SYLLABUS

Course description

Course code	Course	Programowanie obrabiarek CNC
ME/O/I/ST/C6		Programming of CNC machines
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)		6
Affiliation with a group of classes		C . Group of courses to choose from
Course status		Electable

Types of classes, instruction hours, ECTS credits	Types of classes	Number of instruction hours	Number of ECTS credits
	Lecture	15 [h]	5 ECTS
	Classes	[h]	
	Lab	45 [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	ECTS
	with qualifications	It is used to acquire engineering competences by the student	5 ECTS
	with science discipline	Mechanical engineering	5 ECTS

Form of teaching	Traditional – classes organized at the University /classes conducted using distance learning methods and techniques
Prerequisites	Knowledge and skills in the field of materials science, metrology, technology processes, design record
Department	Faculty of Mechanical Engineering
Coordinator	Dmitrij Morozow PhD .Eng.
The website of the basic organizational unit	http://wm.uniwersytetradom.pl
E-mail address, phone number of the coordinator	d.morozow@urad.edu.pl, phone: 48 361 76 21

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

Learning Objective:	The aim of the course is to acquire skills in recording design and technological information in alphanumeric G-code (DIN/ISO) for CNC machine tool numerical control systems

Curriculum Content:	Lecture: Historical information on the development of programming languages for control systems of numerically controlled machine tools. Geometrical basics: workpiece positions; Cartesian coordinates; polar coordinates; absolute dimension; incremental dimension; work planes; zero points and reference points; coordinate systems - machine coordinate systems (MCS) and workpiece coordinate system (WCS). NC programming basics: NC program name; program header; structure and content of the NC program; blocks and block components; available characters. Tool change: tool call using the command (T); tool change using M06. Tool offsets: tool offset call (D). Spindle movement: spindle speed (S), spindle rotation direction (M3, M4, M5); constant cutting speed (G96); constant G97 speed; programmable spindle speed limit. Feed control (F) (G94, G95). Geometric settings: Settable zero point shift (G54 to G57); work plane selection (G17, G18, G19); dimension data - absolute dimension input (G90, AC), incremental dimension input (G91, IC); inch or metric dimensions (G70, G71). Path commands: Travel commands with Cartesian coordinates - rapid traverse movement (G0), straight line interpolation (G1), circular interpolation (G2/G3); Travel commands with polar coordinates - polar coordinate reference point (G110, G111, G112), Travel commands with polar coordinates (G0, G1, G2, G3, AP, RP); chamfer, rounding (CHF, CHR, RND). Tool radius compensation (G40, G41, G42). Path motion behavior: exact stop (G60); smooth transition (G64). Coordinate transformations – concept, instructions. Auxiliary functions (M). Supplementary commands. Programming using machining cycles – machining holes, pockets, contours. Discussion of examples of programming turning and milling machining. Laboratory classes based on the Siemens Sinutrain program or/and MTS (Mathematical Technical Software Development Ltd.). Basic functions of the coordinate system and technological functions and their application. Programming simple contours (G0/G1, G2/G3, RND, CHF/CHR). Programming contours with tool radius compensation (G41/G42). Programming contours with graphic support (contour calculator). Advanced programming using machining cycles.
Didactic (educational) methods:	Informational lecture (regular), practical exercises (laboratory).
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. Form of passing the lecture and project classes based on control work.

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	Has knowledge of computer-aided design, manufacturing and operation of mechanical.	K_WG04 K_WG11	Lectures	Pass with grade	Control work
U1	Is able to use computer methods in solving engineering tasks in the field of design, manufacturing and operation of machinery and equipment; is able to assess the suitability of routine methods and tools for solving a simple engineering task of a practical nature in	K_UW05 K_UW09	Laboratories	Pass with grade	Control work

	the design, manufacture and operation of machinery and equipment, and select and apply the appropriate method and tools;				
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 K-KK02	Laboratories	Verbal form	

Literature and teaching aids
Primary literature: 1. Sinutrain. Siemens training materials. Siemens AG, 2011. 2. Sinumerik 840D sl. NC programming. Siemens Programming Manual, 2021 3. Sinumerik One. NC programming. Siemens Programming Manual, 2024 4. MTS (Mathematical Technical Software). Programming instructions. 2015 Additional literature: 1. Kaushik Kumar, Chikesh Ranjan, J. Paulo Davim: CNC Programming for Machining. Materials Forming, Machining and Tribology (MFMT), Springer, 2020, DOI: https://doi.org/10.1007/978-3-030-41279-1 Study aids:

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] / 45 [h]
Preparation for lectures/classes/lab , Preparation for ... credit / exam	65 [h]	X
Total student workload Preparation for ... credit / exam	65 [h]/ 2.6 ECTS	60 [h]/2.4 ECTS
ECTS points per subject	5 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).