GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Computer aided process planning, PG_00064864		
Field of study	Computer aided process planning		
Date of commencement of studies	February 2025	Academic year of realisation of subject	2025/2026
Education level	second-cycle studies	Subject group	Specialty 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	1	Language of instruction	English
Semester of study	2	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Division of Manufacturing and Production Engineering -> Institute of Manufacturing and Materials Technology -> Faculty of Mechanical Engineering and Ship Technology -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Ewa Kozłowska	
	Teachers	dr inż. Mieczysław Siemiątkowski	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	0.0	30.0	0.0	45

E-learning hours included: 0.0

eNauczanie source addresses:

Moodle ID: 1486 Computer aided process planning
https://enauczanie.pg.edu.pl/2025/course/view.php?id=1486

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	9.0	46.0	100

Subject objectives

Transfer of systematized knowledge in the field of planning production and logistic processes realised in uptodate manufacturing systems, for various types and forms of their organization, using methods and means of flexible automation and logistic and information integration of material flows. Presentation of the possibilities for rationalised and optimised production runs under the conditions of existing technological limitations of the criteria of efficiency and flexibility of product manufacturing.

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	Has an extended and systematised theoretical and practical knowledge on the production facilities' structures of diverse categories, planning and multi-faceted analysis of production and logistics process runs in the area of mechanical engineering using adequate analytical and simulation-based methods, taking into account the needs of structural and parametric optimization of the material flows.	[SW3] Ocena wiedzy zawartej w opracowaniu tekstowym i projektowym
[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 in a team environment.	[SW3] Ocena wiedzy zawartej w opracowaniu tekstowym i projektowym [SW1] Ocena wiedzy faktograficznej
[K7_K13] is ready for responsible performance of proffesional roles, considering ever-changing need of the society, including self developement and supporting and fullfiling work ethics	In future professional work, will be able to use the acquired knowledge and skills in a coherent manner and in accordance with the principle of a systems approach adequately to the changing needs of society, developing the achievements in the area of his/her own activity and observing the principles of professional ethics.	[SK1] Ocena umiejętności pracy w grupie [SK2] Ocena postępów pracy [SK3] Ocena umiejętności organizacji pracy [SK4] Ocena umiejętności komunikacji, w tym poprawności językowej [SK5] Ocena umiejętności rozwiązywania problemów występujących w praktyce
[K7_U02] formulates and solves technical problems specific to Mechanics and Mechanical Engineering using appropriate tools including CAD and MES systems, and prepares technical documentation	Is capable of developing a conceptual and computer model of variants of technological and production processes on the basis of specific specifications and technical-organisational conditions of operation research and nontechnical aspects appropriate to the field of study.	[SU1] Ocena realizacji zadania [SU2] Ocena umiejętności analizy informacji [SU3] Ocena umiejętności wykorzystania wiedzy uzyskanej w ramach przedmiotu [SU4] Ocena umiejętności korzystania z metod i narzędzi [SU5] Ocena umiejętności zaprezentowania wyników realizacji zadania

Subject contents

LECTURE: Layout structure, classification and decomposition of discrete production processes (DPP). Models of DPP flows for typologies and forms of production organization, incl. those in terms of group technology. Planning production flow, its organization and system capacity. Scheduling DPP of the cellularand
flow- type. Algorithms and heuristics for scheduling production tasks. Dispatching rules for scheduling production orders. Operational scheduling optimization criteria. Parameters for evaluation of DPP implementations, utilization of worktime standards and system capacity, trade-off evaluation. Modelling algorithms for sequential and concurrent processes. Mapping DPP organization using selected descriptive methods, i.e. IDEF0 (Integrated Definition for Function Modeling) and BPMN (Business Process Modelling Notation). Modeling process runs using UML (Unified Modelling Language) activity diagrams, Petri net formalism and Grafcet approach. Analytical and simulation modelling in research and quantitative evaluation of production runs. Discrete linear programming in optimization tasks in planning DPP realisations

PROJECT WORK: Modelling production structures and rationale for planning organization of PP in terms of group technology, with the use of multidimensional data mining techniques in the environment of Statistica software package; construction and ranking evaluation of generated operational schedules of DPPs, using adequate task scheduling algorithms for a specific production program and system capacity characteristics in the environment of Preactor APS (Advanced Planning and Scheduling) program; modelling variant realisations of processes of fabrication of welded mechanical structures with the use of graph methods and flow networks, selection of means for accomplishing technological operations, transport tasks as well as storage and palletization of semi-finished products and end products; selection of optimized solutions for process organization with the use of linear programming technique in discrete sets.

Prerequisites and co-requisites	Essential knowledge of manufacturing techniques, features of technological machinery, production process organization and applications of basic operations research techniques.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Final written colloquium	51.0%	50.0%
Final report of design work	51.0%	50.0%

Recommended reading

Basic literature

1. Gawlik J., Plichta J., Świć A.: Procesy produkcyjne. PWE, W-wa 2013.
2. Lasota A.: Modelowanie procesów produkcyjnych z wykorzystaniem diagramów aktywności języka UML i sieci Petriego. Exit, W-wa 2012.
3. Mazurczak J.: Projektowanie struktur systemów produkcyjnych, Wyd. Politechniki Poznańskiej, Poznań 2002.
4. Sawik T.: Optymalizacja dyskretna w elastycznych systemach produkcyjnych. WNT, W-wa 1992.

Supplementary literature

1. Kost G., Łebkowski P., Węsierski Łukasz N.Automatyzacja i robotyzacja procesów produkcyjnych. PWE, W-wa 2013.
2. Stadnicki J.: Teoria i praktyka rozwiązywania zadań optymalizacji , z przykładami zastosowań technicznych. WNT, W-wa 2006.
3. Zdanowicz R., Świder J.: Komputerowe modelowanie procesów wytwórczych. Wyd. Politechniki Śląskiej, Gliwice 2013.
4. Preactor® APS (Advanced Planning & Scheduling), Operation manual, Preactor Intl. Ltd. UK, Chippenham, Wiltshire 2013.

eResources addresses

Example issues/ example questions/ tasks being completed

Principles of rational organization of the production process.
Formulation of the production program and description of the level of production capacity of the system.
Organization of the production process flow according to the assumptions of group technology.
Formulation of optimization models in linear programming for discrete variables.
Assumptions and factors determining the selection of solutions in planning the production structures.
Algorithmization of discrete production processes (DPP) using Petri net formalism and Grafcet technique.
Assumptions of the concept of modelling production runs, using activity diagrams and principles of Unified Modelling Language (UML) approach.
Technical and organizational calculations for cellular flow organization forms of production.
Production process cycle planning for serial and concurrent manufacturing execution.
Graph modelling and formalization of activity network notation in describing the courses of various categories of production processes.
The essence of deterministic and probabilistic models with a comparison of their usefulness in simulation analysis.
Introduction of variability into the simulation model of a discrete manufacturing system: typical applications of random variable distributions of parameters with integer and real values.
Procedure of activities performed in the framework of a simulation project on the operation of a manufacturing system.
Principles of planning simulation studies for specific factors of variation in the course of the production process.
Techniques of modelling and visualization of DPP test runs for simulation studies.

Practical activites within the subject

Not applicable