GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Integrated manufacturing systems, PG_00064915						
Field of study	Mechanical Engineering						
Date of commencement of studies	February 2027		Academic year of realisation of subject	2026/2027			
Education level	second-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	Part-time studies		Mode of delivery	at the university			
Year of study	1		Language of instruction	Polish			
Semester of study	1		ECTS credits	4.0			
Learning profile	general academic profile		Assessment form	assessment			
Conducting unit	Department of Manufacturing and Production Engineering -> Faculty of Mechanical Engineering and Ship Technology -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Ewa Kozłowska				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	18.0	0.0	9.0	9.0	0.0	36
	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	36		4.0	60.0		100
Subject objectives	Transfer of systematized knowledge on design, planning, and operation of modern production systems based on flexible automation, and using means of logistic and informational integration for material flows. Presenting the possibilities for production rationalisation and optimisation based on available material handling and processing capabilities of machinery and related tooling, including practising with prototyping and quantitative analysis of generated process flow alternatives.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W02] demonstrates a structured and theoretically grounded knowledge of the key topics in Mechanical Engineering enabling the analysis and modelling of mechanical systems, processes and devices	Demonstrates a systematic knowledge, based on familiarity with the theoretical underpinnings, of the key issues in the field of the represented field of study, and which is necessary for the analysis of the interoperability of technological machines in manufacturing systems, modelling of diverse forms of their organisation and the multifaceted studies of discrete process flows.	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation
[K7_W13] explains the main principles of individual and teamwork organization, including various forms of entrepreneurship utilizing knowledge from the field of engineering and technical sciences and disciplines relevant to the course of study	Has adequate knowledge of the subject area relevant to the field of study necessary to understand the technical and economic conditions of production systems, including the principles of organisation of the product/process engineer's own work and activities of team-working.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
[K7_U04] creatively designs or modifies devices, processes or systems specific to Mechanics and Mechanical Engineering, using computer-aided design systems in the form of technical documentation, taking into account aspects of economic analysis, using appropriate tools and techniques	Demonstrates the ability to carry out a critera, economically justifiable selection of technological machines and related equipment, to develop structures of automated manufacturing systems and to plan discrete runs of manufacturing processes appropriate to the field of study, using contemporary techniques for analysing and documenting technical solutions and computer-aided means.	[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools
[K7_U13] evaluates the feasibility and potential for utilizing new technical and technological achievements in accomplishing tasks characteristic for the field of study	Be able to critically evaluate the applicability of contemporary approaches and technological innovations when applied to the tasks of planning and analysis of modern manufacturing systems operation in the field of mechanical engineering.	[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools

Subject contents

Course content – lecture

LECTURE: Components of a manufacturing process (definitions and terms). Contemporary concepts for the organisation of discrete manufacturing system and taxonomy of processing operations. fanctional an d information-based Integration of process components: machining (manufacturing), material flow (transportation), information flow and process control. Numerical control and automatic regulation. Automation components for machine tools and their systems. Automation versus flexibility and production scale. Productivity and the degree of system autonomy. Flexibly automated CNC machine tools, multi-tasking machines and autonomous stations for integrated manufacturing. Flexible manufacturing systems (FMS) technology. Measures for FMS integration: transportation and material (part/tooling) handling subsystems using manipulators and industrial robots. Integration of process flow functions. Typologies of production facility organisation. The stationary system layout. group-technology concepts by clustering objects. Cellular and linear forms of layout organisation.

PROJECT WORK: Parts spectrum selection for manufacture in a cellular-type manfacturing system. Formulating conditions for integrated group machining. Formalising the description of requirements and structures of processes and mapping the material flows using graph modelling. Selecting machine resources for realisation of technological operations. Selecting solutions concerning the transport structure, means of transport tasks execution and techniques for storage and palletising of semi-finished and finished products, under conditions of functional integration of system components. Basic manufacturing calculations in terms of discrete process flow for the established system layout and form of its organisation.

