

## MODULE DESCRIPTION

Module code	<b>Z-ZIP-1002</b>
Module name	<b>Równania Różniczkowe</b>
Module name in English	<b>Differential Equations</b>
Valid from academic year	<b>2016/2017</b>

## A. MODULE PLACEMENT IN THE SYLLABUS

Field of study	<b>Management and Production Engineering</b>
Level of education	<b>1st degree</b> <i>(1st degree / 2nd degree)</i>
Studies profile	<b>General</b> <i>(general / practical)</i>
Form and method of conducting classes	<b>Full-time</b> <i>(full-time / part-time)</i>
Specialisation	<b>All</b>
Unit conducting the module	<b>Department of Applied Computer Science and Applied Mathematics</b>
Module co-ordinator	<b>Sylwia Hożejowska, PhD hab.</b>
Approved by:	

## B. MODULE OVERVIEW

Type of subject/group of subjects	<b>Basic</b> <i>(basic / major / specialist subject / conjoint / other HES)</i>
Module status	<b>Compulsory</b> <i>(compulsory / non-compulsory)</i>
Language of conducting classes	<b>English</b>
Module placement in the syllabus - semester	<b>3rd semester</b>
Subject realisation in the academic year	<b>Winter semester</b> <i>(winter / summer)</i>
Initial requirements	<b>Calculus 1</b> <i>(module codes / module names)</i>
Examination	<b>No</b> <i>(yes / no)</i>
Number of ECTS credit points	<b>2</b>

Method of conducting classes	Lecture	Classes	Laboratory	Project	Other
Per semester	<b>15</b>	<b>15</b>			

### C. TEACHING RESULTS AND THE METHODS OF ASSESSING TEACHING RESULTS

<b>Module target</b>	The aim of the module is to familiarise students with the basic methods of solving ordinary differential equations.
----------------------	---

Effect symbol	Teaching results	Teaching methods (l/c/lab/p/other)	Reference to subject effects	Reference to effects of a field of study
W_01	Student recognizes differential equations, can indicate the order of the equation, the unknown function and its arguments. He knows the selected types of ordinary differential equations and the methods of their solutions.	l/c	K_W01	T1A_W01 T1A_W07
U_01	The student can solve linear differential equations of the first order and linear differential equations of the second order with constant coefficients. The student can determine the particular solution of the equation subject to a given condition.	l/c	K_U14	TA1_U07 TA1_U08 TA1_U09
U_02	A student can choose a proper method for solving a differential equation.	l/c	K_U14	TA1_U07 TA1_U08 TA1_U09
K_01	A student understands the necessity of lifetime education and need to supplement the knowledge of the methods of applied mathematics depending on the needs of his professional career. A student also understands the fundamental connection between the workload and its effect.	l/c	K_K01	T1A_K01

#### Teaching contents:

##### 1. Teaching contents as regards lectures

Lecture number	Teaching contents	Reference to teaching results for a module
1	Introduction to ordinary differential equations. Separable differential equations and homogeneous differential equations.	W_01 U_01
2	First order linear differential equations. Examples of the use of such equations in physics and biology.	W_01 U_01 K_01
3	Bernoulli differential equation. The logistic differential equation.	W_01 U_01 K_01
4	Exact differential equation.	W_01 U_01
5	General information on linear differential equations. Homogeneous linear differential equations of the second order with constant coefficients. The use of complex numbers in the case of a negative discriminant.	W_01 U_01 K_01
6	Inhomogeneous linear differential equations of the second order with constant coefficients. Application of a differential equations to analyzing the mass-spring system.	W_01 U_01 K_01
7	Examples of differential equations of different kinds.	W_01 U_01 K_01

## 2. Teaching contents as regards classes

Class number	Teaching contents	Reference to teaching results for a module
1	Solving separated differential equations.	W_01 U_01
2	Homogeneous differential equations. Linear first order differential equations.	W_01 U_01 U_02
3	Linear first order differential equations (cont).	W_01 U_01 U_02
4	Bernoulli differential equation.	W_01 U_01
5	Exact differential equation. Linear differential equations of the second order with constant coefficients.	W_01 U_01
6	Linear differential equations of the second order with constant coefficients (cont).	W_01 U_01
7	Test.	W_01 U_01 U_02 K_01

## 3. Teaching contents as regards laboratory classes

Laboratory class number	Teaching contents	Reference to teaching results for a module

## 4. The characteristics of project assignments

### The methods of assessing teaching results

Effect symbol	Methods of assessing teaching results <i>(assessment method, including skills – reference to a particular project, laboratory assignments, etc.)</i>
W_01	A written test.
U_01	A written test; observing a student's involvement during the classes.
U_02	A written test; observing a student's involvement during the classes.
K_01	A written test; observing a student's involvement during the classes; discussions during the classes.

## D. STUDENT'S INPUT

ECTS credit points		
	Type of student's activity	Student's workload
1	Participation in lectures	15
2	Participation in classes	15
3	Participation in laboratories	
4	Participation in tutorials (2-3 times per semester)	1
5	Participation in project classes	
6	Project tutorials	
7	Participation in an examination	
8		
9	<b>Number of hours requiring a lecturer's assistance</b>	<b>31</b> <i>(sum)</i>
10	<b>Number of ECTS credit points which are allocated for assisted work</b> <i>(1 ECTS point=25-30 hours)</i>	<b>1.13</b>
11	Unassisted study of lecture subjects	4
12	Unassisted preparation for classes	12
13	Unassisted preparation for tests	8
14	Unassisted preparation for laboratories	
15	Preparing reports	
15	Preparing for a final laboratory test	
17	Preparing a project or documentation	
18	Preparing for an examination	
19		
20	<b>Number of hours of a student's unassisted work</b>	<b>24</b> <i>(sum)</i>
21	<b>Number of ECTS credit points which a student receives for unassisted work</b> <i>(1 ECTS point=25-30 hours)</i>	<b>0.87</b>
22	<b>Total number of hours of a student's work</b>	<b>55</b>
23	<b>ECTS points per module</b> <i>1 ECTS point=25-30 hours</i>	<b>2</b>
24	<b>Work input connected with practical classes</b> <i>Total number of hours connected with practical classes</i>	<b>35</b>
25	<b>Number of ECTS credit points which a student receives for practical classes</b> <i>(1 ECTS point=25-30 hours)</i>	<b>1.3</b>

## E. LITERATURE

Literature list	<ol style="list-style-type: none"> <li>1. Krysicki W., Włodarski L., <i>Analiza matematyczna w zadaniach</i>, część II, PWN, Warszawa 1987.</li> <li>2. Siewierski L., <i>Ćwiczenia z analizy matematycznej z zastosowaniami</i>, tom II, PWN, Warszawa 1981.</li> <li>3. Matwiejew N. M., <i>Metody całkowania równań różniczkowych zwyczajnych</i>, PWN, Warszawa 1982.</li> <li>4. Gewert M., Skoczylas Z., <i>Równania różniczkowe zwyczajne. Teoria, przykłady, zadania</i>, Oficyna Wydawnicza GiS, Wrocław 2008.</li> <li>5. Grzymkowski R., Kapusta A., Nowak I., Słota D., <i>Metody numeryczne, zagadnienia brzegowe</i>, Wyd. Pracowni Jacka Skalmierskiego, Gliwice 2003.</li> <li>6. Braun M., <i>Differential equations and their applications</i>, Springer-Verlag, New York 1983.</li> </ol>
-----------------	--

	7. А. Г. Школьник. Дифференциальные уравнения, Учпедгиз, Москва 1963.
Module website	