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| **COURSE TITLE** | **TECHNICAL SYSTEMS COMPUTER CONTROL** | | | | | | | | | | | | |
| **Code** | | PFE109 | | | Year of study | | | | 3rd | | | | |
| **Lecturer(s)** | | Igor Vujović. Ph.D., Assistant Professor | | | Number of credits allocated (ECTS) | | | | 4 | | | | |
| Collaborator(s) | | Joško Šoda, Ph.D.  Petar Matić, dipl.ing | | | Teaching methods (number of classes per term) | | | | L | S | | E | F |
| 45 |  | | 15 |  |
| Course status | | Compulsory | | | Percentage of e-learning application | | | |  | | | | |
| **COURSE DESCRIPTION** | | | | | | | | | | | | | |
| Learning outcomes and competences | | Acquiring adequate basic skills in technical systems and computer aided processes in maritime science. Becoming acquainted with linking principles of various maritime technical systems into control and hierarchically organised computer system, SCADA.STCW 7.03. Electro-technical officer. Part of contents from: 1.1.6. Ch. 6.1. (PLC, digital control systems); 1.1.7. Ch. 7.1. Compentance 1.5. Ch. 1.5.1. 1.1.. 1.5.2. Ch.2.1. 1.1.6. Ch. 6.1., 1.1.7. Ch. 7.1. | | | | | | | | | | | |
| Prerequisites for the course and entry competences | | / | | | | | | | | | | | |
| Expected learning outcomes on the course level  (4-10 learning outcomes) | | Distinguish between basic components of computer managed systems  Compare various program codes for the same project, in order to evaluate it adequately.  Create, based on a particular problem, a program code in ladder diagram.  Provide arguments for operating differences in computer systems managed in on-line and off-line modes.  Present operating principles of shipboard automation systems from schemas  Critically evaluate hierarchical structure of computer control system. | | | | | | | | | | | |
| Course contents elaborated in accordance with the syllabus | | Basic concepts in systems and automation. Off-line and on-line working principles. Complex system structure for managing processes.  Circuit components of computer based process control system.  On-line system example. Analog and digital input and output units.  Signal conditioning, filtering, and multiplexing, S&H circle, A-D, D-A conversions.  Computer connection interface with external units.  Single-chip microcontrollers, managing and programming. Implementation of microcomputer control PI and PID algorithms.  Programmable logic controllers (PLC), PLC architecture. PLC programming, ladder diagram, function blocks.  Distributed computer system. Operating characteristics of one or more processors.  Standardised multi-processor units.  Basic procedures in process control system building. Connecting of standard units into complete systems.  Hierarchical system organisation. Function and organisation of hierarchical control system levels. Examples of hierarchical control system.  Bus-oriented distributed computer system. Industrial networks, fieldbus technology, CAN. (controller area network).  Defining automated control system synthesis problem. Regulation circuit stability. Stability criteria. System behaviour demands.  Measuring noise problem. Approaches to digital regulators synthesis. PLC comparison, microcontrollers, DSP, SPLD, CPLD, FPGA.  Typical elements for preliminary processing of measuring signals. Noise and interference. Noise sources. Control signal forms. Transition from automatic to manual operating manner.  Shipboard automated processes: guidance of ship, propulsion, and cargo; navigation processes, ship manoeuvring, communication, main propulsion process, auxiliary propulsion systems, cargo handling and preservation processes . Main engine remote control system (BSC 200). Engine refrigeration system. Cargo supervision and preservation system (GL-90). Shipboard computer system for automatic fire alarm and fire extinguishing.  Computer navigation system, supervision, and main engine control system. Ship manoeuvering by course, open system of speed steering, sequential steering, feedback connection in autopilot system. Simple autopilot with P and PID regulators. More complex autopilot regulators. ADG 3000 VT adaptive digital autopilot. Hierarchical architecture of distributed system aboard ship. PROFIBUS newtork. Propulsion control system. NMEA 2000 propulsion yachts  Generator supervision and control system. Cargo and ballast loading system. Shipboard integrated electronic system.  SCADA (Supervisory Control And Data Acquisition) system. | | | | | | | | | | | |
| Teaching methods | | ☒ lectures  ☐ seminars and workshops  ☐ exercises  ☐ *on line* entirely  ☐ miscellaneous e-learning  ☐ field tasks | | | | ☐ independent tasks  ☐ multimedia  ☒ laboratory  ☐ work with supervisor | | | | | | | |
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| Student obligations | |  | | | | | | | | | | | |
| Student monitoring and supervision | | Class attendance | 0,5 | Research | | |  | Practical work | | | |  | |
| Experimental work | 1,5 | Paper | | |  | Homework (Other) | | | |  | |
| Essay |  | Seminar paper | | |  | (Other) | | | |  | |
| Preliminary examinations | 2 | Oral examination | | |  | (Other) | | | |  | |
| Written examination | (2 alt.) | Project | | |  | (Other) | | | |  | |
| Evaluation and assessment in class and final examination | | Class attendance: 12,5 points  Computer practice: 7,5 points  Independent creation of program code / experimental work: 30 points  Preliminary examinations (2): 50 points | | | | | | | | | | | |
| Recommended reading (available in library and through the media) | | **Title** | | | | | | | **Number of copies in the library** | | **Availability through other media** | | |
| 1. I. Petrović, Računalno upravljanje tehničkim sustavima, FER Zagreb, 2011. | | | | | | |  | | WEB | | |
| 1. I. Vujović, Računalno upravljanje tehničkim sustavima, nastavni materijali na web stranici | | | | | | |  | | WEB | | |
| 1. D. Kezić, G. Smiljanić, I. Vilović, Računalno upravljanje tehničkim sustavima, Pomorski fakultet u Splitu, 2007. | | | | | | |  | | WEB | | |
| 4. Siemensov LOGO, Siemens. | | | | | | |  | | WEB | | |
| Supplementary reading | | 1. Bolton, W.: Programmable logic controllers, Bidlles Ltd., 2002.  2. EL-Hawary, F.: The Ocean Engineering Handbook, CRC Press, 2001. | | | | | | | | | | | |
| Quality assessment ensuring the determined learning outcomes | | University questionnaire, student evidence list, Faculty surveillance | | | | | | | | | | | |
| Other (according to the proponent) | |  | | | | | | | | | | | |