LABORATORY: Comparative analysis of capabilities of technological machines in automated process operation for various part classes based catalogues and internet databases. System development for with machine resources for integrated manufacturing. Parts spectrum formalisation for cellular manufacturing with established process sequences s and adequate material flows to be implemented in the environment of Preactor APS (Advanced Planning and Scheduling) softwaret. Visualisation of material flows and their quantitative evaluation. Deriving the experimental results in the form of operational schedules, including their proper interpretation and qyuantitative evaluation.

Prerequisites and co-requisites

Basic knowledge of manufacturing technologies, the structure and operation of machine tools as well as production organisation.

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Reports of laboratory excercises	58.0%	25.0%
	Final written colloquium of lectures	58.0%	50.0%
	Final report of design work	58.0%	25.0%
Recommended reading	Basic literature	1. Charczenko A., Świć A., Taranenko W.: Obrabiarki i urządzenia technologiczne w produkcji elastycznej, Politechnika Lubelska, Lublin 2011 2. Groover M.P.: Automation, production systems, and computer-integrated manufacturing, 3rd Edition, Pearson Prentice - Hall, New Jersey 2008. 3. Honczarenko J.: Oraiarki sterowane numerycznie, Warszawa, WNT, Warszawa 2008. 4. Pająk E.: Zarządzanie produkcją. Produkt, tecnologia, organizacja, PWN, Warszawa 2013.	
	Supplementary literature	1. Design of flexible production systems, Methodologies and tools, T. Tolio (Editor), Springer-Verlag, Berlin Heidelberg, 2009. 2. Kalpakjian S., Schmid S.R.: Manufacturing Engineering and Technology, 7th Edition, Pearson Education, Inc 2014. 3. Machine tools for high performance machining, L.N. Lopez de Lacalle, A. Lamikiz (eds), Springer Verlag London Ltd. 2009. 4. Nasalski Z., Romaniuk K., Wichowska A., Chrobocińska K., Szczubełek G.: Zintegrowane systemy wytwarzania, UWM, Olsztyn 2014. 5. Preactor® APS (Advanced Planning & Scheduling), Operation manual, Preactor Intl. Ltd. UK, Chippenham, Wiltshire 2009.	
	eResources addresses		

Example issues/ example questions/ tasks being completed	1. The concepts of concentration and differentiation of process operations in the view of the increase in its productivity. Measures taken to create structures of integrated operations in parts machining. 2. The idea of total (complete) machining and the possibilities for its realisation considering the processing capabilities of contemporary work centres. 3. Techniques and the means used in modelling manufacturing systems operation and related process flow. 4. The functional structure of a typical FMS, including basic means designated to perform those functions. 5. Quantitative metrics used in the description of automation level and flexibility attributes of process performance in single- and multi-machine parts manufacturing systems. 6. Geometric structures and kinematics of definite types of flexibly automated CNC machine tools applied to integrated manufacturing systems for: a) rotational , and (b) prismatic parts. 7. Technical and organisational conditionings determining the realisation capabilities of multi-part machining in integrated manufacture. 8. The determiners of manufacturing facility layouts along with machine tool selection versus production quantity and the requirements concerning the parts spectrum manufactured. 9. Layout classification and operational attributes of multi-machine integrated machining systems. 10. Classification factors for the typology of complex parts processing operations, performed in single-machine based FMSs 11. Palletization equipment and workpiece flow integration for machine tools operation in integrated production systems 12. Material handling techniques and capabilities of the resources concerning parts flow used in dedicated flexible manufacturing cells. 13. Classification scheme and related features of machines used in integrated manufacturing processes of differentiated parts spectrum. 14. Application features and criteria used in equipment selection for parts and tooling storage under the demands of integrated production. 15. Part inspection technologies and relevant measurement equipment used in automated and integrated systems of production.
Practical activites within the subject	Not applicable

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