**Course description**

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| **Generic information** |
| Head of Course | Assist. Prof. Nikola Lopac, PhD |
| Course | Automation in Transport |
| Study Programme | Undergraduate Degree Programme of Transport and Mobility |
| Type of Course | Mandatory |
| Year of Study | 3 |  |
| Estimated Student Workload and Methods of Instruction | ECTS coefficient of Student Workload | 4 |
| Number of Hours (L+E+S) | 30+15+0 |

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| **1. GENERAL COURSE DESCRIPTION** |
| *1.1. Course Objectives*  |
| The main objectives of the course are to acquire knowledge about the areas of automation, the principles of automatic control, automatic regulation, and automatic process management, along with the functioning of measuring, actuating and control members and their elements. The course also covers the analysis of the structure and operation of process computers and programmable logic controllers, and the method of integrating them with traffic operation processes. |
| *1.2. Prerequisites for Course Registration*  |
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| *1.3. Expected Learning Outcomes*  |
| After passing the exam, students will be able to:1. Distinguish 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 types of automation elements and their basic characteristics.5. Apply standard techniques for tuning controllers.6. Explain the basic structures of traffic automation systems.7. Explain the basic structure of programmable logic controllers.8. Explain the fundamental operating principle of a process computer in traffic systems. |
| *1.4. Course Outline*  |
| Areas of automation, principles of describing automation objects. Signals. Energy/media in automation and factors for energy selection. Defining transient and transfer functions, and the principles of 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 control and regulation systems (measuring elements, comparators, control devices, actuators, ...). Requirements for control systems. Process computers and PLCs and their integration with technical processes. Systems of automatic regulation and automatic control in transportation. Characteristics of automatic regulation of traffic processes. |
| *1.5. Modes of* *Instruction*  | [x] Lectures[ ]  Seminars and workshops [x]  Exercises [ ]  E-learning[ ]  Field work | [x]  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 assignment during lab sessions, final exam |
| *1.8. Assessment1 of Learning Outcomes*  |
| Course attendance | 1,5 | Class participation | 0,5 | Seminar paper | 0,5 | Experiment |     |
| Written exam | 0,5 | Oral exam |     | Essay |     | Research |     |
| Project |     | Continuous Assessment | 1 | 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, presentation of a research project (seminar), 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 acquired learning outcomes are evaluated as follows: 1st midterm covering learning outcomes 1-4 (25%), 2nd midterm covering learning outcomes 5-8 (25%), presentation of the research assignment (seminars) covering learning outcomes 1-8 (20%); The students must achieve at least 50% of the possible points on each midterm, while the presentation of the research assignment 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 speed sensors used in transportation systems.5. Explain how to adjust the control action of a PID controller using the Ziegler-Nichols tuning method.6. Explain the basic structure, functioning, and characteristics of servo systems.7. Explain what a PLC (Programmable Logic Controller) is, its structure, what constitutes a scan cycle, and the methods for programming a PLC.8. Explain which elements are involved in the operation of a process computer on a technical process |
| *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.
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| *1.11. Recommended Reading*  |  |  |
| 1. R. L. Gordon, W. Tighe, Traffic Control Systems Handbook, Siemens ITS, Federal Highway Administration, 2005.2. Z. Vukić, Lj. Kuljača, Automatsko upravljanje - analiza linearnih sustava upravljanja, Kigen, 2005.3. D. Matika, D. Brnobić, Osnove regulacijske tehnike, Tehnički fakultet Rijeka, 2004.4. C. De Silva, Sensors and Actuators: Control System Instrumentation, CRC Press, 2007.5. W. Bolton, Programmable Logic Controllers, Newnes, 2015. |
| *1.12. Number of Main Reading Examples*  |  |  |
| *Title*  | *Number of examples*  | *Number of students*  |
| Course materials available on the e-learning system, Merlin |  | 15 |
| V. Tomas, I. Šegulja, M. Valčić, Osnove automatizacije, Pomorski fakultet, Sveučilište u Rijeci, 2010. | 10 | 15 |
| *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. |