SYLLABUS

Course description

Course code	Course	Robotyka
ME/O/I/ST/B16		Robotics
Language of instruction		English
Academic year		2025/2026
field of study:		Mechanical Engineering
field of specialisation:		All
Educational level		first-cycle studies
Education profile		General academic
Mode of study		Full-time studies
Semester(s)		V
Affiliation with a group of classes		B. Group of basic course
Course status		Obligatory

Types of classes, instruction hours, ECTS credits	Types of classes	Number of instruction hours	Number of ECTS credits
	Lecture	15 [h]	4 ECTS
	Classes	- [h]	
	Lab	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	4 ECTS
	with qualifications	It is used to acquire engineering competences by the student	4 ECTS
	with science discipline	Mechanical engineering	4 ECTS

Form of teaching	Traditional – classes organized at the University /classes conducted using distance learning methods and techniques
Prerequisites	knowledge of mathematics and mechanics
Department	Faculty of Mechanical Engineering
Coordinator	Krzysztof Kołodziejczyk
The website of the basic organizational unit	http://wm.uniwersytetradom.pl
E-mail address, phone number of the coordinator	k.kolodziejczyk@urad.edu.pl; +48 48 361 71 16

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

Learning Objective:	C1 - Familiarization with basic concepts and issues in robotics, the structure of robots, and their effectors. C2 - Acquisition of knowledge and skills in robot kinematics and

	dynamics, as well as motion planning, including the mathematical description of manipulators and robots. C3 - Acquisition of knowledge and skills in robot programming and control, as well as robot modeling and computer simulation.
Curriculum Content:	**Lecture :** Basic concepts in robotics. Laws of robotics. Common issues in robotics. Classification of robots and manipulators. Generations and development of robots. Overview of robot applications. Structure of robots and manipulators. Robot effectors – classification, characteristics, and functions. Kinematic pairs. Degrees of freedom. Mobility and maneuverability. Mathematical description of spatial robots and manipulators: coordinate systems, homogeneous coordinates, Denavit-Hartenberg notation. Kinematics of robots and manipulators – forward and inverse kinematics. Methods for solving forward and inverse kinematics problems. Statics and dynamics of robots and manipulators. Forward and inverse dynamics problems. Methods for determining velocities, accelerations, forces, and torques of a manipulator. Trajectory planning for robots and manipulators. Robot programming and control. Occupational health and safety in robotics. **Laboratory Exercises:** Health and safety rules during laboratory classes. Practical exercises with robots: structure and capabilities of selected types of robots. Operation and control of robots – working with technical documentation. Kinematics and dynamics of robots. Path and trajectory modeling. Robot modeling in MATLAB/SIMSCAPE MULTIBODY/ROBOTICS TOOLBOX environment – modeling of predefined motion and simulation based on given guidelines for a selected type of robot.
Didactic (educational) methods:	Conventional lecture using audiovisual means. During laboratory exercises: practical methods (demonstration, laboratory exercises)
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 out comes specified for the course.

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 the mathematical description of robots and manipulators, as well as kinematics and dynamics problems and methods for solving them	K_WG02,	lecture	exam	written exam (theory + tasks)
W2	has knowledge of robot programming and control, as well as robot modeling and computer simulation	K_WG17	lecture	exam	written exam (theory + tasks)
W3	has knowledge of the structure and applications of robots, is familiar with the current state of technology and development trends, as well as health and safety regulations in robotics	K_WG20	lecture	exam	written exam (theory + tasks)
U1	is able to describe the kinematics of manipulator, as well as formulate and solve kinematics and dynamics problems, including the use of CAE techniques	K_UW02	classes	credit	reports
U2	can program and control a robot based on given guidelines and prepare a report on the task execution	K_UW05	classes	credit	reports

K1	is ready to complete and critically evaluate specialized knowledge and is able to select sources of knowledge and methods of learning appropriate for himself/herself and others;	K_KK01	lecture, classes	Verbal evaluation	Verbal evaluation
K2	is willing to comprehensively analyze and effectively carry out assigned tasks, and in the event of difficulties in solving them, use expert opinion	K_KK02	lecture, classes	Verbal evaluation	Verbal evaluation

Literature and teaching aids
Primary literature: 1. Craig J.: Introduction to robotics: Mechanics and control, Pearson Education Limited 2. Lynch K.M., Park F.C.: Modern robotics: Mechanics, Planning, and Control, Cambrige 3. Spong M.V.: Robot modeling and control, Wiley 4. Siciliano B., Khatib O.: Handbook of robotics, Springer 5. Siciliano B., Sciavicco L., Villani L., Oriolo G.: Robotics: Modelling, Planning and Control 6. Russell K., Shen J.Q, Sodhi R.J.: Kinematics and Dynamics of Mechanical Systems: Implementation in Matlab and Simscape Multibody, CRC Press Study aids: 1. Educational materials for laboratory sessions provided by the teacher

Student workload required to achieve the assumed learning outcomes – the balance of ECTS credits		
Attendance, participation	Student workload [h].	
	Student's self-study hours Classes without a teacher (ZBN**)**	Classes
Participation in lectures/classes/lab	X	15 [h] / 30 [h]
Preparation for lectures/classes/lab Preparation for credit / exam	35 [h] 20 [h]	X
Total student workload Preparation for ... credit / exam	55 [h]/ 2.2 ECTS	45 [h]/ 1.8 ECTS
ECTS points per subject	4 ECTS	

Additional information, comments
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. 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, przewlekle chorych).