

SYLLABUS

Course description

| Course code | | Course | SYSTEMY WBUDOWANE | | |
|---|----------------------------|--|-----------------------------|------------------------|--|
| MB/O/1/NST/C1A.15 | | | EMBEDDED SYSTEMS | | |
| Language of instruction | | English | | | |
| Academic year | | 2023/2024 | | | |
| field of study: | | Mechanical engineering | | | |
| field of specialisation: | | CAE – Computer Aided Engineering | | | |
| Educational level | | First-cycle studies | | | |
| Education profile | | general academic | | | |
| Mode of study | | part-time studies | | | |
| Semester(s) | | 7 | | | |
| Affiliation with a group of classes | | Specialization module | | | |
| Course status | | obligatory | | | |
| Types of classes, instruction hours, ECTS credits | | Types of classes | Number of instruction hours | Number of ECTS credits | |
| | | Lecture | 8 [h] | 3 ECTS | |
| | | Classes | 16 [h] | | |
| | | ... | ... | | |
| Linkage of the course | with the education profile | related to the conducted scientific activity in the discipline to which the field of study is assigned | | 3 ECTS | |
| | with qualifications | it is used to acquire engineering competences by the student | | 3 ECTS | |
| | with science discipline | Mechanical engineering | | 3 ECTS | |
| Form of teaching | | Traditional lecture, laboratory experiments in groups | | | |
| Prerequisites | | knowledge of issues in the field of electrical engineering and electronics, mechatronics and automation, basics of programming | | | |
| Department | | Wydział Mechaniczny UTH Rad. | | | |
| Coordinator | | Dr hab. inż. Iwona Komorska | | | |
| The website of the basic organizational unit | | www.wm.uniwersytetradom.pl | | | |
| E-mail address, phone number of the coordinator | | 48 3617634; iwona.komorska@uthrad.pl | | | |

LEARNING OUTCOMES, CURRICULUM CONTENT, TEACHING CLASSES, VERIFICATION OF LEARNING OUTCOMES

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|---|--|
| Learning Objective: | The aim of the course is to provide practical and theoretical knowledge on the principles of operation of embedded systems based on microcontrollers and the possibility of using these systems in modern control and regulation systems. As part of the course, knowledge about modelling, designing, construction and commissioning of embedded microprocessor systems as well as development of embedded and system software is provided. During laboratory exercises, students have the opportunity to gain practical knowledge at workstations equipped with the most popular microcontroller systems. |
| Curriculum Content: | The content of the classes is related to the conducted scientific research. Lecture (NB): Single-chip microcomputers: architecture and applications (1h). Principles of cooperation of the microprocessor system with the environment; parallel input-output systems; A/C converter systems, PWM (2h). Communication systems - serial transmission, principle of operation, applications: asynchronous and synchronous transmission, transmission protocols (2h). Modeling and simulation of control and regulation systems in LabView and Matlab/Simulink (1 hours). Design, construction and commissioning of a microprocessor system (debuggers, emulators) (1h). Test (1h) Laboratory (NB): Arduino basics (2h). Programming digital inputs/outputs (2h). Support for analogue inputs (2h). Testing distance sensors (2h). LCD text display operation (2h). Analogue temperature measurement (2h). Support for PWM outputs - controlling the output voltage (2h). Servo control (1h). DC motor control (1h). UART transmission (1h). Programmable RGB LEDs (1h). |
| Didactic (educational) methods: | Lecture: informative lecture, presentation of the computer program, demonstration of cooperation between the program and the device Laboratory: laboratory exercises in teams |
| Course assessment type, the criteria for assessing the achieved learning outcomes, and the method of calculating the final grade: | The condition for passing the course is to achieve all the required learning outcomes specified for the subject. Lecture: pass (51% of points) Laboratory: the final grade is calculated on the basis of the average value of grades from all reports (50%), project (50%). |

