Zał. nr 5 do ZW 16/2020

FACULTY OF ARCHITECTURE

SUBJECT CARD

Name of subject in Polish Elementy matematyki wyższej
Name of subject in English Elements of higher mathematics
Main field of study (if applicable): Spatial Management
Specialization (if applicable): ……..
Profile: academic / ~~practical~~*
Level and form of studies: ~~1st~~/ 2nd level, ~~uniform magister studies~~*, full-time / ~~part-time~~*
Kind of subject: obligatory / ~~optional~~ / ~~university-wide~~*
Subject code MAT001753W
Group of courses ~~YES~~ / NO*

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30				
Number of hours of total student workload (CNPS)	60				
Form of crediting	~~Examination~~ / crediting with grade*	Examination / crediting with grade*	Examination / crediting with grade*	Examination / crediting with grade*	Examination / crediting with grade*
For group of courses mark (X) final course					
Number of ECTS points	2				
including number of ECTS points for practical classes (P)	0				
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	1				

*delete as not necessary

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Knowledge of mathematics equivalent to high school certificate at the advanced level is recommended.

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SUBJECT OBJECTIVES

C1 Explaining the basic notions and examples in topology.
C2 Presenting the basic information on graph theory with an emphasis on applications.
C3 A basic exposition of cellular automata and their applications.
C4 Explaining the basics of statistical testing.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:
PEU_W01 demonstrate knowledge of mathematics, physics and engineering that is useful in formulating and completing complex task related to spatial management (K2GP_W01)
PEU_W02 demonstrate knowledge and understanding of advanced experimental, observational and numerical techniques for prognostic research and methods of building mathematical

models used in spatial planning and spatial management (K2GP_W02)

relating to skills:

PEU_U01 apply statistical methods and information techniques and tools, in particular GIS tools, to data analyze, to describe phenomena and as well as predicting future states of spatial systems (K2GP_U02)

PROGRAMME CONTENT

	Lecture	**Number of hours**
Lec 1-2	Basic notions in topology. Open sets. Topological spaces. Metrics. Continuous maps. Homeomorphisms. Compactness. Connectedness. Examples.	4
Lec 3	The notion of dimension, with intuitive understanding and formal definitions. The Minkowski dimension (the “box-counting” dimension). Fractals as sets of non-integer dimension.	2
Lec 4	Special types of fractals: the Cantor and Sierpinski sets. IFS fractals, such as Barnsley’s fern. Examples of real-life objects and phenomena which exhibit fractal character.	2
Lec 5	Introduction to graph theory. Basic definitions and notions in graph theory. Representing graphs using matrices. Graph isomorphism.	2
Lec 6	Paths and cycles in graphs. Eulerian and Hamiltonian graphs. The Chinese postman problem and the traveling salesman problem.	2
Lec 7	Trees, planar graphs and the Euler formula.	2
Lec 8	Coloring graphs: the chromatic number and the chromatic index. The four-color theorem, and contrasting the situation on a plane with surfaces of other genus.	2
Lec 9	Matchings in bipartite graphs. Transversals. The Hall and Menger theorems.	2
Lec 10	Directed graphs. Network flow analysis. The Ford-Fulkerson algorithm.	2
Lec 11	Analyzing networks. Vertex degree distribution, distance statistics, clusters.	2
Lec 12	Randomized networks. Statistical properties of random graphs. The small-world phenomenon. Scale-free networks.	2
Lec 13	The definition of cellular automata. Examples of cellular automata: Wolfram’s “Rule 90”, Conway’s “Life”. Cellular automata on the plane: Moore and von Neumann neighborhoods. Possible behaviors: stability, periodicity, chaos. Using cellular automata for modeling real-life phenomena.	2
Lec 14	Basic notions in statistical hypothesis testing: statistical tests, the two kinds of errors, significance, critical value, critical area, the power of a test.	2
Lec 15	Tests for mean and variance of statistical samples, independence tests.	2
	Total hours	**30**

TEACHING TOOLS USED
N1. Lectures – traditional and using multimedia tools. N2. Tutorial. N3. Student's self-study.

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F – forming during semester), P – concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
F1	PEU_W01, PEU_W02, PEU_U01	final test
P - rules set by the lecturer		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] J. Mioduszewski, Wykłady z topologii, Topologia przestrzeni euklidesowych, Katowice, 1994.
[2] R. J. Wilson, Wprowadzenie to teorii grafów, PWN, 1998.
[3] R. Magiera. Modele i metody statystyki matematycznej. Część I - Rozkłady i symulacja stochastyczna, GiS 2005.
[4] R. Magiera. Modele i metody statystyki matematycznej. Część II – Wnioskowanie stochastyczne, GiS 2007.

SECONDARY LITERATURE:

[1] K. A. Ross, C. R. B. Wright, Matematyka dyskretna, PWN 1986.
[2] W. Krysicki, J. Bartos, W. Dyczka, K. Królikowska, M. Wasilewski, Rachunek prawdopodobieństwa i statystyka matematyczna w zadaniach, Cz. I-II, PWN, Warszawa, 2007.

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)

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