

Course syllabus

binding for the doctoral students of the CUT Doctoral School commencing their studies
in the academic year 2022/2023

Information on the course

Name of the course in Polish	Modelowanie systemów wytwarzania
Name of the course in English	Modeling of manufacturing systems
Number of the ECTS points	1
Language of instruction	Polish
Category of the course	Choosable
Field of education	Engineering and technology
Discipline of education	Mechanical engineering
Person responsible for the course Contact	Jerzy Zajac, <i>doctor habilitatus</i> , prof. of CUT zajac@pk.edu.pl

Type of course, number of hours in the study programme curriculum

Semester	Credit type (G / NG)*	Lecture	Practical classes	Laboratory	Computer Lab	Project Class	Seminar
2, 3, 4, 5	G	15	0	0	0	0	0

*G – graded credit, NG – non-graded credit

Course objectives

Code	Objective description
Objective 1	Introduction to the role of digital transformation in the development of the fourth industrial revolution.
Objective 2	Expanding knowledge in the field of modelling and control of manufacturing systems.

Learning outcomes

Code	Description of the learning outcome adjusted to the specific characteristics of the discipline	Learning outcome symbol in the CUD DS	Methods of verification
OUTCOMES RELATED TO KNOWLEDGE			
EUW1	The doctoral student knows the role of digital transformation in the development of the fourth industrial revolution.	E_W01, E_W02	Involvement in class activities.
EUW2	The doctoral student is familiar with the architectures of manufacturing control systems.	E_W01, E_W02	Involvement in class activities.
OUTCOMES RELATED TO SKILLS			
EUU1	The doctoral student is able to present the stages of building a model of a manufacturing control system.	E_U01	Discussion.

EUU2	The doctoral student is able to present the functional structures of integrated manufacturing systems.	E_U01	Discussion.
OUTCOMES RELATED TO SOCIAL COMPETENCES			
EUK1	The doctoral student is ready to discuss the importance of the fourth industrial revolution.	E_K01, E_K03	Discussion.

Course outline

No.	Contents	Learning outcomes for the course	No. of hours
LECTURE			
W1	Basic concepts. Development of manufacturing systems. Manufacturing paradigms. Functional structure of integrated manufacturing systems.	EUW1, EUW2, EUU2	2
W2	The fourth industrial revolution. Digital transformation. Reference architectures in the development of Industry 4.0.	EUW1, EUW2, EUK1	5
W3	Modelling of discrete manufacturing systems. UML Unified Modeling Language. Petri nets.	EUW2, EUU1, EUU2	2
W4	Primary tasks of the manufacturing control system. Stages of building a model of a manufacturing control system. Manufacturing control systems architectures.	EUW2, EUU1	2
W5	Resource conflicts in discrete manufacturing systems. Necessary conditions for a blockage to occur. Strategies for dealing with blockades.	EUW2, EUU1	2
W6	Controlling Discrete Manufacturing Systems. Comparing the features of traditional manufacturing systems with new generation systems.	EUW2, EUU1	2

The ECTS points statement

WORKING HOURS SETTLEMENT	
Type of activity	Average number of hours (45 min.) dedicated to the completion of an activity type
SCHEDULED CONTACT HOURS WITH AN ACADEMIC TEACHER	
Hours allotted in the syllabus	15
Consultations	1
Examination / course credit assignment	1
HOURS WITHOUT THE PARTICIPATION OF AN ACADEMIC TEACHER	
Independent study of the course contents	9
Preparation of a paper, a report, a project, a presentation, a discussion	4
ECTS POINTS STATEMENT	
Total number of hours	30
The ECTS points number	1

Preliminary requirements

No.	Requirements
1	None specified.

Course credit assignment conditions / method of the final grade calculation

No.	Description
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COURSE CREDIT ASSIGNMENT CONDITIONS	
1	75% attendance in class.
2	Passing the oral final test.
METHOD OF THE FINAL GRADE CALCULATION	
Grade for the final test, taking into account the attendance.	

Additional information

None specified

The course reading list

1	Cyklis J., Pierzchała W. <i>Modelowanie procesów dyskretnych w elastycznych systemach produkcyjnych</i> , Kraków, 1995, Politechnika Krakowska.
2	Zajac J.: <i>Rozproszone sterowanie zautomatyzowanymi systemami wytwarzania</i> , Kraków, 2003, Wydawnictwo Politechniki Krakowskiej.
3	Gola A., Kost G., Zajac J., <i>Integracja zautomatyzowanych i zrobotyzowanych systemów wytwarzania</i> , 2022, PWE.