Course Syllabus

I. General Information

Course name	Topology
Programme	mathematics
Level of studies (BA, BSc, MA, MSc, long-cycle MA)	BA
Form of studies (full-time, part-time)	full-time
Discipline	mathematics
Language of instruction	English

Course coordinator/person responsible	Dr Wiesław Główczyński

Type of class *(use only the types mentioned below)*	Number of teaching hours	Semester	ECTS Points
lecture	30	III	5
tutorial			
classes	30	III	
laboratory classes			
workshops			
seminar			
introductory seminar			
foreign language classes			
practical placement			
field work			
diploma laboratory			
translation classes			
study visit			

Course pre-requisites	

II. Course Objectives

C-1 The aim of the lecture is to introduce students to the basic concepts of topology, in particular those which are applied in other fields of mathematics.

III. Course learning outcomes with reference to programme learning outcomes

Symbol	Description of course learning outcome	Reference to programme learning outcome
	KNOWLEDGE	
W_01	The student understands the importance of topology and its applications, in particular its role in the context of contemporary civilization's dilemmas	K_W01
W_02	The student has a good understanding of the role and importance of proof in mathematics, and the notion of essence of hypotheses	K_W02
W_03	The student understands the structure of topology, can use a topological formalism to construct and analyze simple mathematical models in other areas of science	K_W03
W_04	The student has advanced knowledge of the basic areas of topology and its applications.	K_W04
W_05	The student knows basic examples both those that illustrate concrete topological notions, and those that allow false hypotheses or unsupported argumentation	K_W05
W_07	The student knows the fundamentals of differential and integral calculus of one and several variable functions, and other branches of mathematics applied in topology	K_W07
	SKILLS	
U_01	The student can in a clear manner, in speech and writing, present correct topological reasoning, formulate theorems and definitions	K_U01
U_02	The student uses sentential and quantifier calculus, can properly use quantifiers in colloquial language	K_U02
U_03	The student is able to conduct easy and more advanced proofs be means of complete induction, can define functions and recurrent relations	K_U03
U_04	The student can apply classical logic system to topology	K_U04
U_05	The student is capable to create new object by means of construction of quotient spaces or Cartesian products	K_U05
U_06	The student utilizes the language of set theory when interpreting problems from topology	K_U06
U_07	The student can define functions, including limits, and describe their properties	K_U09
U_08	The student recognizes and determines the main topological properties of subsets of the Euclidean space and metric spaces	K_U23
U_09	The student can use topological properties of sets and functions to solve problems of qualitative character	K_U24

SOCIAL COMPETENCIES		
K_01	The student is prepared to take into account the limits of his own knowledge and skills, adequate assessment of his level of competence, his weaknesses, the need to constantly improve his professional skills, and at the same time know his strengths and present a critical attitude towards opinions not supported by rational justification	K_K01
K_02	The student is ready to present selected achievements of topology in a popular way	K_K05

IV. Course Content

Part 1. Metric spaces:
Metric spaces. Convergence. Cauchy sequences. Continuous mappings.
Closed and open sets. Closure and interior of the set. Dense and boundary sets. Subspace of a metric space. Cartesian product of the metric spaces. Complete spaces. Baire theorem. The Cantor's theorem about a nested sequence of closed sets. The Banach fixed point theorem. Compact spaces. Characterization of a compact subspace of R^n. ε-nets. Lebesgue number lemma. Borel- Lebesgue theorem. Separable spaces. Hereditary separability a metric spaces. Gorss-Lindelof theorem. The Tietze extension theorem. Connected spaces. The Darboux property of continuous functions and its applications. Information of the Borsuk's antipodal theorem and the Brouwer's fixed point theorem. Homeomorphism of the metric spaces and topological properties. Embeddings in a metrics space. Completion. Basis for topology. Tychonoff of the product of metric spaces. Hilbert cube.
Topology of the uniform convergence in C([0, 1]).

Part 2. Topological spaces:

Topological spaces. Open and closed sets. Bases. Closure and interior of a set. Methods of generating topologies. Continuous mappings. Homeomorphisms. Axioms of separation. Urysohn's lemma. Operations on topological spaces (subspaces, Cartesian products, quotient spaces). The Tietze-Urysohn theorem. Compact spaces. The Tychonoff theorem. Connected spaces. Metrizable spaces. The Urysohn metrization theorem.

