



Sveučilište u Rijeci, Pomorski fakultet
University of Rijeka, Faculty of Maritime Studies

CURRICULUM AND STUDY PROGRAM

Marine Electronic Engineering and Information Technology

UNDERGRADUATE DEGREE PROGRAMME
GRADUATE DEGREE PROGRAMME



UNIVERSITY OF RIJEKA

Faculty of Maritime Studies, Rijeka

Undergraduate and Graduate Degree Program

**MARINE ELECTRONIC ENGINEERING AND
INFORMATION TECHNOLOGY**

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1. INTRODUCTION

Challenges related to the improvement of safety and protection of crew, passengers, and cargo, prevention of marine pollution, improvement of operational security in maritime organisations and information flows on the one hand, and growing global competitiveness on the other hand, call for the implementation of new technologies. These trends demand high levels of expertise from crew members and managers, along with in-depth knowledge of electronics, computing, automatic control systems, and information technology.

The study programme Marine Electronic Engineering and Information Technology (undergraduate and graduate degree) bridges the gap between natural and technical sciences and their practical application in maritime transport. Completion of the programme enables students to work in companies focused on maritime transport technologies, coast guard operations, and those specialized in the development, design, installation, and maintenance of computer, electronic, communication and navigation systems, as well as systems for automatic process management in the maritime sector.

1.1. Program compliance

The programme complies with the Law on Scientific Activities and Higher Education as well as the development strategy of the Republic of Croatia "Croatia in the 21st Century" - project areas: Maritime Transport and Information and Communication Technology.

The undergraduate curriculum is fully aligned with the principles, aims and intentions of the STCW Convention (International Convention on Standards of Training, Certification and Watchkeeping for Seafarers), IMO (Model Course 7.08 Electro-Technical Officer), and ISO standards, with a special focus on education of seafarers from the aspect of maritime safety improvement.

The study programme (undergraduate as well as graduate) is comparable to those offered by leading maritime universities, faculties and higher education institutions worldwide, including: Gdynia Maritime University (Poland), Maritime University of Szczecin (Poland), Latvian Maritime Academy (Riga, Latvia), Estonian Maritime Academy (Tallinn, Estonia), Satakunta University of Applied Sciences (Rauma, Finland), University of the Basque Country (Spain), Piri Reis University (Istanbul, Turkey), Klaipėda University (Lithuania), Technical University of Košice (Slovakia), Nikola Vaptsarov Naval Academy (Varna, Bulgaria), Lithuanian Maritime Academy (Klaipėda, Lithuania), Obuda University (Budapest, Hungary), Johann von Neumann Faculty of Informatics (Budapest, Hungary), Constanta Maritime University (Romania), Universitat Politècnica de Catalunya (UPC), Barcelona School of Nautica Studies (FNB), Spain, Kobe University (Japan), Fisheries and Marine Institute of Memorial University of Newfoundland (Canada), and others.

During the development of the study programme, special care was taken to align the teaching chapters and courses with the recommendations of leading world institutions, in particular: International maritime organization (IMO), International telecommunication union (ITU), Association of computer machinery (ACM), Institute of electrical and electronic engineers

(IEEE), International federation for information processing (IFIP), UNESCO and European computer driving license foundation (ECDLF).

The necessary content of the newly proposed undergraduate study, which is in accordance with the Convention STCW 78/95, is covered within three study years.

After passing the exams of the first, second and third years of study, which include mandatory content in accordance with the STCW Convention 78/95 and the Ordinance on ranks and certificates of competency of seafarers on merchant navy ships of the Republic of Croatia (Official Gazette 130/13), students enrolled in the undergraduate study programme can, with a certificate from the higher education institution, complete navigation practice and take the exam to acquire the Electro-Technical Officer (ETO) license.

Upon completion of a university undergraduate degree programme, a student is issued a certificate.

The compliance of the undergraduate degree programme Marine Electronic Engineering and Information Technology with information technology studies and international standards of the STCW Convention (International Convention on Standards of Training, Certification and Watchkeeping for Seafarers), IMO and ISO standards will be presented in subsequent documents.

