GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00058632						
Field of study	Mechatronics						
Date of commencement of studies	February 2023		Academic year of realisation of subject	2023/2024			
Education level	second-cycle studies		Subject group				
Mode of study	Full-time studies		Mode of delivery	at the university			
Year of study	1		Language of instruction	Polish			
Semester of study	2		ECTS credits	2.0			
Learning profile	general academic profile		Assessment form	assessment			
Conducting unit	Zakład Technologii Maszyn i Automatyzacji Produkcji -> Institute of Manufacturing and Materials Technology -> Faculty of Mechanical Engineering and Ship Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Daniel Chuchała				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	0.0	0.0	30
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours	Self-study		SUM
	Number of study hours	30		0.0	0.0		30
Subject objectives	Introduction to the most popular control systems for multi-axis CNC machine tools and their CNC programming languages. To learn about the possibilities and limitations of CNC programming of multi-axis machining.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W10] knows development trends and most important new achievements in technical sciences and science disciplines: Mechanical Engineering, Automation, Electronics and Electrical Engineering and related: Informatics and Materials Engineering	The student knows the latest solutions facilitating the implementation of the CNC program code for multi-axis machining introduced with new versions of control systems	[SW1] Assessment of factual knowledge
[K7_W06] has detailed, supported by the theory knowledge in terms of mechatronic design, mechatronic systems and machines, devices and process where they are used	The student has basic knowledge of the requirements for multi-axis machining processes that must be met so that such machining can be implemented and programmed	[SW1] Assessment of factual knowledge
[K7_U04] is able to utilise known methods and mathematical models, as well as computer simulations for analysis and evaluation of non-stationary continuous and discrete mechatronic systems and processes	The student is able to create a program code that will be responsible for the implementation of complex spatial movements of the cutting tool - workpiece assembly. He can simulate this machining using the CNC system environment	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject
[K7_W01] has extended knowledge in terms of selected areas of mathematics, including discrete and applied mathematics, optimisation methods, mathematical and numerical methods essential for: 1) modelling and analysis of nonstationary mechatronics, continuous and discrete time systems as well as physical phenomena; 2) description and analysis of mechatronic systems that include programmable devices 3) description and analysis of signal processing algorithms 4) synthesis of non-stationary mechatronic systems	The student knows the logical methods used in the CNC programming code, as well as the methods of analyzing changes in the spatial position of the coordinate system as a reference base for the programmed machining path	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects

Subject contents

LECTURE:Construction and fundamentals of multi-axis CNC machine tools. Basic control systems of commercialCNC machine tools and their programming languages used for multi-axis machining. Construction of a CNC machining program. Multi-axis programming in Heidenhain. Indexing and floating multi-axis machining. Coordinate system rotation methods. Logic methods and function jumps used in the implementation of CNC code.LABORATORY:Rotations and displacements of the coordinate system. Indexical multi-axis machining using linear interpolation. Indexing multi-axis machining using circular interpolations. Realisation of hole machining based on a multi-axis process. Realisation of pocket machining based on a multi-axis process. Realisation of quasi-smooth multiaxis machining. Use of logic functions and function jumps in the realisation of multi-axis machining.

Prerequisites and co-requisites

Knowledge of the basics of CNC programming in G-code and/or Heidenhain. Basic knowledge of machining.

Subjects:Machining and/or Manufacturing TechniquesControl systems for numerical machine tools

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Laboratory exercises	100.0%	10.0%
Final test	56.0%	90.0%

Recommended reading	Basic literature	1. Grzesik W., NIesłony P., Kiszka P.: Programowanie obrabiarek CNC. PWN Warszawa, 2020.2. Honczarenko J.: Obrabiarki sterowane numerycznie. WNT Warszawa 20083. Users Manual HEIDENHAIN Conversational TNC 640, 4, 20124. Lathe Operators Manual. December 2018, English, Original Instructions, Haas Automation Inc., U.S.A. HaasCNC.com
	Supplementary literature	1. Kaushik Kumar, Chikesh Ranjan, J. Paulo Davim. CNC Programming for Machining. Springer International Publishing, 1stEdition, 2020, p.136. DOI: 10.1007/978-3-030-41279-1 2. Fundamentals of CNC Machining. A Practical Guide for Beginners. Compliments of Autodesk, Inc. USA, 2014 3. Graham T. Smith. CNC Machining Technology. Volume 3: Part Programming Techniques. Springer-Verlag London, 1993, p. 137. DOI: 10.1007/978-1-4471-1748-3
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	Indexed rotation of the coordinate system around the Y axis.	
Work placement	Not applicable	