

# SYLLABUS

## Course description

Course code		Course	SYSTEMY WBUDOWANE		
C1A.15/MB/O/I/ST			EMBEDDED SYSTEMS		
Language of instruction		English			
Academic year		2023/2024			
<b>field of study:</b>		Mechanical engineering			
<b>field of specialisation:</b>		CAE			
Educational level		first-cycle studies			
Education profile		General academic			
Mode of study		full-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	15 [h]	3 ECTS	
		Classes	30 [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 – classes organized at the University /classes conducted using online learning methods and techniques			
Prerequisites		knowledge of issues in the field of electrical engineering and electronics, mechatronics and automation, basics of programming			
Department		Faculty of Mechanical Engineering			
Coordinator		Dr hab. inż. Iwona Komorska			
The website of the basic organizational unit		<a href="http://www.wm.uniwersytetradom.pl">www.wm.uniwersytetradom.pl</a>			
E-mail address, phone number of the coordinator		48 3617634; <a href="mailto:iwona.komorska@uthrad.pl">iwona.komorska@uthrad.pl</a>			

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

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 (2h). Principles of cooperation of the microprocessor system with the environment; parallel input-output systems; A/C converter systems, PWM (4h). Communication systems - serial transmission, principle of operation, applications: asynchronous and synchronous transmission, transmission protocols (4h). Modeling and simulation of control and regulation systems in LabView and Matlab/Simulink (2 hours). Design, construction and commissioning of a microprocessor system (debuggers, emulators) (2h). Test (1h) Laboratory (NB): Arduino basics (2h). Programming digital inputs/outputs (2h). Support for analog 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 (2h). DC motor control (2h). UART transmission (2h). Programmable RGB LEDs (2h). Team project using C++ or Matlab-Simulink or LabView (6h). Project presentation (2h)
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 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 ( <b>W</b> ) knows and understands / ( <b>U</b> ) can / ( <b>K</b> ) 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 foreign language recognized as the language of international communication at B2 level, including in the field of designing and manufacturing embedded systems	K_UK18	Lab	Report	mark
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"> <li>1. Godse AP, Godse DA: Microprocessors and Microcontrollers, Tech Publications Pune</li> <li>2. Deshmukh AV: Microcontrollers – Theory and Applications, McGraw Hill</li> <li>3. Clarence W. de Silva: Mechatronics. A Foundation Course. CRC Press 2010</li> <li>4. <a href="https://www.dspace.com/en/pub/home/products/hw/singbord/ds1104.cfm">https://www.dspace.com/en/pub/home/products/hw/singbord/ds1104.cfm</a></li> <li>5. <a href="https://www.mathworks.com/hardware-support/arduino-simulink.html">https://www.mathworks.com/hardware-support/arduino-simulink.html</a></li> <li>6. <a href="https://www.arduino.cc/en/Tutorial/HomePage">https://www.arduino.cc/en/Tutorial/HomePage</a></li> <li>7. <a href="https://learn.ni.com/teach/resources/92/ni-myrio-project-essentials-guide">https://learn.ni.com/teach/resources/92/ni-myrio-project-essentials-guide</a></li> <li>8. <a href="https://www.mathworks.com/products/simulink.htm">https://www.mathworks.com/products/simulink.htm</a></li> <li>9. <a href="http://www.ni.com/academic/students/learn-labview/">http://www.ni.com/academic/students/learn-labview/</a></li> <li>10. <a href="http://www.ni.com/pdf/manuals/373427j.pdf">http://www.ni.com/pdf/manuals/373427j.pdf</a></li> </ol>	

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	15 [h]
Participation in .... classes/laboratory classes	X	X	30 [h]
Meeting with teachers during their duty hours	2 [h]	X	X
Preparation for lectures/classes/.... , Preparation for ... credit / exam	X	10 [h]/ 10 [h] 8 [h]	X
Total student workload	2 [h]/ 0,1 ECTS	28 [h]/ 1.1 ECTS	45 [h]/ 1,8 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>