The undergraduate study programme is fully harmonized with the corresponding studies at the University of Split and Dubrovnik, thus enabling student mobility.

1.2. Need for the study programme

The study programme Marine Electronic Engineering and Information Technology is based on the requirements for knowledge in electronic communications, electronic navigation, information technology and automatic process control in maritime transport technology. A similar study has been conducted for many years at the Faculty of Maritime Studies in Rijeka.

Information and communication technology enables the transmission and use of all types of information. It represents the most pervasive generic technology of today and it is the foundation of both the economy and society of the 21st century. This technology is a generator of change in all spheres of society. It is applied in all branches of the economy, and in all areas of science. As such, it is the basis for the successful operation of entrepreneurship as well as all social and state structures.

The Strategy of Informatisation of the Republic of Croatia emphasizes that our experts in the field of information and communication technology are highly valued in Europe and worldwide and that they perform some of the most complex tasks related to research, development and production.

2. GENERAL SECTION

2.1. Study programme title

The title of the study programme is: MARINE ELECTRONIC ENGINEERING AND INFORMATION TECHNOLOGY

2.2. Study programme holder and provider

Study programme holder and provider is: University of Rijeka, Faculty of Maritime Studies

2.3. Duration of the study programme

The duration of the study programme is 3+2 years or 10 semesters. The undergraduate degree programme is conducted over six semesters - 180 ECTS credits.

The graduate degree programme is conducted over four semesters - 120 ECTS credits.

Modes of instruction include: lectures, seminars, exercises, workshops, individual consultations, mentoring, and problem solving from practice and literature.

2.4. Enrolment requirements

Applicants apply for admission to undergraduate degree programme through the National Information System for Applications to Higher Education Institutions (NISpVU) and the website www.postani-student.hr. An applicant with a completed four-year high school has the right to apply for admission.

The application procedure for enrolment in study programmes of the University of Rijeka's constituent units via the National Information System for Higher Education Applications (NISpVU) is explained on the website www.postani-student.hr.

Upon the publication of the final rankings, the applicant will only be included in the ranking of the study programme that is listed highest on their priority list and for which they become entitled to enrol. They will be removed from other rankings.

After the publication of the final rankings, an applicant may only enrol in the study programme for which they have become entitled to enrol and for which they have received an enrolment number. The assignment of an enrolment number for a specific study programme obliges the applicant to enrol in that study program. Graduate degree programme can be enrolled by students who have completed an undergraduate degree programme Marine Electronic Engineering and Information Technology. An applicant who has completed another, corresponding undergraduate university study programme at a related maritime, traffic or technical faculty can also apply for enrolment in a graduate study programme, with the

requirement to pass differential exams. The selection procedure is carried out without an entrance exam, according to the academic achievement at the undergraduate level (average grade during the undergraduate degree programme).

Enrolment in the study programme is carried out according to the results of the selection procedure, on the basis of the established ranking list.

Detailed information on the enrolment procedure for the study programme to which the applicant has been granted admission is published in the admission call for the first year of undergraduate university study programmes, integrated (undergraduate and graduate) university study programmes as well as undergraduate professional study programmes in the following academic year and on the websites of the higher-education institution's website.

2.5. Competencies acquired upon completion of undergraduate degree programme

The fundamental objective of the systematic education of current and future professionals in the application, skills and approaches to modern technology and new forms of business in the maritime sector, as a means of improved management and more intensive development of the entire maritime system, is to strengthen the competence of the individual as well as to create a structure that will better meet the challenges of the future economic development of Croatia. The programme refers to the application of electronics, automation and information technology in the maritime sector.

Upon completion of this undergraduate degree programme, the student is qualified to successfully follow the graduate degree programme Marine Electronic Engineering and Information Technology.

