**Course description**

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| **Generic information** | | | |
| Head of Course | Assist. Prof. Nikola Lopac, PhD | | |
| Course | Basics in Automation | | |
| Study Programme | Undergraduate Degree Programme of Marine Electronic Engineering and Information Technology | | |
| Type of Course | Mandatory | | |
| Year of Study | 2 |  | |
| Estimated Student Workload and Methods of Instruction | ECTS coefficient of Student Workload | | 5 |
| Number of Hours (L+E+S) | | 30+30+0 |

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| **1. GENERAL COURSE DESCRIPTION** | | | | | | | | |
| *1.1. Course Objectives* | | | | | | | | |
| The main objectives of the course are to gain knowledge about the areas of automation, the principles of automatic control and automatic regulation, as well as understanding the manner in which the measuring, actuating and control members and their elements operate. | | | | | | | | |
| *1.2. Prerequisites for Course Registration* | | | | | | | | |
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| *1.3. Expected Learning Outcomes* | | | | | | | | |
| After passing the exam, students will be able to do the following:  1. Distinguish between areas of automation based on various classification criteria  2. Explain the basic structure of an automation system  3. Calculate the transfer function for a control loop  4. Distinguish the types of automation elements and their basic characteristics  5. Apply standard techniques for tuning controllers  6. Perform calibration of measuring sensors (temperature, pressure, level)  7. Explain the basic principles of operation of different types of controllers  8. Distinguish automatic control systems based on their mode of operation and the method of forming executive actions on the object | | | | | | | | |
| *1.4. Course Outline* | | | | | | | | |
| Areas of automation, principles of describing automation objects. Signals. Energies/media in automation and factors for energy selection. Defining the transient and transfer functions, and principles for calculating the transfer function for various complex structures. Features of automatic regulation, automatic control and automatic process management. Principles and techniques of automatic regulation. The structure of the automatic control system. Basic components of regulation and control systems (measuring members, comparators, control devices, actuators, ...). Calibration of measuring sensors. Regulator types. Classification of regulation methods. | | | | | | | | |
| *1.5. Modes of*  *Instruction* | | Lectures  Seminars and workshops  Exercises  E-learning  Field work | | | Practical work  Multimedia and Network  Laboratory  Mentorship  Other \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | | |
| *1.6. Comments* | | - | | | | | | |
| *1.7. Student Obligations* | | | | | | | | |
| 1st Midterm, 2nd Midterm, preparation and presentation of a research task during a lab session, final exam. | | | | | | | | |
| *1.8. Assessment1 of Learning Outcomes* | | | | | | | | |
| Course attendance | 2 | Class participation |  | Seminar paper | | 0,5 | Experiment |  |
| Written exam |  | Oral exam | 1 | Essay | |  | Research |  |
| Project |  | Continuous Assessment | 1,5 | Presentation | |  | Practical work |  |
| Portfolio |  |  |  |  | |  |  |  |

1 **NOTE:** Name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course. Use empty fields for additional activities.

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| *1.9. Assessment of Learning Outcomes and Examples of Evaluation during Classes and on the Final Exam* | | | | |
| Student obligations include: regular attendance (students may miss a maximum of 30% of classes), the 1st and 2nd midterms, laboratory exercises, and the final exam.  The procedure for evaluating the acquired learning outcomes is carried out in accordance with the Regulations on Studies of the University of Rijeka and the Regulations on Studies at the Faculty of Maritime Studies in Rijeka as follows:  - through continuous assessment during classes, 70% of the learning outcomes are evaluated as follows: 1st midterm covering learning outcomes 1-4 (25%), 2nd midterm covering learning outcomes 5-8 (25%), and submission of reports from laboratory exercises covering learning outcomes 1-8 (20%). The students must achieve at least 50% of the possible points on each midterm, while the presentation of practical work (laboratory exercises) is assessed based on detailed grading criteria;  - in the final exam, 30% of the learning outcomes (1-8) are assessed. To pass the final exam, students must achieve at least 50% of the possible points.  Examples of assessing learning outcomes relative to the established learning outcomes include:  1. List the areas of automation, their features, and their most common applications.  2. Draw a block diagram of a control loop, label the control elements, components, and variables within the loop.  3. Calculate the transfer function for a given control loop.  4. Describe the operating principles and application areas of temperature sensors used on ships.  5. Explain how to adjust the control action of a PID controller using the Ziegler-Nichols tuning method.  6. Describe the calibration of temperature measuring sensors with a thermocouple.  7. Describe how to adjust the actions of an electronic controller with a differential amplifier.  8. Explain the basic structure, operating mechanism, and properties of programmatic control. | | | | |
| *1.10. Main Reading* |  | |  | |
| 1. Course materials are available on the e-learning system, Merlin (<https://moodle.srce.hr>)  2. V. Tomas, I. Šegulja, M. Valčić, Osnove automatizacije, Pomorski fakultet, Sveučilište u Rijeci, 2010. | | | | |
| *1.11. Recommended Reading* |  | |  | |
| 1. T. Šurina, Automatska regulacija, Školska knjiga, Zagreb, 2001.  2. C. A. Smith, A. B. Corripio. Principles and Practices of Automatic Process Control. John Wiley & Sons, 2005.  3. Z. Vukić, Lj. Kuljača, Automatsko upravljanje - analiza linearnih sustava upravljanja, Kigen, 2005.  4. D. Matika, D. Brnobić, Osnove regulacijske tehnike, Tehnički fakultet Rijeka, 2004.  5. N. Nise, Control Systems Engineering, John Wiley & Sons, 2020.  6. W. Bolton, Programmable Logic Controllers, Newnes, 2015.  7. S. Boyer, SCADA: Supervisory Control and Data Acquisition, International Society of Automation, 2016.  8. C. De Silva, Sensors and Actuators: Control System Instrumentation, CRC Press, 2007.  9. K. Tan, A. Putra, Drives and Control for Industrial Automation, Springer, 2011. | | | | |
| *1.12. Number of Main Reading Examples* |  | |  | |
| *Title* | *Number of examples* | | *Number of students* | |
| Course materials available on the e-learning system, Merlin | |  | | 55 |
| V. Tomas, I. Šegulja, M. Valčić, Osnove automatizacije, Pomorski fakultet, Sveučilište u Rijeci, 2010. | | 10 | | 55 |
| *1.13. Quality Assurance* | | | | |
| The quality of education is consistently monitored in accordance with the ISO 9001 system, which is implemented at the Faculty of Maritime Studies in Rijeka. An annual analysis of exam results is conducted, and a student survey is administered once each semester. | | | | |