V. Didactic methods used and forms of assessment of learning outcomes

Symbol	Didactic methods *(choose from the list)*	Forms of assessment *(choose from the list)*	Documentation type *(choose from the list)*
KNOWLEDGE			
W_01	Conventional lecture/Practical classes	Exam / Written test	Protocol
W_02	Conventional	Exam / Written	Protocol

	lecture/Practical classes	test	
W_03	Conventional lecture/Practical classes	Exam / Written test	Protocol
W_04	Conventional lecture/Practical classes	Exam / Written test	Protocol
W_06	Conventional lecture/Practical classes	Exam / Written test	Protocol
W_07	Conventional lecture/Practical classes	Exam / Written test	Protocol
		SKILLS	
U_01	Conventional lecture/Practical classes	Exam / Written test	Protocol
U_02	Conventional lecture/Practical classes	Exam / Written test	Protocol
U_03	Conventional lecture/Practical classes	Exam / Written test	Protocol
U_04	Conventional lecture/Practical classes	Exam / Written test	Protocol
U_05	Conventional lecture/Practical classes	Exam / Written test	Protocol
U_06	Conventional lecture/Practical classes	Exam / Written test	Protocol
U_07	Conventional lecture/Practical classes	Exam / Written test	Protocol
U_08	Conventional lecture/Practical classes	Exam / Written test	Protocol
U_09	Conventional lecture/Practical classes	Exam / Written test	Protocol
		SOCIAL COMPETENCIES	
K_01	Conventional lecture/Practical classes	Exam / Written test	Protocol
K_02	Conventional lecture/Practical classes	Exam / Written test	Protocol

VI. Grading criteria, weighting factors.....

VII. Exam (for students who passed classes):
– in groups of less than 8 students – oral exam
– in groups of 8 or more students – written exam (and oral exam for students who didn't received 50% points at written exam).
Exam, passing level is 50% of the sum of points;
91% – 100% excellent (5.0)
81% – 90% very good (4.5)
71% – 80% good (4.0)
61% – 70% satisfactory (3.5)
50% – 60% sufficient (3.0)
less than 50% fail (2.0)

W1- W7 - discussion on lessons, colloquium, exam
U1 - U9 - discussion on lessons, colloquium, exam
K1, K2 - discussion on lessons

In groups of less than 8 students credits are given by active participation in classes.
Colloquium, passing level is 50% of the sum of points;
91% – 100% excellent (5.0)
81% – 90% very good (4.5)
71% – 80% good (4.0)
61% – 70% satisfactory (3.5)
50% – 60% sufficient (3.0)
less than 50% fail and lack of active participation in classes (2.0)

W1- W7 - discussion on lessons, colloquium,
U1 - U9 - discussion on lessons, colloquium,
K1, K2 - discussion on lessons
K1, K2,K3 - discussion on lessons

Hourly equivalent to ECTS credits:
Lecture - 30
Classes - 30
Consultations - 30
Preparation for classes including self-solving of tasks identified by the teacher - 30
Preparing for the tests and exam, including reading the literature - 30
Total number of hours 150.
Total number of ECTS credits per module 5

VIII. Student workload

Form of activity	Number of hours
Number of contact hours (with the teacher)	90
Number of hours of individual student work	60

IX. Literature

Basic literature
Kuratowski K., Introduction to set theory and topology, Pergamon Press and PWN, 1961; Munkres J., Topology, Pearson, 2014; Viro O.Ya., [et al.] Elementary Topology. Problem Textbook. AMS, 2008; Tkachuk V. V., A Cp-Theory Problem Book, Topological and Function Spaces, Springer 2011; Kumaresan S., Topology of metric spaces, Alpha Science, 2005; Kaplansky I., Set theory and metric spaces, AMS, 2001.
Additional literature
Engelking R., General topology, Heldermann, 1989; Engelking R., Outline of General Topology, Wiley, 1968; Kelley J.L.,General Topology, Springer, 1975; Gaal S.A., Point set topology, Dover Pub., 2009; Willard S. General Topology,Dover Pub.,2004; Jianfei Shen, General Topology. A Solution Manual for Willard (2004), https://jianfeishen.weebly.com/uploads/4/7/2/6/4726705/general_topology.pdf Oxtoby J.C.,, Measure and category, Springer, 1980; Howes N.R., Modern Analysis and Topology, Springer, 1995; Jameson G.J.O., Topology and Normed Spaces, Chapman and Hall, 1974.