2.6. Competencies acquired upon completion of graduate degree programme

The graduate degree programme Marine Electronic Engineering and Information Technology focuses on the deepening of knowledge in the following areas: ship electronic systems, integrated ship navigation, optoelectronic systems, multimedia communications, operating systems, biological effects of electromagnetic radiation in maritime affairs, information system security, programming and processing in transport, error-resistant diagnostic ship control systems, modelling and simulation of ship processes, models of networks and operations with information flows, and analysis and synthesis of controllable, reliable and safe systems in transport.

Upon completion of this programme, specialized knowledge in the aforementioned areas is acquired. Such knowledge is needed in the merchant navy and naval force, coast guards, companies engaged in the development, design, installation and maintenance of computer, electronic communication and navigation systems in the maritime sector, as well as control systems for energy and transport facilities.

2.7. Professional or academic title upon completion

Upon completion of a three-year undergraduate degree programme, the academic title awarded is *sveučilišni prvostupnik/prvostupnica (baccalaureus) inženjer/inženjerka* with a specification of the profession (in international transport and diploma issued in English: University Bachelor of Science).

The academic title is:

SVEUČILIŠNI PRVOSTUPNIK/PRVOSTUPNICA (BACCALAUREUS) INŽENJER /
INŽENJERKA ELEKTRONIČKE I INFORMATIČKE TEHNOLOGIJE (univ. bacc. ing. el.)

In international transport and diploma issued in English:

UNIVERSITY BACHELOR OF SCIENCE IN MARINE ELECTRONIC ENGINEERING
AND INFORMATION TECHNOLOGY (BSc)

Upon completion of a two-year graduate degree programme, the academic title awarded is *sveučilišni magistar/magistra inženjer/inženjerka* with a specification of the profession (in international transport and certificates in English: University Master of Science).

The academic title is:

SVEUČILIŠNI MAGISTAR/MAGISTRA INŽENJER/INŽENJERKA ELEKTRONIČKE I
INFORMATIČKE TEHNOLOGIJE (univ. mag. ing. el.)

In international transport and diploma issued in English:

UNIVERSITY MASTER OF SCIENCE IN MARINE ELECTRONIC ENGINEERING AND
INFORMATION TECHNOLOGY (MSc)

3. LEARNING OUTCOMES FOR THE STUDY PROGRAMME MARINE ELECTRONIC ENGINEERING AND INFORMATION TECHNOLOGY

3.1. Description of learning outcomes for the undergraduate degree programme and list of courses

1. MARINE ELECTRICAL ENGINEERING - Demonstrate knowledge and understanding in the field of marine electrical engineering, including the utilization of electrical and electronic measuring instruments and equipment
2. MARINE ELECTRICAL POWER SYSTEMS - Understand the concept, structure and function of specific components within ship's power systems, including familiarity with the regulations of classification institutions and technical documentation.
3. MARINE ELECTRICAL EQUIPMENT - Know the operational principles of electrical machines and apply this knowledge when installing, maintaining, and repairing marine electrical devices.
4. MARINE AUTOMATION - Understand the working principle and structure of automatic control devices, monitoring systems, and protective devices tailored to the specific requirements of ship propulsion systems. Put this knowledge into practical use through application and implementation.
5. MARINE ELECTRONICS - Know the fundamental principles of electronics, analogue and digital electronic circuit theories, power electronics circuits, methods of testing and installing electronic components, and the maintenance of marine electronic devices.
6. MARINE INFORMATION AND COMMUNICATION TECHNOLOGY - Know the basic topologies, operational principles, and protocols of computer and communication networks utilized aboard ships. Know the legal regulations pertaining to ship communication systems.
7. SHIP HIGH VOLTAGE SYSTEMS - Demonstrate practical knowledge in handling marine high voltage devices, along with a thorough understanding of safety protocols and the proper utilization of protective equipment when dealing with high voltage systems.
8. SAFETY AT SEA - Know the technical and technological characteristics of vessels based on their intended purpose and classification, know the safety procedures mandated by the STCW Convention as well as the basic legal regulations
9. FUNDAMENTAL PROFESSIONAL COURSES - Apply mathematical laws to solve problems. Understand and apply fundamental laws of physics.
10. ENGLISH LANGUAGE - Apply linguistic knowledge and skills to independently perform specialized tasks in the field of maritime affairs.
11. BSc THESIS - Apply both theoretical and practical knowledge when working independently on the topic, employ appropriate methodology and writing techniques, and present conclusions and findings.

