



UNDERGRADUATE STUDY: **TRANSPORT**

SEMESTER (II)

Syllabus

Academic year 2025/2026

Course: Mathematics 2						
Head of course: Asst. Prof. Tomislav Fratrović , Ph. D.						
Co-lecturers: Marijana Greblički , Ph. D. Radomir Lončarević , mag. educ. math. et phys. Asst. Prof. Jelena Rupčić , Ph.D. Diana Hunjak , Ph. D.						
Semester: S	Course code: 272060	Lectures: 30	Auditory exercises: 45	Laboratory exercises: 0	Seminars: 0	ECTS credits: 6
Group for lectures: 150 students			Group for auditory and laboratory exercises: 50 students			

Objective of the course:

- Introduce students to matrix calculus, solving systems of linear equations, partial derivatives and integrals of functions of two variables, and linear differential equations of the first and second order, with emphasis on their applications.

Course enrolment requirements:

- There are no requirements for enrolling in the course, but for taking the Mathematics 2 course it is necessary to have passed the Mathematics 1 course (achieved learning outcomes).

Learning outcomes:

After completing the course, students will be able to:

1. Combine basic algebraic operations with matrices and solve a matrix equation with interpretation of the form of the solution
2. Formulate a system of linear equations as a matrix equation and solve it by Gaussian transformations
3. Determine the natural domain and partial derivatives of the function of two variables
4. Calculate the gradient and differential of the function of two variables at a given point with application to the tangential plane and the normal



5. Determine the points of local extremes and extreme values of the function of two variables
6. Set and calculate a simple double integral in rectangular or polar coordinates
7. Distinguish types of ordinary differential equations
8. Solve simple linear differential equations of the first and second order with emphasis on application



LECTURES, EXERCISES and SEMINARS

Week	Syllabus	Form of classes	Performed by	Lessons	Remark
1.	- Introduction to the course Mathematics 2 - Matrix definition - Matrix operations - Matrix polynomial	L	Marijana Greblički	3	
	- Adding matrices - Multiplying a matrix by a scalar - Multiplying matrices	AE	Marijana Greblički	3	
2.	- Inverse matrix - Matrix equation	L	Marijana Greblički	3	
	Solving systems of linear equations using matrix notation	AE	Marijana Greblički	3	
3.	- Areas in space and analytical geometry - Curve level - Isolines	L	Marijana Greblički	3	
	- Explicitly and implicitly given surfaces - Surfaces of the first and second order - Parametric curves in 3d	AE	Marijana Greblički	3	
4.	- Functions of two variables - Domain - Definition and properties of partial derivatives - Differential - Gradient	L	Marijana Greblički	3	
	- Determination of domains of functions of two variables - Calculation of partial derivatives	AE	Marijana Greblički	3	
5.	- Mean value theorem - Tangential plane and normal	L	Marijana Greblički	3	



	- Gradient - Differential - Tangential plane - Normal	AE	Marijana Greblički	3	
6.	- Local extrema of functions of several variables - Conditional extrema of functions of two variables	L	Marijana Greblički	3	
	Determining the extremes of functions of two variables	AE	Marijana Greblički	3	
7.	Application of partial derivatives	L	Marijana Greblički	3	
	Application of partial derivatives	AE	Marijana Greblički	3	
8.	- Definition of double integral - Order of integration - Determination of limits of integration	L	Marijana Greblički	3	
	Double integrals in rectangular coordinates	AE	Marijana Greblički	3	
9.	- Polar coordinate system - Determination of boundaries in polar coordinates	L	Marijana Greblički	3	
	Integrating in polar coordinates	AE	Marijana Greblički	3	
10.	Application of the double integral to surfaces and volume	L	Marijana Greblički	3	
	Practice double integrals and applications	AE	Marijana Greblički	3	



