COURSE GUIDE

Subject name	**Computer simulation of manufacturing processes**
Course of study	**Quality and Production Management**
The form of study	**Full-time**
Level of qualification	**First**
Year	**III**
Semester	**VI**
The implementing entity	**Department of Production Engineering and Safety**
The person responsible for preparing	**dr inż. Marek Krynke**
Profile	**General academic**
ECTS points	**3**

TYPE OF TEACHING – NUMBER OF HOURS PER SEMESTER

LECTURE	CLASS	LABORATORY	PROJECT	SEMINAR
15		**30**	**-**	**-**

COURSE AIMS

C1. Presentation of methodological assumptions of modeling and simulation of production systems.
C2. To acquaint students with IT systems allowing for modeling of elements of production systems and their simulation.
C3. Reporting and analyzing results from the functioning of the production systems data and improving those elements.

ENTRY REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Computer handling.
2. Fundamentals of managing a manufacturing and / or service company.
3. Knowledge of the operation of information systems.

LEARNING OUTCOMES

EU1. Diagnose and solve problems in the organization using simulation methods and production process modeling.
EU2. Design and propose changes to the organization and / or its selected areas using expert knowledge in the field of simulation of production processes.
EU3. Identification of methods (including: simulation and modeling of production processes) and IT tools for problem solving in selected areas of organization functioning.
EU4. Student is able to solve optimization problems of production processes using the GNU Octave computing environment.

COURSE CONTENT

Type of teaching – LECTURE	Number of hours
W1. Concepts of modeling and simulation theory. Objectives, conditions and stages of the simulation model. Approaches to modeling the process and the system.	2
W2. Modeling and simulation of production systems, construction of virtual production process model.	2
W3. Input data for production process modeling.	1
W4. Defining the problem and identifying and collecting needed data and information.	1
W5. The steps of modeling and simulating the production process system.	1
W6. Selection of modeling and simulation software.	1
W7. Adding model logic and data management.	1
W8. Unit management and time tables. Grouping flow elements.	1

W9. Random models. Select the probability distribution. Use random sampling to control the simulation.	2
W10. Analysis of the resulting simulation data. Evaluation of profitability of production orders.	1
W11. The task of linear programming in the Gnu Octave environment.	1
W12. The question of reliability modeling. Simulation of machine failure, use of personnel for repairs.	1
Type of teaching - LABORATORY	**Number of hours**
L1. Introduction to the FlexSim simulation package - functionality and navigation in the system.	2
L2. Use a diagramming and schematic design package to visualize system models / production processes (eg Visio).	2
L3. Building the basic sequence of model components: source, queue, processor, sink. Parameterization of model components.	2
L4. Construction of models and simulation of processes to test the workload of one station.	2
L5. Construction of the work load test model for many parallel work stations.	4
L6. Possibility to visualize system operation / production process in FlexSim simulation package.	2
L7. Production and simulation of the production department model.	6
L8. Simulations involving operator and transporter.	4
L9. Use of built-in analytical and optimization tools for simulation package for system / process analysis.	4
L10. Reports and statistics on simulation results as a source of information on the functioning of processes / production systems (from the FlexSim package).	2

TEACHING TOOLS

1. Books and monographs.
2. Audiovisual presentation.
3. Exercises using the computer and FlexSim software.

WAYS OF ASSESSMENT (F – FORMATIVE, P – SUMMATIVE)

Fl.Observation of students' work in the classroom.

Pl. Final test.

STUDENT WORKLOAD

Form of activity		**Average number of hours for realization of the activity**		
		[h]	**ECTS**	**ECTS**
Contact hours with the teacher	Lecture	15	0.6	0.8
Preparation for lecture		5	0.2	
Contact hours with the teacher	Laboratory	30	1.2	1.6
Preparation of the laboratory		10	0.4	
Getting acquainted with the indicated literature		10	0.4	0.4
Consultation		5	0.2	0.2
TOTAL NUMBER OF HOURS / ECTS POINTS FOR THE COURSE		**75**	**3**	

BASIC AND SUPPLEMENTARY RESOURCE MATERIALS

Basic resources

1. Beaverstock M., Greenwood A., Lavery E., Nordgren W. Applied Simulation Modeling And Analysis Using Flexsim. FlexSim Software Products. 2012.