MARINE ELECTRONIC ENGINEERING AND INFORMATION TECHNOLOGY

Learning outcomes for the study programme	Marine electrical engineering	Marine electrical power systems	Marine electrical equipment	Marine automation	Marine electronics	Marine information and communication technology	Ship high voltage systems	Safety at sea	Fundamental professional courses	English language	BSc thesis
Mandatory courses Winter semester (I)											
MATHEMATICS 1									+		
PHYSICS									+		
FUNDAMENTALS OF ELECTRICAL ENGINEERING 1	+		+						+		
INFORMATICS FUNDAMENTALS						+					
SHIP DESIGN AND CONSTRUCTION								+			
ENGLISH 1										+	
PHYSICAL AND HEALTH EDUCATION 1								+			

Learning outcomes for the study programme	Marine electrical engineering	Marine electrical power systems	Marine electrical equipment	Marine automation	Marine electronics	Marine information and communication technology	Ship high voltage systems	Safety at sea	Fundamental professional courses	English language	BSc thesis
Mandatory courses Summer semester (II)											
MATHEMATICS 2									+		
ELECTRICAL MEASUREMENT AND INSTRUMENTATION	+				+						
LABORATORY AND SKILLS	+				+	+					
FUNDAMENTALS OF ELECTRICAL ENGINEERING 2	+		+						+		
ENGLISH 2										+	
PHYSICAL AND HEALTH EDUCATION 2								+			

MARINE ELECTRONIC ENGINEERING AND INFORMATION TECHNOLOGY

Learning outcomes for the study programme	Marine electrical engineering	Marine electrical power systems	Marine electrical equipment	Marine automation	Marine electronics	Marine information and communication technology	Ship high voltage systems	Safety at sea	Fundamental professional courses	English language	BSc thesis
Elective courses	Marine electrical engineering	Marine electrical power systems	Marine electrical equipment	Marine automation	Marine electronics	Marine information and communication technology	Ship high voltage systems	Safety at sea	Fundamental professional courses	English language	BSc thesis
Summer semester (II)											
SAFETY AT SEA								+			
ADVANCED PROGRAMMING						+					

Learning outcomes for the study programme	Marine electrical engineering	Marine electrical power systems	Marine electrical equipment	Marine automation	Marine electronics	Marine information and communication technology	Ship high voltage systems	Safety at sea	Fundamental professional courses	English language	BSc thesis
Mandatory courses	Marine electrical engineering	Marine electrical power systems	Marine electrical equipment	Marine automation	Marine electronics	Marine information and communication technology	Ship high voltage systems	Safety at sea	Fundamental professional courses	English language	BSc thesis
Winter semester (III)											
ELECTRONIC DEVICES AND CIRCUITS					+						
MARINE ELECTRICAL SYSTEMS		+	+								
FUNDAMENTALS OF AUTOMATION	+		+	+	+	+			+		
ENGLISH 3										+	

Learning outcomes for the study programme	Marine electrical engineering	Marine electrical power systems	Marine electrical equipment	Marine automation	Marine electronics	Marine information and communication technology	Ship high voltage systems	Safety at sea	Fundamental professional courses	English language	BSc thesis
Elective courses	Marine electrical engineering	Marine electrical power systems	Marine electrical equipment	Marine automation	Marine electronics	Marine information and communication technology	Ship high voltage systems	Safety at sea	Fundamental professional courses	English language	BSc thesis
Winter semester (III)											
MARINE PROPULSION SYSTEMS		+	+								
MARITIME MEDICINE								+			
COMPUTER NETWORKS AND PROTOCOLS						+					
WEB PROGRAMMING						+					
DATABASES						+					
PHYSICAL AND HEALTH EDUCATION 3								+			

