MODULE DESCRIPTION

Module code	full-time studies:	**Z-ZIP1-E-531**
	part-time studies:	**Z-ZIPN1-E-531**
Module name	**Modeling in Production Engineering**	
Module name in Polish	**Modelowanie w inżynierii produkcji**	
Valid from academic year	**2019/2020**	

MODULE PLACEMENT IN THE SYLLABUS

Field of study	**MANAGEMENT AND PRODUCTION ENGINEERING**
Level of education	**1st degree**
Studies profile	**General**
Form and method of conducting classes	**Full-time and Part-time**
Specialisation	**Production and Innovation Management**
Unit conducting the module	**Department of Production Engineering**
Module co-ordinator	**Anna Rębosz-Kurdek, PhD**
Approved by:	**Dariusz Bojczuk, PhD, DSc**

MODULE OVERVIEW

Type of subject / group of subjects	**Specialist subject**
Module status	**Compulsory**
Language of conducting classes	**English**
Module placement in the syllabus - semester	**Semesetr V**
Initial requirements	**Differential equations**
Examination (YES/NO)	**YES**
Number of ECTS credit points	**3**

Method of conducting classes		**Lecture**	**Classes**	**Laboratory**	**Project**	**Other**
Per semester	full-time studies:	**15**		**15**		
	part-time studies:	**9**		**9**		

TEACHING RESULTS AND THE METHODS OF ASSESSING TEACHING RESULTS

Category	Symbol	Learning outcomes	Assignations to the directional learning outcomes
Knowledge	W01	The student has knowledge of the use of mathematical methods to describe real phenomena and processes, knows the basics of modeling using differential equations in technical issues, economics and management, and natural sciences.	ZIP1_W01
	W02	The student has knowledge of numerical methods of solving ordinary differential equations.	ZIP1_W01
	W03	The student has basic knowledge in the field of mechanics (statics, kinematics, dynamics) and the strength of materials necessary to solve engineering problems related to production engineering.	ZIP1_W02
	W04	The student has a basic knowledge of economic phenomena, especially related to production engineering.	ZIP1_W10
Skills	U01	The student is able to use mathematical tools, including differential equations, to describe physical, natural and economic processes.	ZIP1_U14
	U02	The student is able to use the numerical methods implemented in mathematical calculation programs (Mathcad) to solve ordinary differential equations and is able to evaluate the usefulness of the methods used.	ZIP1_U14 ZIP1_U19
	U03	The student is able to prepare a report presenting the results of the performed task.	ZIP1_U03
Social competences	K01	The student understands the need to constantly supplement knowledge in the area of computer modeling and simulation in the field of production engineering.	ZIP1_K01

TEACHING CONTENTS

Method of conducting classes	Teaching contents
Lecture	The essence of modeling. Modeling in research. Importance of simulation models. The use of mathematical tools in building models. Computer simulation. The meaning of differential equations. Numerical methods of solving ordinary differential equations. The problem of accuracy of solutions. Examples of models - differential models in life sciences, in economics and management, in mechanical and electrical systems.
Laboratory	Introduction to the Mathcad program - Basic information about the purpose of the program, how to use it. Determination of zeros of functions. Solving linear and nonlinear systems of equations. Methods of solving equations and systems of ordinary differential equations. Graphical presentation of the results. Construction and analysis of differential models found in natural sciences. Construction and analysis of differential models found in economics and management. Construction and analysis of differential models found in mechanical and electrical systems.

METODS OF ASSESSING TEACHING RESULTS

Symbol	Methods of checking the learning outcomes *(select X)*					
	Oral exam	**Written exam**	**Test**	**Project**	**Statement**	**Other**
W01		X	X		X	X
W02		X	X		X	X
W03		X	X		X	X
W04		X	X		X	X
U01		X	X		X	X
U02		X	X		X	X
U03					X	
K01		X	X			X

FORM AND CONDITIONS OF PASSING

Form of classes	Form of credit	Passing conditions
Lecture	Exam	Obtaining at least 50% of the exam points in the form of a test in the last lecture class. Students who obtain at least a good plus grade in laboratory classes and participate in lectures are eligible for exemption from taking the final exam.
Laboratory	Credit with grade	Obtaining at least 50% of the points available: total for independent work (on selected laboratory classes), report on selected classes and a test (on the last laboratory classes).

STUDENT WORKLOAD

<table>
<tr><th colspan="13">Balance of ECTS points</th></tr>
<tr><th rowspan="3">No.</th><th rowspan="3">Type of student's activity</th><th colspan="10">Student's workload</th><th rowspan="3">Unit</th></tr>
<tr><th colspan="5">full-time</th><th colspan="5">part-time</th></tr>
<tr><td rowspan="2">1.</td><td rowspan="2">Participation in the activities</td><td>Lc</td><td>C</td><td>Lb</td><td>P</td><td>O</td><td>Lc</td><td>C</td><td>Lb</td><td>P</td><td>O</td><td rowspan="2">h</td></tr>
<tr><td>15</td><td></td><td>15</td><td></td><td></td><td>9</td><td></td><td>9</td><td></td><td></td></tr>
<tr><td>2.</td><td>Other (consultation, exam)</td><td>4</td><td></td><td>2</td><td></td><td></td><td>4</td><td></td><td>2</td><td></td><td></td><td>h</td></tr>
<tr><td>3.</td><td>Number of hours of a student's assisted work</td><td colspan="5">36</td><td colspan="5">24</td><td>h</td></tr>
<tr><td>4.</td><td>Number of ECTS credit points which are allocated for assisted work</td><td colspan="5">1,4</td><td colspan="5">1,0</td><td>ECTS</td></tr>
<tr><td>5.</td><td>Number of hours of a student's unassisted work</td><td colspan="5">39</td><td colspan="5">51</td><td>h</td></tr>
<tr><td>6.</td><td>Number of ECTS credit points which a student receives for unassisted work</td><td colspan="5">1,6</td><td colspan="5">2,0</td><td>ECTS</td></tr>
<tr><td>7.</td><td>Work input connected with practical classes</td><td colspan="5">38</td><td colspan="5">38</td><td>h</td></tr>
<tr><td>8.</td><td>Number of ECTS credit points which a student receives for practical classes</td><td colspan="5">1,5</td><td colspan="5">1,5</td><td>ECTS</td></tr>
<tr><td>9.</td><td>Total number of hours of a student's work</td><td colspan="5">75</td><td colspan="5">75</td><td>h</td></tr>
<tr><td>10.</td><td>Punkty ECTS za moduł
1 ECTS=25 hours</td><td colspan="10">3</td><td>ECTS</td></tr>
</table>

LITERATURE

1. Bird J., Ross C. (2019), *Mechanical Engineering Principles (fourth edition)*, Taylor & Francis Ltd.
2. Brauer F., Kribs Ch. (2015), *Dynamical systems for biological modeling: An Introduction (Advances in applied mathematics)*, Chapman and Hall/CRC.
3. Maxfield B. (2009), *Essential Mathcad for Engineering, Science and Math (second edition)*, Academic Press Inc.
4. Mathcad Users Guide (compatible with the used program version).