GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Production Process Planning, PG_00047704						
Field of study	Automatic Control, Cybernetics and Robotics						
Date of commencement of studies	October 2024		Academic year of realisation of subject	2027/2028			
Education level	first-cycle studies		Subject group	Optional subject group 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	4		Language of instruction	Polish			
Semester of study	7		ECTS credits	4.0			
Learning profile	general academic profile		Assessment form	exam			
Conducting unit	Department of Decision Systems and Robotics -> Faculty of Electronics, Telecommunications and Informatics						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Krystyna Rudzińska-Kormańska				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	0.0	0.0	0.0	45
	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	45		4.0	51.0		100
Subject objectives	Learning methods of production planning, transportation and management in flexible manufacturing systems. The acquisition of skills in operations research algorithms production planning.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U01] can apply mathematical knowledge to formulate and solve complex and non-typical problems related to the field of study and perform tasks, in an innovative way, in not entirely predictable conditions, by:n- appropriate selection of sources and information obtained from them, assessment, critical analysis and synthesis of this information,n- selection and application of appropriate methods and toolsn	Uses numerical methods in solving engineering tasks.	[SU4] Assessment of ability to use methods and tools
[K6_U03] can design, according to required specifications, and make a simple device, facility, system or carry out a process, specific to the field of study, using suitable methods, techniques, tools and materials, following engineering standards and norms, applying technologies specific to the field of study and experience gained in the professional engineering environment	Creates navigation algorithms for mobile robots; creates a decision support system.	[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment
[K6_W03] knows and understands, to an advanced extent, the construction and operating principles of components and systems related to the field of study, including theories, methods and complex relationships between them and selected specific issues - appropriate for the curriculum	He knows the methods of production planning, transport and management in flexible production systems.	[SW1] Assessment of factual knowledge
[K6_W01] knows and understands, to an advanced extent, mathematics necessary to formulate and solve simple issues related to the field of study	Has knowledge in the field of operational research.	[SW1] Assessment of factual knowledge

Subject contents

1. Introduction. Basic definitions. Examples of production processes.
2. Computer Integrated Manufacturing (CIM system). Flexible Manufacturing Systems (FMS) – a structural approach.
3. Architecture of FMS and control systems.
4. Hierarchical planning methods (strategical, tactical and operational planning).
5. Classification of scheduling problems. Sequencing tasks for different FMS structures. Serial and parallel processes.
6. Job sequencing for a production line.
7. Time criteria in one machine scheduling. SPT, EDD and Smith's rules.
8. Johnson's algorithm for the two- and three machines job-shop.
9. Graph data representation in operation research. Construction of operation precedence.
10. Minimum tardiness problems with precedence constraints. Lawler's technique.
11. Sequencing problems in FSM with parallel machines.
12. Zero-one variable programming. Problems:
13.
    - optimal job assignment to parallel processors;
    - optimal allocation of multiple resources.
14. Balanced and unbalanced assignment problems. Hungarian algorithm.
15. Network models in production planning.
16. Technological path determination for production lines with parallel machines.
17. Optimization of FMS – transport system. Free-collision path finding for automated vehicles (AGV, MP).
18. Application of visibility graph and Dijkstra's algorithm for determining the collision-free trajectory of the AGV with a minimum travel time
19. Strategic production planning by using Linear Programming.
20. Matrix forms of Linear Programming (LP). Simplex algorithm.
21. Starting basic solution. LP – optimal solutions (single, alternative degenerated).
22. Inventory and transportation problems.
23. Transportation algorithm (TA) for balanced problems.

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
two tests (40+40 points), activity (20 points)	50.0%	100.0%

Recommended reading	Basic literature	1. T. Sawik, "Optymalizacja dyskretna w elastycznych systemach produkcyjnych". 2. H.A. Taho, "Operations Research". 3.
	Supplementary literature	1. K. Santarek, S. Strzelczak, "Elastyczne Systemy Produkcyjne". 2. W. Grabowski, "Programowanie matematyczne". 3.
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	