| Learning outcomes for the course in relation to the field of study learning outcomes and the type of classes | | | | Methods of verifying learning outcomes | |
|--|---|---------------------------------------|------------------|--|-----------------------------------|
| Learning outcome number | Description of the learning outcomes for the course (PEU) A student who has passed the course (W) knows and understands / (U) can / (K) is ready to: | Field of study learning outcome (KEU) | Types of classes | Form of verification (credits) | Methods of testing and assessment |
| W1 | Knows and understands the logical structure, organization and operation of an embedded system | K_WG08 | Lecture | Test | mark |
| W2 | Knows examples of solutions and areas of application of embedded systems | K_WG11 K_WG19 | Lecture | Test | mark |
| W3 | Knows the techniques of embedded system programming | K_WG11 | Lecture | Test | mark |
| U1 | Can program a simple single-chip microcomputer system using a selected program | K_UW05 | Lab | Report | mark |
| U2 | Can design and implement a simple system consisting of a microcomputer, sensors and actuators | K_UW05 K_UW13 | Lab | Report | mark |
| K1 | Can search, analyze and use information from sources in English or another | K_UK18 | Lab | Report | mark |

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|----|--|--------|----------------|---|--------|
| | foreign language recognized as the language of international communication at B2 level, including in the field of designing and manufacturing embedded systems | | | | |
| K2 | is ready to supplement and critically evaluate specialist knowledge and is able to choose the right sources of knowledge and learning methods for himself and others | K_KK01 | Lecture lab | - | Verbal |

| Literature and teaching aids | | | | | |
|--|--|--|--|--|--|
| <ol style="list-style-type: none"> Godse AP, Godse DA: Microprocessors and Microcontrollers, Tech Publications Pune Deshmukh AV: Microcontrollers – Theory and Applications, McGraw Hill Clarence W. de Silva: Mechatronics. A Foundation Course. CRC Press 2010 https://www.dspace.com/en/pub/home/products/hw/singbord/ds1104.cfm https://www.mathworks.com/hardware-support/arduino-simulink.html https://www.arduino.cc/en/Tutorial/HomePage https://learn.ni.com/teach/resources/92/ni-myrio-project-essentials-guide https://www.mathworks.com/products/simulink.htm http://www.ni.com/academic/students/learn-labview/ http://www.ni.com/pdf/manuals/373427j.pdf | | | | | |

| Student workload required to achieve the assumed learning outcomes – the balance of ECTS credits | | | |
|--|---------------------------|---|------------------|
| Attendance, participation | Student workload [h]. | | |
| | Other contact hours (IGK) | Student's self-study hours Classes without a teacher (ZBN) | Classes |
| Participation in ... lectures | X | X | 8 [h] |
| Participation in classes/laboratory classes | X | X | 16 [h] |
| Meeting with teachers during their duty hours | 8 [h] | X | X |
| Preparation for lectures/classes/.... , Preparation for ... credit / exam | X | 10 [h]/ 30 [h] 3 [h] | X |
| Total student workload | 8 [h]/ 0,4 ECTS | 43 [h]/ 1,7 ECTS | 24 [h]/ 0.9 ECTS |
| ECTS credits for the course | 75 h/ 3 ECTS | | |

| Additional information, comments |
|---|
| <p>In the case of students with special needs, including disabilities, and chronic illnesses, the methods and forms of verification of learning outcomes specified above (in the syllabus) are adapted to the individual needs of these students, as appropriate.</p> <p>Detailed rules and forms of support for students with special needs, including those with disabilities and chronically ill, during classes, credits, and exams are specified in: University Regulations (Regulamin Studiów Uniwersytetu Technologiczno-Humanistycznego w Radomiu), Study Regulations (Zasady Studiowania), and Procedure for Ensuring Accessibility of the Educational Process to Students with Special Needs, Including Those with Disabilities and Chronically ill (Procedura dotycząca zapewnienia dostępności procesu kształcenia studentom ze szczególnymi potrzebami, w tym: z niepełnosprawnością, przewlekłe chorych).</p> |

