Computer-Aided design and simulation of manufacturing processes - course description

General information

Course name	Computer-Aided design and simulation of manufacturing processes
Course ID	06.9-WM-ZIP-ZL-ANG-D-14_20
Faculty	Faculty of Mechanical Engineering
Field of study	Management and Production Engineering
Education profile	academic
Level of studies	Second-cycle studies leading to MSc degree
Beginning semester	winter term 2023/2024

Course information

Semester	2
ECTS credits to win	4
Course type	obligatory
Teaching language	english
Author of syllabus	• dr hab. inż. Sławomir Kłos, prof. UZ

Classes forms

The class form	Hours per semester (full-time)	Hours per week (full-time)	Hours per semester (part-time)	Hours per week (part-time)	Form of assignment
Laboratory	30	2	-	-	Credit with grade
Lecture	15	1	-	-	Credit with grade

Aim of the course

The aim of the course is to acquaint students with the method of computer simulation and familiarization with the techniques of building simulation models of processes and production systems. After completion of the course students should be able to use the selected software to simulate production processes (eg. Tecnomatix Plant Simulation, Enterprise Dynamics, Arena, etc.), model building (mapping the actual system in a form of a simulation model), Designing of simulation experiments and analysis of research results.

Prerequisites

Knowledge of basic production processes implemented in enterprises.

Scope

Computer simulation as a research method - introduction. Stages of the construction of a simulation model. Generating pseudorandom data based on various probability distributions. Basic objects needed to build the simulation model of the production system. Planning of a simulation experiment. Modelling and simulation of discrete manufacturing processes. Modelling and simulation of assembly processes. Analysis of the efficiency of utilization of production resources. Analysis of the efficiency of logistics processes and inventory levels of work in progress. Analysis of the effectiveness of employees on the basis of a simulation model of the production system.

Lecture 1. Introduction to modeling and simulation of production processes.

Lecture 2. Methodology of building a simulation model of the production system.

Lecture 3. Tecnomatix Plant Simulation system functionality - user interface and the most important tools, production flow.

Lecture 4. Tecnomatix Plant Simulation system functionality - production resources.

Lecture 5. The functionality of the Tecnomatix Plant Simulation system - analysis and reports.

Lecture 6. Tecnomatix Plant Simulation system functionality - simulation experiments.

Lecture 7. Tecnomatix Plant Simulation system functionality - artificial intelligence methods.

Lecture 8. 3D modeling.

Laboratories

Lab 1. Introduction to modeling production processes in Tecnomatix Plant Simulation.

Lab 2, Lab 3 - Modeling and simulation of discrete processes.

Lab 4, Lab 5 - Modeling of production processes with the use of AGV trucks.

Lab 6, Lab 7 - Analysis of the efficiency of production processes.

Lab 8, Lab 9 - Modeling of production processes carried out with the participation of employees (machine operators).

Lab 10, Lab 11 - Modeling of production logistics processes with the use of pallets. Production flow models for different production batch sizes.

Lab 12, Lab 13 - Modeling and simulation of energy consumption in production systems.

Lab 14, Lab 15 - Designing simulation experiments.

Teaching methods

Lecture – Conventional lecture with the use of a videoprojector.

Laboratory– practical classes carried out with the use of Tecnomatix Plant Simulation.

Learning outcomes and methods of theirs verification

Outcome description	Outcome symbols	Methods of verification	The class form
The student has an orderly, theoretical knowledge of computer-aided management in an enterprise.	• K_W09	• an evaluation test	• Lecture
The student is able to obtain, integrate and interpret knowledge, draw conclusions and formulate opinions on the basis of catalogue entries issued by manufacturers of appliances, advertising material, information obtained from literature, databases and other modern means of communication, which relate to issues of mechanical engineering and management methods in this field.	• K_W04 • K_U04	• an evaluation test • carrying out laboratory reports	• Lecture • Laboratory
The student is able to choose and use appropriate computer applications for calculation, simulation, designing and verification of solutions related to Management and Production Engineering.	• K_U12	• an evaluation test • carrying out laboratory reports	• Lecture • Laboratory
The student is able to think and act both creatively and entrepreneurially.	• K_K06	• carrying out laboratory reports	• Laboratory
The student has knowledge of development trends and new developments in manufacturing engineering.	• K_W16	• an evaluation test	• Lecture

Assignment conditions

Lecture - a written exam at the end of the semester.

Laboratory – final grade is the weighted sum of grades obtained for the completion of individual laboratory classes. The contribution of individual components of evaluation: grade for laboratories - 50%, grade for the lecture – 50%.

Final grade = 50 % of grade for lecture + 50 % of grade for project classes.

Recommended reading

1. Kłos S., The simulation of manufacturing systems with Tecnomatix Plant Simulation, Wydawnictwo UZ, 2017
2. S. Bangsow, Tecnomatix Plant Simulation: Modeling and Programming by Means of Examples, Springer; 2016
3. S. Bangsow, Manufacturing Simulation with Plant Simulation and Simtalk: Usage and Programming with Examples and Solutions, Springer, 2010
4. G. L. Curry, R. M. Feldman, Manufacturing Systems Modeling and Analysis, Springer, 2010

Further reading

1. Tecnomatix on-line documentation

Notes

Modified by dr hab. inż. Sławomir Kłos, prof. UZ (last modification: 14-04-2023 15:02)