MARINE ELECTRONIC ENGINEERING AND INFORMATION TECHNOLOGY

Learning outcomes for the study programme	Marine electrical engineering	Marine electrical power systems	Marine electrical equipment	Marine automation	Marine electronics	Marine information and communication technology	Ship high voltage systems	Safety at sea	Fundamental professional courses	English language	BSc thesis
Mandatory courses Summer semester (IV)											
MARINE ELECTRICAL MACHINES	+	+	+				+				
DIGITAL ELECTRONICS				+	+						
MARITIME RADIOCOMMUNICATIONS						+					
ENGLISH 4										+	
TECHNOLOGY OF ELECTRIC MATERIALS	+								+		

Learning outcomes for the study programme	Marine electrical engineering	Marine electrical power systems	Marine electrical equipment	Marine automation	Marine electronics	Marine information and communication technology	Ship high voltage systems	Safety at sea	Fundamental professional courses	English language	BSc thesis
Elective courses Summer semester (IV)											
MARINE AUXILIARY ENGINES AND EQUIPMENT		+	+								
MARINE HYDRAULICS AND PNEUMATICS			+	+							
INTERNET TECHNOLOGIES						+					
SAFETY AND QUALITY MANAGEMENT IN SHIPPING								+			
PHYSICAL AND HEALTH EDUCATION 4								+			

Learning outcomes for the study programme	Marine electrical engineering	Marine electrical power systems	Marine electrical equipment	Marine automation	Marine electronics	Marine information and communication technology	Ship high voltage systems	Safety at sea	Fundamental professional courses	English language	BSc thesis
Mandatory courses Winter semester (V)											
BASICS IN ELECTRONIC COMMUNICATIONS						+					
MICRO AND PERSONAL COMPUTERS					+	+					
AUTOMATION OF SHIP SYSTEMS			+	+							
POWER ELECTRONICS		+			+						
ELECTRONIC NAVIGATION DEVICES					+	+			+		
MAINTENANCE OF ELECTRONIC SYSTEMS			+		+						

Learning outcomes for the study programme	Marine electrical engineering	Marine electrical power systems	Marine electrical equipment	Marine automation	Marine electronics	Marine information and communication technology	Ship high voltage systems	Safety at sea	Fundamental professional courses	English language	BSc thesis
Elective courses Winter semester (V)											
MARINE ENVIRONMENTAL PROTECTION								+			
MARITIME LAW								+			
ENGLISH 5										+	

Learning outcomes for the study programme	Marine electrical engineering	Marine electrical power systems	Marine electrical equipment	Marine automation	Marine electronics	Marine information and communication technology	Ship high voltage systems	Safety at sea	Fundamental professional courses	English language	BSc thesis
Mandatory courses Summer semester (VI)											
MARINE COMMUNICATIONS EQUIPMENT					+	+					
COMPUTER MANAGEMENT OF SHIP SYSTEMS			+	+		+					
SHIP ELECTRIC PROPULSION		+	+		+		+				
BACHELOR'S THESIS COURSE											+

Learning outcomes for the study programme	Marine electrical engineering	Marine electrical power systems	Marine electrical equipment	Marine automation	Marine electronics	Marine information and communication technology	Ship high voltage systems	Safety at sea	Fundamental professional courses	English language	BSc thesis
Elective courses Summer semester (VI)											
DYNAMIC POSITIONING OF VESSELS			+	+	+						
ON-BOARD TRAINING			+	+		+					
INTELLIGENT TRANSPORTATION SYSTEMS						+					
SHIP ORGANIZATION AND MANAGEMENT								+			
ENGLISH 6										+	

