



MODULE DESCRIPTION

Module code	full-time studies:	Z-ZIP1-E-302
	part-time studies:	Z-ZIPN1-E-302
Module name	Differential equations	
Module name in Polish	Równania różniczkowe	
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	All
Unit conducting the module	Department of Mathematics and Physics
Module co-ordinator	Krzysztof Grysa, PhD, DSc, ProfTit
Approved by:	Dariusz Bojczuk, PhD, DSc

MODULE OVERVIEW

Type of subject / group of subjects	Basic
Module status	Compulsory
Language of conducting classes	English
Module placement in the syllabus - semester	Semester III
Initial requirements	Calculus I, Calculus II
Examination (YES/NO)	NO
Number of ECTS credit points	2

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 out-comes
Knowledge	W01	A 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.	ZIP1_W01
Skills	U01	A 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.	ZIP1_U14
	U02	A student can choose a proper method for solving a differential equation.	ZIP1_U14
Social competences	K01	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.	ZIP1_K01

TEACHING CONTENTS

Method of conducting classes	Teaching contents
Lecture	Introduction to ordinary differential equations. Separable differential equations and homogeneous differential equations. First order linear differential equations. Examples of the use of such equations in physics and biology. Modelling of engineering and economic problems with first-order differential equations Bernoulli differential equation. The logistic differential equation. Exact differential equation. 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. Inhomogeneous linear differential equations of the second order with constant coefficients. Application of a differential equations to analyzing the mass-spring system. Examples of differential equations of different kinds.
Classes	Solving separated differential equations. Homogeneous differential equations. Linear first order differential equations. Bernoulli differential equation. Exact differential equation. Linear differential equations of the second order with constant coefficients. Linear differential equations of the second order with constant coefficients (cont).

METHODS OF ASSESSING TEACHING RESULTS

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

FORM AND CONDITIONS OF PASSING

Form of classes	Form of credit	Passing conditions
Lecture	Credit with grade	Completion of exercises.
Classes	Credit with grade	Obtaining at least 50% of points from tests and individual work grades during classes.

STUDENT WORKLOAD

Balance of ECTS points												
No.	Type of student's activity	Student's workload										Unit
		full-time					part-time					
1.	Participation in the activities	Lc	C	Lb	P	O	Lc	C	Lb	P	O	h
		15	15				9	9				
2.	Other (consultation, exam)	2	2				2	2				h
3.	Number of hours of a student's as- sisted work	34					22					h
4.	Number of ECTS credit points which are allocated for assisted work	1,4					0,9					ECTS
5.	Number of hours of a student's un- assisted work	16					28					h
6.	Number of ECTS credit points which a student receives for unassisted work	0,6					1,1					ECTS
7.	Work input connected with practical classes	25					25					h
8.	Number of ECTS credit points which a student receives for practical classes	1,0					1,0					ECTS
9.	Total number of hours of a stu- dent's work	50					50					h
10.	Punkty ECTS za modul <i>1 ECTS=25 hours</i>	2										ECTS

LITERATURE

1. Chicone C. (1999), Ordinary Differential Equations with Applications, Department of Mathematic, University of Missouri, Columbia, Springer (https://is.muni.cz/el/1431/jaro2018/M6201/Chicone-Ordinary_Differential_Equations_with_Applications.pdf)
2. Grigorian A. (2008), Ordinary Differential Equation, University of Bielefeld Lecture Notes (<https://www.math.uni-bielefeld.de/~grigor/odelec2008.pdf>)
3. Nagy G. (2021), *Ordinary Differential Equations*, Mathematics Department, Michigan State University, East Lansing (<https://users.math.msu.edu/users/gnagy/teaching/ode.pdf>)