COURSE SPECIFICATION

Course code	full-time programme:	**M#2-S2-ME-PT-112**
	part-time programme:	
Course title in Polish	**Zaawansowane systemy CAM**	
Course title in English	**Advanced CAM Systems**	
Valid from (academic year)	**2024/2025**	

GENERAL INFORMATION

Programme of study	**MECHANICAL ENGINEERING**
Level of qualification	**second-cycle**
Type of education	**academic**
Mode of study	**full-time programme**
Specialism	**Design and Manufacturing**
Department responsible	**Department of Machine Design and Machining**
Course leader	**dr inż. Michał Skrzyniarz**
Approved by	**dr hab. Jakub Takosoglu, prof. PŚk, Dean of the Faculty of Mechatronics and Mechanical Engineering**

COURSE OVERVIEW

Course type		**specialism-related**
Course status		**compulsory**
Language of instruction		**English**
Semester of delivery	full-time programme	**Semester I**
	part-time programme	**Semester I**
Pre-requisites		
Examination required (YES/NO)		**NO**
ECTS value		**3**

Mode of instruction		**lecture**	**class**	**laboratory**	**project**	**seminar**
No. of hours per semester	full-time programme	**15**		**15**	**15**	
	part-time programme					

LEARNING OUTCOMES

Category of outcome	Outcome code	Course learning outcomes	Corresponding programme outcome code
Knowledge	W01	The student will have a sound and in-depth knowledge of the design of technological processes using CAM (Computer Aided Manufacturing) software.	MiBM2_W12
	W02	The student will have a detailed and in-depth knowledge of manufacturing and machining technologies, including subtractive techniques used for material processing and forming.	MiBM2_W05
	W03	The student has detailed and in-depth knowledge enabling to design a technological process. They are familiar with CAD/CAM programmes used for designing technological processes and developing machining programmes for numerically controlled machines.	MiBM2_W12
Skills	U01	Be able to select and use manufacturing methods, tools and computer software.	MiBM2_U02
	U02	Be able to design a technological process in the field of mechanics and engineering, selecting appropriate machines, technological equipment and tools for this purpose.	MiBM2_U07
	U03	Be able to prepare a project and technological process for machine components using CAM (Computer Aided Manufacturing) software.	MiBM2_U07
	U04	Be able to apply appropriate methods and tools to the solution of a complex engineering problem of a practical nature in the field of manufacturing.	MiBM2_U08
Competence	K01	Be aware of the need for self-directed learning and knowledge development, including familiarising themselves with new computer-aided manufacturing (CAM) programmes and techniques.	MiBM2_K01

COURSE CONTENT

Mode of instruction	Topics covered
lecture	Discussion of simultaneous 4 and 5 axis machining. Contour based operations, 5-axis contour machining, variable profile. Definition of curves as guide geometry, definition of projection vector, definition of tool axis tracking. Safety levels for 4 and 5 axis machining. Discussion of lead angle and yaw angle. Definition of model wall as guide geometry. Projection vector, tool axis tracking. Turning and CY milling. Definition of geometries, safe points, turning with driven tools. Machining simulation. Collision check. Machining path optimisation.
laboratory	Create machining programmes for selected parts using 4- and 5-axis machining with CAM (Computer Aided Manufacturing) software. Definition of tools, part and fixtures. Definition of collision pairs. Load the machine. Create toolpaths for 4- and 5-axis machining. Machining simulation and collision checking.
project	Carrying out a technological process design project using CAM (Computer Aided Manufacturing) software. Develop a sample technological process for machining a selected object using 4- and 5-axis machining technology.

ASSESSMENT METHODS

Outcome code	Methods of assessment					
	Oral examination	Written examination	Test	Project	Report	Other
W01			X			
W02			X			
W03			X			
U01			X	X		
U02			X	X		
U03			X	X		
U04			X	X		
K01						X

ASSESSMENT TYPE AND CRITERIA

Mode of instruction	Assessment type	Assessment criteria
lecture	non-examination assessment	Achieving at least 50% of the points on the test.
laboratory	non-examination assessment	Achieving at least 50% of the points on the test.
project	non-examination assessment	Positive completion of the project task.

OVERALL STUDENT WORKLOAD

ECTS weighting													
No.	Activity type	Student workload											Unit
		full-time programme					part-time programme						
1.	Scheduled contact hours	L	C	Lb	P	S	L	C	Lb	P	S		h
		15		**15**	**15**								
2.	Other contact hours (office hours, examination)	**2**		**2**	**2**								h
3.	**Total number of contact hours**	**51**											h
4.	**Number of ECTS credits for contact hours**	**2,0**											ECTS
5.	**Number of independent study hours**	**24**											h
6.	**Number of ECTS credits for independent study hours**	**1,0**											ECTS
7.	**Number of practical hours**	**50**											h
8.	**Number of ECTS credits for practical hours**	**2,0**											ECTS
9.	**Total study time**	**75**											h
10.	**ECTS credits for the course** *1 ECTS credit = 25-30 hours of study time*	**3**											ECTS

READING LIST

1. Krzysztof Augustyn: NX CAM. Programowanie ścieżek dla obrabiarek CNC, Helion

2. Piotr Niesłony: Podstawy programowania maszyn CNC w systemie CAD/CAM Mastercam, BTC 2012
3. Przybylski W., Deja M.: Komputerowo wspomagane wytwarzanie maszyn. Podstawy i zastosowanie. WNT Warszawa 2007.
4. Augustyn K.: NX CAM – Virtual Machine. Podręcznik programisty CNC. Wydawnictwo CAMdivision, Miękinia 2016.
5. Mazur D., Rudy M.: Modelowanie w systemie NX CAD. Oficyna Wydawnicza Politechniki Rzeszowskiej, Rzeszów 2016.
6. Menchen P., Budzyński A.: NX 8.5 Ćwiczenia. GMSystem Wrocław 2012.
7. Menchen P.: NX 9.0. Ćwiczenia „Od koncepcji do wytwarzania – krok po kroku". GM System Wrocław 2013.
8. Curran Kelly Curran, Stenerson Jon Stenerson, CNC Machining & Turning Center Programming and Operation, Independently Published, 2021
9. Sachidanand Jha, Siemens Nx Exercises, Independently Published, 2019
10. Shih Randy H., Parametric Modeling with Siemens NX, SDC Publications, 2023