Course name: Mathematics III (Multivariable Analysis)

ECTS	6.0
Course status	*facultative*
Course final assessment /evaluation of outcomes	*Exam*
Prerequisite	*Mathematics I (One variable analysis), Mathematics II (Linear algebra)*

Main field of study: **Environmental Engineering**

Educational profile	*General academic*
Code of studies and education level	*bachelor*
Semester of studies	*summer*
Language of instruction	*English*

Course offered by:

Name of faculty offering the course	Environmental Engineering and Land Surveying
Name of department offering the course	Applied Mathematics
Course coordinator	Prof. Marek Ptak Ph. D. and Kamila Kliś-Garlicka, Ph. D.

Learning outcomes:

Symbol of outcome	Description of the learning outcome	Reference to main field of study outcomes	Area symbol*
KNOWLEDGE – student knows and understands			
MA3-K1	mathematics issues including algebra, geometry, analysis of function of one and many variables necessary to describe technical and natural phenomena occurring in the environment	IS1_W01	TS
SKILLS – student is able to			
MA3-S1	apply standard mathematical methods to solve environmental engineering problems and critically evaluate the results of numerical analysis	IS1_U01	TS
SOCIAL COMPETENCIES – student is ready to:			
MA3-C1	carry on continuous training and raising professional, personal and social competences as well as demonstrating an active attitude towards environmental protection problems and shaping its resources	IS1_K01	TS

Teaching contents

Lectures:	15 hours
Topics	1. The definition and examples of metric spaces 2. Functions of several variables • limits and continuity of function subspaces • derivative and partial derivatives

	• minimum and maximum of multivariable functions 3. Multivariable of Riemann integral 4. Differential equations
Accomplished learning outcomes	
Means of verification, rules and criteria of assessment	*Single-choice test, positive assessment should be given at least 50% of correct answers to given questions: <50% - insufficient (2.0); 50-60% - sufficient (3.0); 61-70% - satisfactory plus (3,5); 71-80% - good (4.0); 81-90% - good plus (4,5); 91-100% - very good (5.0). The share of the lecture grade in the final grade is 50%.*
Classes:	30 hours
Topics	1. The definition and examples of metric spaces 2. Functions of several variables • limits and continuity of function subspaces • derivative and partial derivatives • minimum and maximum of multivariable functions 3. Multivariable of Riemann integral 4. Differential equations
Accomplished learning outcomes	
Means of verification, rules and criteria of assessment	*Passing reports on exercises - a grade from exercises is an arithmetic average of formative grades. The share of the grade for the project exercises in the final grade of the subject is 50%.*

References:

Basic	*Paul Dawkins "Calculus 2", http://www.math.armstrong.edu/faculty/lambert/CalcII_Complete.pdf*
Supplementary	*EDWIN "JED" HERMAN, GILBERT STRANG, Calculus vol. 2, https://d3bxy9euw4e147.cloudfront.net/oscms-dev/media/documents/CalculusVolume2-OP_7nNwGJD.pdf*

Structure of learning outcomes

Area of academic study: R – Agricultural, forestry and veterinary sciences	...	ECTS **
Area of academic study: T – technical sciences	6.0	ECTS**

Structure of student activity

Contact hours		57	hrs.	2.3	ECTS**
Including:	lectures	15	hrs.		
	classes and seminars	30	hrs.		
	consultations	10	hrs.		
	participation in research	…	hrs.		
	obligatory traineeships	…	hrs.		
	participation in examination	2	hrs.		
e-learning		…	hrs.	….	ECTS**
student own work		93	hrs.	3.7	ECTS**

*Areas of academic study in the fields of: A – the arts; H- humanities; M- medical, sport and health sciences; N – natural sciences; P – biological sciences; R – Agricultural, forestry and veterinary sciences; S - social studies; T – engineering and technology;

** stated with an accuracy to 0.1 ECTS, where 1 ECTS = 25 - 30 hours of classes