MODULE SPECIFICATION

Module code	
Module title in Polish	**Matematyka 3**
Module title in English	**Mathematics 3**
Module running from the academic year	**2016/17**

A. MODULE IN THE CONTEXT OF THE PROGRAMME OF STUDY

Field of study	**Environmental Engineering**
Level of qualification	first cycle (first cycle, second cycle)
Programme type	academic (academic/practical)
Mode of study	full-time (full-time/part-time)
Specialism	All
Organisational unit responsible for module delivery	**Department of Mathematics and Physics**
Module co-ordinator	dr Marcin Stępień
Approved by:	**prof. Arkadiusz Płoski, PhD hab.**

B. MODULE OVERVIEW

Module type	core module (core/programme-specific/elective HES*)
Module status	compulsory module (compulsory/optional)
Language of module delivery	**Polish/English**
Semester in the programme of study in which the module is taught	semester 2
Semester in the academic year in which the module is taught	summer semester (winter semester/summer semester)
Pre-requisites	Mathematics 1 (module code/module title, where appropriate)
Examination required	Yes (Yes/No)
ECTS credits	4

* elective HES – elective modules in the Humanities and Economic and Social Sciences

Mode of instruction	lectures	classes	laboratories	project	others

Total hours per semester	**15**	**15**			

Politechnika Świętokrzyska
al. Tysiąclecia Państwa Polskiego 7; 25-314 Kielce
tel.: 41 34 24 850, fax: 41 34 42 860
e-mail: wisge@tu.kielce.pl

C. LEARNING OUTCOMES AND ASSESSMENT METHODS

Module aims	The aim of the module includes familiarising students with the fundamentals of a differential and integral calculus of a function with several variables (together with basic differential equations and the methods of solving them).

Module outcome code	Module learning outcomes	Mode of instruction *(l/c/lab/p/ others)*	Corresponding programme outcome code	Corresponding discipline-specific outcome code
W_01	A student has basic knowledge as regards basic notions of a differential and integral calculus with two variables as well as the applications of applications of partial and double integrals.	l/c	IŚ_W01	T1A_W01 T1A_W02
W_02	A student has fundamental knowledge concerning complex numbers.	l/c	IŚ_W01	T1A_W01 T1A_W02
W_03	A student has basic knowledge on ordinary differential equations (together with their application to solve some issues concerning physics, chemistry, or biology).	l/c	IŚ_W01	T1A_W01 T1A-_W02
U_01	A student can calculate partial derivatives and utilise them to calculate approximate values of numeric expressions, directional derivatives, and solving optimisation problems.	c	IŚ_U01	T1A_U08 T1A_U09
U_02	A student can calculate double integrals and utilise them in geometry and physics.	c	IŚ_U01	T1A_U08 T1A_U09
U_03	A student can recognise ordinary differential equations and determine their solutions.	c	IŚ_U01	T1A_U08 T1A_U09
K_01	A student understands the necessity of continuous improvement his/her knowledge concerning mathematics.	l/c	IŚ_K03	T1A_K01

Module content:

1. Topics to be covered in the lectures

No.	Topics	Module outcome code
1-2	Basic second order surfaces in R^3. A differential calculus of a function with many variables. A limit, the continuity of a function with two variables. Partial derivatives and function extremes with two variables. Implicit functions. The elements of the field theory. The concept of a gradient, divergence, and rotation.	W_01
3-4	An integral calculus of a function with several variables. A double integral. Geometrical and physical interpretation of a double integral. The Fubini theorem. Variable change in a double integral (polar coordinates).	W_01
5	Complex numbers. A trigonometric and exponential form of a complex number. Operations on complex numbers.	W_02
6-7	An ordinary differential equation. First-order linear differential equation and with separable variables. Linear differential equations with constant coefficients.	W_03 K_01

2. Topics to be covered in the classes

No.	Topics	Module outcome code
1-2	Determining the domain of a function with two variables. Calculating partial derivatives of a function with several variables. Determining extremes of a function with two variables.	W_01 U_01
3-4	Calculating a double integral in a rectangle and in normal areas. The change of integrating order in a double integral. The change of variables in a double integral. The applications of double integrals.	W_01 U_02
5	Operations on complex numbers. Reducing to a trigonometric form. The roots of polynomials.	W_02
6-7	Solving differential equations with separable variables. A first-order linear equation and the variation of parameters method. Solving linear differential equations with constants. Prediction method.	W_03 U_03 K_01

3. Topics to be covered in the laboratories
None

Assessment methods

Module outcome code	Assessment methods *(Method of assessment; for module skills − reference to specific project, laboratory and similar tasks)*
W_01	A written examination
W_02	A written examination
W_03	A written examination
U_01	Tests during the classes and a student's involvement during the classes
U_02	Tests during the classes and a student's involvement during the classes
U_03	Tests during the classes and a student's involvement during the classes
K_01	Comments during the classes and a student's involvement during the classes

D. STUDENT LEARNING ACTIVITIES

ECTS summary		
	Type of learning activity	**Study time/ credits**
1	Contact hours: participation in lectures	**15**
2	Contact hours: participation in classes	**15**
3	Contact hours: participation in laboratories	
4	Contact hours: attendance at office hours (2-3 appointments per semester)	**6**
5	Contact hours: participation in project-based classes	
6	Contact hours: meetings with a project module leader	
7	Contact hours: attendance at an examination	**4**
8		
9	**Number of contact hours**	**40** *(total)*
10	**Number of ECTS credits for contact hours** *(1 ECTS credit =25-30 hours of study time)*	**1.6**
11	Private study hours: background reading for lectures	**15**
12	Private study hours: preparation for classes	**15**
13	Private study hours: preparation for tests	**15**
14	Private study hours: preparation for laboratories	
15	Private study hours: writing reports	
16	Private study hours: preparation for a final test in laboratories	
17	Private study hours: preparation of a project/a design specification	
18	Private study hours: preparation for an examination	**15**
19		
20	**Number of private study hours**	**60** *(total)*
21	**Number of ECTS credits for private study hours** *(1 ECTS credit =25-30 hours of study time)*	**2.4**
22	**Total study time**	**100**
23	**Total ECTS credits for the module** *(1 ECTS credit =25-30 hours of study time)*	**4**
24	**Number of practice-based hours** *Total practice-based hours*	**0**
25	**Number of ECTS credits for practice-based hours** *(1 ECTS credit =25-30 hours of study time)*	**0**

E. READING LIST

References	1. D. Hughes-Hallet, A. M. Gleason et al., Calculus. Single and multivariable. International Student Version, John Wiley & Sons, Inc. 2010. 2. О. Н. Афанасьева, Я. С. Бродский, И. и. Гуткин, А. Л. Павлов, Сборник задач по математике для техникумов на базе средней школы, Издательство "Наука" Москва 1987 (in Russian) English translation: O. N. Afanasyeva, Ya. S. Brodsky, I. I. Gutkin, A. L. Pavlov, Problem Book in Mathematics for Technical Colleges, Mir Publishers, Moscow 1989 3. Solutions manual to accompany Raymond A Burnett and Michael R. Ziegler's Apllied Calculus for

	Business and Economics, Life Sciences and Social Sciences, Third Edition, Dallen Publishing Company 1988, San Francisco, California 1988. 4. J. Goldberg, M. C. Potter, Differential equations. A systems approach, Simon and Shuster, New York 1998.
Module website	