Coding.	15 L	2	5
107	Mobile Radio Communications Systems <i>Description:</i> Basic concept and properties of MRS. Topology. Traffic engineering. Efficiency. Doppler effect. GSM system architecture. Burst types. Logical channels.	15 L	2	5
108	Satellite Radio Communications Systems <i>Description:</i> Satellite systems. Architecture. Receiver properties. GEO, LEO and MEO systems, INMARSAT. Orbits, bands, operation.	15 L	2	5
109	Digital Radio Communications Equipment Design <i>Description:</i> Digital transmitter. Signal generation and processing. Modulator. Coder. Digital receiver. Frequency and phase synchronisation. Detector. Decoder.	15 L	2	5
110	Radio Communications Network Design <i>Description:</i> Field intensity prediction. Range. basic equation. Net structures.	15 L	2	5
111	Radio Communications Measurements <i>Description:</i> Measurement methods for transmitters and receivers. Power, frequency, spectrum, modulation, distortion. Digital measurements. Measurement automation.	15 L	2	5
112	Distortion Suppression Technique <i>Description:</i> Distortion types. Basic methods of protection. Distortion resistance of analogue and digital systems. Earthing and shielding. Distortion suppression and measuring.	15 L	2	5

Fall semester (VII)

113	English	30 Lab	4	6
114	Antenna Technique <i>Description:</i> Antenna parameter measurements. Microwave antenna testing. Computer-aided antenna design.	15 Lab	2	5
115	Fibre Optics Communications <i>Description:</i> Sources, detectors, transmitters and receivers. Modulation. Coding. Measurements.	15 Lab	2	5
116	TV Systems <i>Description:</i> Transmission principles and conditions. Signal properties. Colour CRT. Transmitters and receivers. Standards. Digital TV. Source coding.	15 L	2	5

MARINE ELECTRICAL ENGINEERING FACULTY

117	Mobile Radio Communications Systems <i>Description:</i> Testing mobile radio equipment	15 Lab	3	5
118	Satellite Radio Communications Systems <i>Description:</i> INMARSAT – A and INMARSAT-C MES. Message coding and programming for COSPAS-SARSAT	15 Lab	3	5
119	Digital Radio Communications Systems Design <i>Description:</i> Training in use of MATLAB/SIMULINK for designing digital radio systems.	15 P	5	5
120	Radio Communications Network Design <i>Description:</i> Training in use of software for field strength prediction on digital maps.	15 P	5	5
121	Radio Communications Measurements <i>Description:</i> Frequency, spectrum, modulation, power, synchronisation and distortion measurement in AM, FM, PCM, FSK transmitters.	30 Lab	2	5
122	Distortion Suppression Technique <i>Description:</i> Single and multi-point earthing. Shielding. Disturbance resistance. Testing selected digital systems.	15 Lab	2	5

Summer semester (VIII)

123	English	30 Lab	4	6
124	Economics <i>Description:</i> Production costs. Market customer behaviour. GNP. Money. Banking. Job market. Unemployment. State budget and taxes. Micro- and macroeconomics.	30 L	2	9
125	Management <i>Description:</i> Strategies. Company management. Planning and control. Product and marketing. Organisation, manufacturing and labour. Production programming. Planning and prediction.	30 L	2	9
126	B.Sc. Thesis Seminar <i>Description:</i> General instruction on thesis preparation. Defining goal and methods. Intermediate and final result presentation. References. Appendices. Final presentation.	30 T	22	5