Appendix No. 1.5 to the Resolution No. 61/2025
of the Rector of the University of Rzeszów

SYLLABUS

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

1. BASIC COURSE/MODULE INFORMATION

Course/Module title	Calculus 4
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	Svetlana Mincheva-Kamińska, PhD
Course instructor	Svetlana Mincheva-Kamińska, PhD

* - 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)

Lectures: exam,

Classes: pass with a grade

2. PREREQUISITES

Knowledge of differential calculus of one and several variables and integral calculus of one variable.

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

3.1. Course/Module objectives

O1	To provide knowledge in the field of integral calculus of multivariable functions, with particular emphasis on concepts and theorems relating to functions of two and three variables,
O2	To familiarise students with the basic applications of integral calculus of multivariable functions.

3.2. Course/Module Learning Outcomes

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 concepts and theorems in the field of integral calculus of multivariable functions, proof techniques and examples	K_W01,K_W03
LO_02	The student knows and understands the basic differences between integral calculus of one and several variables	K_W04,K_W02
LO_03	The student is able to apply integral calculus of multivariable functions in geometric and physical problems: to calculate the surface area of a figure and a surface patch, volumes of solids, mass of a curve, mass of a surface patch, etc.	K_U06
LO_04	The student is ready to expand their knowledge and improve their competencies in the field of differential calculus and its applications	K_K01, K_K02, K_K03

3.3. Course content

A. Lectures

Content outline
Multiple integrals. Definition and basic properties of multiple integrals. Geometric and physical interpretation. Reduction of a multiple integral to iterated integrals. Change of variables theorem. Applications of multiple integrals. Introduction to line and surface integrals.

B. Classes, laboratories, seminars, practical classes

Content outline
Multiple integrals. Definition and basic properties of double and triple integrals. Geometric and physical interpretation. Reduction of a double integral over a rectangle, respectively a triple integral over a box to iterated integrals; Double and triple integrals over general regions. Change of variables theorem; polar, cylindrical and spherical coordinates. Applications of multiple integrals. Introduction to line and surface integrals.

3.4. Methods of Instruction

Lectures – traditional method; distance learning methods

Classes – traditional method; distance learning methods, problem solving, group work

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, knowledge tests and observation during classes	lectures
LO_02	tests, exam, knowledge tests and observation during classes	lectures, classes
LO_03	knowledge tests, tests, exam, observation during classes	lectures, classes
LO_04	observation during classes	lectures, classes

4.2 conditions for passing the course (assessment criteria)

Classes: passing on the basis of colloquia and activity in classes.

The condition for obtaining the completion of the classes is to obtain at least 50% of points from each colloquium. Being active during classes can increase the grade by a maximum of half a grade.

The final grade is determined according to the scale:

00 - 49 % of points – fail (2.0);

50 – 59 % of points – satisfactory (3.0); 60 – 69 % of points – satisfactory plus (3.5);

70 – 79 % of points – good (4.0); 80 – 89 % of points – good plus (4.5);

90 – 100 % of points – very good (5.5).

Lecture: written exam.

Assessment criteria: (percentage share in mastering knowledge – assessment)

00-49 % of points – fail (2.0);

50 – 59 % of points - satisfactory (3.0); 60 – 69 % of points - satisfactory plus (3.5);

70 – 79% pts.- good (4.0); 80 – 89% points – good plus (4.5);

90 – 100% points - very good (5.0).

The final grade from the exam is determined on the basis of a written exam and an interview with the student.

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)	10

Activity	Number of hours
Non-contact hours - student's own work (preparation for classes or examinations, projects, etc.)	80
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. E. Herman, G. Strang, Calculus Volume 3, **CALCULUS VOLUME 3** 2. Paul Dawkins, *CALCULUS III*, **CALCIII_COMPLETE.PDF**
Complementary literature: 1. George B. Thomas, Jr., *Thomas' Calculus* , **THOMAS CALCULUS: LATE TRANSCENDENTALS, 13TH EDITION**

Approved by the Head of the Department or an authorised person