SYLLABUS

REGARDING THE QUALIFICATION CYCLE FROM 2026 TO 2029
ACADEMIC YEAR 2027/2028

1. BASIC COURSE/MODULE INFORMATION

Course/Module title	Introduction to Topology
Course/Module code *	
Faculty (name of the unit offering the field of study)	Faculty of Exact and Technical Sciences
Name of the unit running the course	Institute of Mathematics
Field of study	Mathematics
Qualification level	First-cycle studies (Bachelor's)
Profile	General academic
Study mode	Full-time
Year and semester of studies	Year 2, Semester 4
Course type	Major subject
Language of instruction	English
Coordinator	Prof. Mykhaylo Zarichnyy, PhD, DSc
Course instructor	Prof. Mykhaylo Zarichnyy, PhD, DSc

* - as agreed at the faculty

1.1. Learning format – number of hours and ECTS credits

Semester (no.)	Lectures	Classes	Laboratories	Seminars	Practical classes	Internships	others	**ECTS credits**
4	30	30						6

1.2. Course delivery methods

☒ conducted in a traditional way
☐ involving distance education methods and techniques

1.3. Course/Module assessment (exam, pass with a grade, pass without a grade)
Lecture – exam, classes – pass with a grade

2. PREREQUISITES

Knowledge from the student's mathematical school education, knowledge of set theory and differential calculus from the 1st year of studies.

3. OBJECTIVES, LEARNING OUTCOMES, COURSE CONTENT, AND INSTRUCTIONAL METHODS

3.1. Course/Module objectives

O1	Familiarization with the basic concepts of topology.
O2	Familiarization with basic proof methods used in topology.
O3	Familiarization with basic computational techniques used in topology

3.2. COURSE/MODULE LEARNING OUTCOMES (TO BE COMPLETED BY THE COORDINATOR)

Learning Outcome	The description of the learning outcome defined for the course/module	Relation to the degree programme outcomes
LO_01	The student knows and understands the basic theorems in the field of topology	K_W01, K_W04
LO_02	The student knows and understands the basic issues and methods used to describe problems in the field of topology	K_W01, K_W02, K_W03, K_W04
LO_03	The student is able to analyze problems and find their solutions based on the learned theorems	K_U02
LO_04	The student is able to formulate definitions and theorems as well as questions serving the understanding of the examined problem in the field of metric spaces and topological spaces	K_U01
LO_05	The student recognizes and determines the most important topological properties for Euclidean and metric space	K_U09
LO_06	The student is able to use topological properties of sets and functions to solve qualitative problems	K_U09
LO_07	The student is ready to critically evaluate the acquired content in the field of metric and topological spaces and to recognize the necessity of improving their own competencies in this area	K_K01
LO_08	The student is ready to present a critical attitude towards the received content in the field of topology in terms of their logical justification	K_K02
LO_09	The student is ready to ask questions serving the understanding of the examined problem in the field of topology in solving theoretical and practical issues in mathematics	K_K03

3.3. Course content (to be completed by the coordinator)

A. Lectures

Content outline
Metric spaces: metric space, definition, examples; open ball, closed ball in a metric space; interior, closure and boundary of a set in a metric space; open sets, closed sets; distance of a point from a set; diameter of a set. Convergence of sequences in a metric space, basic theorems; Cauchy sequence, complete metric space; Banach fixed-point theorem.
Topological spaces: definition and examples of topological spaces; various ways of defining a topology (equivalence of these ways); open family, closed family, base of a topological space. Interior, closure, boundary and set of accumulation points of a set in a topological space; various types of sets in a topological space: dense set, boundary set, nowhere dense set, sets of the first and second category. Separation axioms and equivalent conditions; Hausdorff spaces, regular spaces, normal spaces.
Continuous functions in topological spaces: definition and examples of continuous functions, equivalent conditions for continuity; composition of continuous functions; homeomorphisms – definition, examples; open and closed mappings.
Different types of topological spaces: separable spaces, complete spaces, compact spaces, characterization of compact sets in metric spaces; connected spaces; properties of continuous functions on connected sets.

