GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Automation and Robotization of Production Processes, PG_00039958		
Field of study	Management and Production Engineering, Management and Production Engineering		
Date of commencement of studies	October 2020	Academic year of realisation of subject	2022/2023
Education level	first-cycle studies	Subject group	Obligatory subject group in the field of study Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	3	Language of instruction	Polish
Semester of study	5	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Manufacturing and Production Engineering -> Faculty of Mechanical Engineering and Ship Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Mieczysław Siemiątkowski	
	Teachers	dr inż. Bogdan Ścibiorski dr inż. Mieczysław Siemiątkowski	

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						
	Address on the e-learning platform: https://enauczanie.pg.edu.pl/moodle/course/view.php?id=7311						

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	5.0	40.0	75

Subject objectives	Conveying basic knowledge on methods and means of production automation, including robotisation technologies of manufacturing processes, alongr with the issues related to controlling the related process flow. The development of thecapability for selecting the adequate technical mesures and means aimed at enhancing the operational efficiency of individual machines by mechanisation and automation of related working cycless as well as the entire process flow within multi-machine systems.

Learning outcomes

Course outcome	Subject outcome	Method of verification
K6_W04	Have basic knowledge of: structure built and operation of modern automated mechanically driven production machines , CNC control technology, construction and application of industrial robots as well as controlling the automated machine cycles for various manufacturing techniques	[SW1] Assessment of factual knowledge
K6_K01	Is able to creatively identify the purpose and requirements for continuous improving the performance of existing machine systems through the application of emerging innovations in the field of techniques and means of automation and robotisation; dealing with a problem, shows considerable creativity and the ability to identify opportunities for their effective application.	[SK5] Assessment of ability to solve problems that arise in practice [SK1] Assessment of group work skills
K6_U07	Is capable of performing a preliminary analysis of engineering activities concerning existing production process flows based on the custom criteria of quantitative assessment; identifies the needs and specifies requirements for the selection of techniques and technical resources for the conditions of the economically justified degree and scope of automation of the process, taking into account the existing limitations and benefits of the postulated improvements	[SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject
K6_U05	Is competent in the field of engineering activities concerning the analyses of the functioning the automated production systems and the presentation of their results, including planning of experiments, measurement activities and applying appropriate production calculations and computer simulation-based techniques, together with the ability to interpret the derived results and to formulate synthetic pragmatic and cognitive conclusions.	[SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task
K6_W06	Has a structured knowledge of: the construction and operation of modern technological machines and the directions for their development in the area of manufacturing of mechanical components, as well controlling the manufacturing process realisation under the conditions related the part-spectrum variety and production volumes.	[SW1] Assessment of factual knowledge

Subject contents	LECTURE: Definitions and terms concerning production automation and robotisation. Objectives and trends in production automation. Automation versus flexibility and production quantity. Productivity and the degree of system integration. Quantitative description of automation. Classification of control systems for machine tools. Numerical control and automatic regulation. Methods and technical means of automation in large-volume production. Flexible manufacturing automation. Flexibly automated CNC machines, machining centers, and autonomous machining stations. Flexible manufacturing systems (FMSs). Automation components for machine tools and their systems. Automation in transportation and storage. Techniques and means for automation flow of product and related technological equipment. Handling tasks in FMSs. Manipulators and industrial robots in manufacturing technologies. Monitoring and supervision within FMSs. LABORATORY: Automation of CNC machining operations: tool measurements in machine settings, positioning the working system; in-process measurement of work parts using the technology of measuring probes. Start-up of an industrial robot: safety aspects of a robotised workstation. Defining tools in a robotic system and measuring their length, coordinate systems of the robot and the machinist. Programming of the material handling cycle with robot, analysis of the robot working space considering the operating characteristics of a robot with six degrees of freedom, analysis of the influence of robot positioning in working space on its handling abilities. Programming robot movement trajectory with interpolation. Recognition of manipulation objects and conditional programming with the change in the sequence of process events.
Prerequisites and co-requisites	Basic knowledge of manufacturing technologies as well as the structure and operation of machine tools and manufacturing equipment.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Subject exam as test in writing	56.0%	50.0%
Reports related to practical laboratory exercises	56.0%	50.0%

Recommended reading

Basic literature	1. Grzesik W., Niesłony P., Kiszka P., Programowanie Obrabiarek CNC. Wydawnictwo Naukowe PWN, Warszawa 2020. 2. Honczarenko J. Obrabiarki sterowane numerycznie. Wydawnictwo Naukowe PWN, Warszawa 2017. 3. Honczarenko J., Roboty przemysłowe, Wydawnictwo Naukowe PWN, Warszawa 2010. 4. Kost G., Łebkowski P., Węsierski Ł. N.: Automatyzacja i robotyzacja procesów produkcyjnych. Seria: Zarządzanie i Inżynieria Produkcji, PWE, Warszawa 2013. 5. Pająk E.: Zarządzanie produkcją. Produkt, technologia, organizacja, PWN, Warszawa 2013. 5. Mechatronika. Praca zbiorowa pod kier. D. Schmida (oprac. polskie M. Olszewski i inni), Verlag Europa - Lehrmittel Rea. Warszawa 2002.
Supplementary literature	1. Honczarenko J.: Elastyczna automatyzacja wytwarzania. Obrabiarki i systemy obróbkowe, WNT, Warszawa 2000. 2. Panasiuk J., Kaczmarek W. Robotyzacja procesów produkcyjnych, Wydawnictwo Naukowe PWN, Warszawa 2018. 3. Heindenhain, TNC Guide (Webside): http://content.heidenhain.de/doku/tnc_guide/html/en/index/1242135142456/1242135142489/1242135142489.html 4. Poradnik inżyniera. Tom II. Obróbka skrawaniem. Praca zbiorowa. WNT. Warszawa 1993. 5. Mechatronika. Praca zbiorowa pod kier. D. Schmida (oprac. polskie M. Olszewski i inni), Verlag Europa - Lehrmittel Rea. Warszawa 2002.

	eResources addresses	Adresy na platformie eNauczanie: Automatyzacja i robotyzacja procesów produkcyjnych, W/L, ZiIP, sem. 05, zimowy 22/23 (M:31822W0) - Moodle ID: 24064 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=24064
Example issues/ example questions/ tasks being completed	1. Models of concentration and diversification of manufacturing operations in the viewpoint of the productivity of the manufacturing processes. 2. Quantitative description of automation and of manufacturing process operations. 3. The concept of (total) complete machining and its realisation with the use of use of working machining centres. 4. The classification of machine tool systems in terms of part diversification and the scale of production. 5. The general purpose machine tools and machine specialisation, and the forms of production automation. 6. Functional division of the means for programmed control and the factors for related application tor specific production tasks. 7. Palletising and part supply and flow for machining centre operation in flexible manufacturing systems. 8. Typical applications of industrial robots and handling equipment for the operation of manufacturing facilities. 9. The basic parameters used in the description of atributes and operational characteristics of industrial robots. 10. Application features of machining centres (MCs)and stand-alone machining stations (SMSs). 11. The criteria and conditions determining the selection of multi-axis CNC machine tools. 12. The classification schemes of layout structures in parts manufacture with regard to automation of production processes. 13. The rationale behind and conditions (technical measures) for selecting multi-part machining operations; sketches of selected examples of applications. 14. The techniques and means used in the subsystems allocated to the parts - and tool storage meeting the demands of flexible manufacturing. 15. Techniques and means for automated inspection and measurement functions in modern manufacturing systems.	
Work placement	Not applicable	