2. Averill M. Law. Simulation Modeling and Analysis. McGraw-Hill, 2015.
3. Kłos S. The Simulation of Manufacturing Systems with Tecnomatix Plant Simulation. Oficyna Wydaw. Uniwersytetu Zielonogórskiego, 2017.

Supplementary resources

1. Chin, Cheng Siong. Computer-Aided Control Systems Design: Practical Applications Using MATLAB and Simuling. Boca Raton, CRC Press, 2013.
2. Browning J.E., K. McMann A.K. Computational Engineering Desing, Development and Applications. Nova Science Publishers, New York 2012.
3. Thalmann D. Scientific Visualization and Graphics Simulation. Chichester, John Wiley and Sons, Inc., 1990.
4. Krynke M., Mielczarek K. Applications of linear programming to optimize the costbenefit criterion in production processes. [in:] 12th International Conference Quality Production Improvement (QPI 2018), Zaborze, Polska (18 - 20 June 2018). MATEC Web of Conferences, Vol.183.

TEACHERS (NAME, SURNAME, E-MAIL ADDRESS)

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MATRIX OF LEARNING OUTCOMES REALISATION

Learning outcome	Reference of given outcome to outcomes defined for whole program (PRK)	Course aims	Course content	Teaching tools	Ways of assessment
EU1	K_W01, K_W02, K_W03, K_W05, K_U01, K_U02, K_U04, K_U05, K_U06, K_U07, K_U08, K_U09, K_U10, K_K01	C1	W1, W11, W12, L1, L2	1,2, 3	F1, P1
EU2	K_W05, K_W07, K_W09, K_U01, K_U02, K_U03, K_U04, K_U05, K_U06, K_U07, K_U08, K_U09, K_U10	C2	W2-W10, L3-L8,	1,2, 3	F1, P1
EU3	K_W02, K_W05, K_W08, K_W09, K_U01, K_U02, K_U04, K_U05, K_U06, K_U07, K_U09, K_U10	C3	W6, L9, L10,	1,2, 3	F1, P1
EU4	K_W01, K_W02, K_W08, K_W09, K_U01, K_U04, K_U07, K_U09, K_U10, K_K01, K_K04, K_K05	C2, C3	W10, W11, L9, L10	1, 2, 3	F1, P1

FORM OF ASSESSMENT - DETAILS

	grade 2	grade 3	grade 4	grade 5
EU1	Student can not plan a simulation experiment.	Student is able to independently plan a simulation experiment, allow for minor errors, and be able to analyze the test design.	Student can flawlessly and independently plan a simulation experiment, can do analysis of the structure of the research object for the needs of the simulation model. Minor errors are allowed.	Student can flawlessly and independently plan a simulation experiment, can do analysis of the structure of the research object for the needs of the simulation model.
EU2	Student can not perform the simulation of the operation of the production process.	Student can simulate the operation of the given production process, but can not propose modifications of the simulation model.	Student is able to simulate the operation of the given production process, he can propose modifications of the simulation model, using the instructor's suggestion.	Student can flawlessly and perform simulation of the operation of the given production process, he can himself propose modifications of the simulation model.

EU3	Student can not independently evaluate the results, he can not use the instructor's suggestions.	Student is able to evaluate the obtained results, he has problems with the proposal modifications of the model, it is necessary to help the instructor.	Student is able to evaluate the results and propose modifications to the model.	Student can flawlessly and independently evaluate the obtained results and propose modifications of the model, determine the impact of applied changes on the accuracy of the results.
EU4	Student can not solve any simple optimization problem.	Student can solve simple optimization problems of various production processes.	Student has the ability to use linear programming to optimize production processes. He can use the Octave package.	Student is able to perform optimization using the linear programming method. He knows the GNU Octave computing environment. He can accurately analyze the results.

ADDITIONAL USEFUL INFORMATION ABOUT THE COURSE

1. Information where presentation of classes, instruction, subjects of seminars can be found, etc. - presented to students during first classes, if required by the formula classes are sent electronically to the e-mail addresses of individual dean groups.
2. Information about the place of classes - Information can be found on the website of the Faculty of Management.
3. Information about the timing of classes (day of the week / time) - Information can be found on the website of the Faculty of Management.
4. Information about the consultation (time + place) - Information can be found on the website of the Faculty of Management.