B. Classes, laboratories, seminars, practical classes

Content outline
Metric spaces: metric space, properties of a metric, examples, open ball, closed ball in a metric space, interior, closure and boundary of a set in a metric space. Open sets, closed sets, diameter of a set. Convergence of sequences in a metric space, basic theorems and their application, Cauchy sequence, complete metric space.
Topological spaces: definition and examples of topological spaces, open family, closed family, interior, closure of a set in a topological space, various types of sets in a topological space: open, closed, dense, boundary, nowhere dense set. Separation axioms and equivalent conditions, Hausdorff spaces.
Continuous functions in topological spaces: definition and examples of continuous functions, equivalent conditions for continuity, composition of continuous functions. Homeomorphisms – definition, examples.
Different types of topological spaces: compact spaces, characterization of compact sets in metric spaces; connected spaces.

3.4. Methods of Instruction

Lecture: lecture with a multimedia presentation (there is a possibility to conduct the lecture using the MS Teams tool)

Exercises: solving tasks, discussion

4. Assessment techniques and criteria

4.1 Methods of evaluating learning outcomes

Learning outcome	Methods of assessment of learning outcomes (e.g. test, oral exam, written exam, project, report, observation during classes)	Learning format (lectures, classes,…)
LO-01	*EXAM*	LECTURE
LO-02	EXAM, QUIZ	LECTURE, CLASSES
LO-03	QUIZ	CLASSES
LO-04	EXAM, QUIZ	LECTURE, CLASSES
LO-05	QUIZ	CLASSES
LO-06	QUIZ	CLASSES
LO-07	OBSERVATION DURING CLASSES	CLASSES
LO-08	OBSERVATION DURING CLASSES	CLASSES
LO-09	OBSERVATION DURING CLASSES	CLASSES

4.2 Course assessment criteria

Passing exercises on the basis of quizzes and activity during classes. The condition for passing the exercises is obtaining at least 50% of points from each quiz. The final grade is then determined according to the scale: below 50% pts. – fail, [50 – 60%) pts. – satisfactory, [60 – 70%) pts. – satisfactory plus, [70 – 80%) pts. – good, [80 – 90%) pts. – good plus, [90– 100%] pts. – very good. Activity during exercises can raise the grade by at most half a degree.

The exam consists of a task and theoretical part. The condition for passing the exam is obtaining at least 50% of points from it. The final grade is then determined according to the scale: below 50% pts. – fail, [50 – 60%) pts. – satisfactory, [60 – 70%) pts. – satisfactory plus, [70 – 80%) pts. – good, [80 – 90%) pts. – good plus, [90 – 100%] pts. – very good.

5. Total student workload needed to achieve the intended learning outcomes – number of hours and ECTS credits

Activity	Number of hours

Course hours	60
Other contact hours involving the teacher (consultation hours, examinations)	5
Non-contact hours - student's own work (preparation for classes or examinations, projects, etc.)	85
Total number of hours	150
Total number of ECTS credits	6

* One ECTS point corresponds to 25-30 hours of total student workload

6. Internships related to the course/module

Number of hours	*Not applicable*
Internship regulations and procedures	*Not applicable*

7. Instructional materials

Compulsory literature: 1.John L. Kelley, General Topology, Graduate texts in Mathematics (GTM, volume 27), Springer, 1975. 2.Willard, Stephen (2004) General Topology, New York: Dover Publications, Inc. 3.Ryszard Engelking. General Topology. Heldermann Verlag, Berlin, 1989. Revised and completed edition, Sigma Series in Pure Mathematics,Vol.6. 4.James Raymond Munkres, Topology, 2nd edition, Prentice Hall, 2000 (2nd ed.; 1st ed. 1975), ISBN: 0-13-181629-2
Complementary literature: 1.Jay Mehta, General Topology for Beginners, Cambridge University Press, 2026, ISBN (Digital): 9781009505871 2.Jacques Dixmier, General Topology, Undergraduate Texts in Mathematics, Springer-Verlag, New York–Berlin–Heidelberg–Tokyo, 1984.

Approved by the Head of the Department or an authorised person