3.2. Description of learning outcomes for the graduate degree programme and list of courses

1. ELECTRICAL ENGINEERING - Demonstrate knowledge of how the ship's power network and electrical devices work and apply the acquired knowledge in the process of designing and construction of vessels
2. ELECTRONICS - Understand the operational principles behind marine electronic systems and devices, as well as the fundamental principles governing electromagnetic compatibility in marine electronics. Apply acquired knowledge in the selection and installation of marine electronic equipment
3. AUTOMATION - Apply contemporary electronic and computer methods, understand new technologies for diagnosing and managing technical systems, robotics, as well as guidance and management of surface and underwater vessels
4. INFORMATION AND COMMUNICATION SYSTEMS - Understand the working principle of computer networks and protocols, telecommunications and telemetry systems used on vessels, and know the basics of information system security
5. APPLIED SCIENTIFIC RESEARCH METHODS - Apply scientific research methods to improve ship's electrical and information-communication systems with the aim of increasing the ship's energy and economic efficiency
6. MARITIME BUSINESS PROCESSES - Understand the specific nature of business processes in maritime affairs and shipbuilding, know and apply specific information systems and principles of electronic business
7. MSc THESIS - Apply both theoretical and practical knowledge when working independently on the topic, employ appropriate scientific research methodology, and present conclusions and findings.

MARINE ELECTRONIC ENGINEERING AND INFORMATION TECHNOLOGY

Learning outcomes for the study programme	Electrical engineering	Electronics	Automation	Information and communication systems	Applied scientific research methods	Maritime business processes	MSc thesis
Mandatory courses Winter semester (I)							
SELECTED TOPICS IN MATHEMATICS					+		
RESEARCH SCIENTIFIC METHODOLOGY					+		
INFORMATION PROCESSING AND TRANSMISSION	+	+		+			
ROBOTICS	+	+	+	+			

Learning outcomes for the study programme	Electrical engineering	Electronics	Automation	Information and communication systems	Applied scientific research methods	Maritime business processes	MSc thesis
Elective courses Winter semester (I)							
OPERATING SYSTEMS				+	+		
ELECTRONIC BUSINESS						+	
MARINE ELECTRIC MOTOR DRIVES	+	+					
PROJECT MANAGEMENT						+	
CLOUD COMPUTING				+			

Learning outcomes for the study programme	Electrical engineering	Electronics	Automation	Information and communication systems	Applied scientific research methods	Maritime business processes	MSc thesis
Mandatory courses Summer semester (II)							
APPLICATION OF MATHEMATICAL TOOLS IN ELECTRICAL ENGINEERING					+		
OBJECT ORIENTED PROGRAMMING				+			
INTERNET OF THINGS				+			
APPLICATION OF MARITIME RADIOCOMMUNICATION SYSTEMS	+			+	+		

Learning outcomes for the study programme	Electrical engineering	Electronics	Automation	Information and communication systems	Applied scientific research methods	Maritime business processes	MSc thesis
Elective courses Summer semester (II)							
DECISION SUPPORT SYSTEMS				+			
ALGORITHMS AND DATA STRUCTURES			+	+			
STATISTICS					+		
RELIABILITY AND SAFETY OF TECHNICAL SYSTEMS			+	+			
MANAGEMENT INFORMATION SYSTEMS						+	

MARINE ELECTRONIC ENGINEERING AND INFORMATION TECHNOLOGY

Learning outcomes for the study programme	Electrical engineering	Electronics	Automation	Information and communication systems	Applied scientific research methods	Maritime business processes	MSc thesis
Mandatory courses Winter semester (III)							
MARITIME CYBER SECURITY				+			
NEW TECHNOLOGIES IN DIAGNOSTICS AND CONTROL SYSTEMS	+	+	+	+	+		
OPTOELECTRONIC SYSTEMS		+		+	+		
MARINE ELECTRICAL POWER GRIDS	+						

Learning outcomes for the study programme	Electrical engineering	Electronics	Automation	Information and communication systems	Applied scientific research methods	Maritime business processes	MSc thesis
Elective courses Winter semester (III)							
AUTOMATIC CONTROL OF MARINE VESSELS	+	+	+	+	+		
TESTING OF SHIPS ELECTRICAL APPLIANCES	+						
BIG DATA ANALYSIS				+			
ARTIFICIAL INTELLIGENCE				+			

Learning outcomes for the study programme	Electrical engineering	Electronics	Automation	Information and communication systems	Applied scientific research methods	Maritime business processes	MSc thesis
Mandatory courses Summer semester (IV)							
MASTER'S THESIS COURSE							+