11.	- Ordinary differential equations - Definitions - Cauchy's problem	L	Marijana Greblički	3	
	Ordinary differential equations (equations with separated variables)	AE	Marijana Greblički	3	
12.	- Linear diff. equations of the first order - Field of directions - Examples	L	Marijana Greblički	3	
	- Linear differential equations - Constant variation method	AE	Marijana Greblički	3	
13.	- Linear diff. higher order equations with constant coefficients - Examples	L	Marijana Greblički	3	
	Higher-order linear differential equations with constant coefficients (method of undetermined coefficients)	AE	Marijana Greblički	3	
14.	Examples of differential equations in application	L	Marijana Greblički	3	
	Application of differential equations	AE	Marijana Greblički	3	
15.	Application of double integrals and differential equations	L	Marijana Greblički	3	
	Mixed problems from double integrals and differential equations	AE	Marijana Greblički	3	

L = Lectures; AE = Auditory Exercises; LE = Laboratory Exercises; S = Seminars



STUDENT OBLIGATIONS AND EXAMS

Conditions for obtaining signatures:

A student can take the exam if status of completed subject is obtained (10 + 10 + 10):

- 10 attended lectures
- 10 attended exercises
- 10 points from homework checks (out of a total of 20 points!)

Written Examination:

In addition to homework checks, students also write two colloquia for exemption from the written part of the exam. A bonus in the amount of 10% of the total number of points from homework checks (max. 2 points!) is added to the number of points from the colloquia (max. 20 points from two colloquia). To be exempted from the written part of the exam, a minimum of 10 points (50%) must be obtained. The exemption from the written exam is valid for the first application of the exam.

If the written part is not passed through the colloquium, the student must take the written part of the exam during the exam period, which consists of 5 tasks. Then, to pass the exam at least 5 points must be obtained out of a total of 10 (50%).

Colloquium scoring:

POINTS	GRADE
10 - 12,99	sufficient (2)
13 - 15,99	good (3)
16 - 17,99	very good (4)
18 +	excellent (5)

Written exam scoring:

POINTS	GRADE
0 - 4,99	insufficient (1)
5 - 6,49	sufficient (2)
6,5 - 7,99	good (3)
8 - 8,99	very good (4)
9 +	excellent (5)



Oral examination:

After successfully passing the written part of the exam, students also solve tasks and/or answer questions in the oral part. Depending on the answers, the grade achieved in the written part can be raised or lowered in the final oral exam, and the student can be directed to retake the exam.

LITERATURE

a) Obligatory literature:

1. Ivanković, Fratrović, D. Rupčić, J. Rupčić: MATEMATIKA 2 - odabrana poglavlja za primjenu u prometu, FPZ, 2015.

b) Recommended literature:

1. B.P. Demidovič i suradnici: Zadaci i riješeni primjeri iz matematičke analize za tehničke fakultete, DANJAR d.o.o., Zagreb, 1995.
2. V.P. Minorski: Zbirka zadataka iz više matematike, Tehnička knjiga, Zagreb, 1971.
3. Stewart, J.: Calculus Concepts and Contents, Brooks/Cole, 2001.

- 1.11. *Methods of quality monitoring that ensure the acquisition of knowledge, skills and competences.*



METHODOLOGY OF THE IMPLEMENTATION OF THE COURSE PLAN

1. LECTURES

Ex cathedra

2. AUDITORY EXERCISES

Ex cathedra

3. LABORATORY EXERCISES

4. SEMINAR

Note: Individual and/or group viewing negative written test



5. DOCUMENTATION

6. SCORING SYSTEM

Table 1 The scoring system for the monitoring of students and explained credit values in ECTS credits

no	Segment:		Required credits to be achieved:		Remark:	ECTS credits
			Min.	Max.		
1.	Presence at the lectures		0	1	Independent work	1
2.	Presence at the exercises (auditory and laboratory)		0	2		2
3.	Seminar					
4.	First colloquium	= Written exam	0	1		1
5.	Second colloquium		0	1		1
6.	Oral exam		0	1		1
Σ	Overall points:			6	Overall ECTS points:	6

*During the course the student is evaluated based on the sum of the internal points earned through participating in class (lectures and exercises) and grading the seminar work. The student, in order to realize the condition "courses requirements achieved", must achieve a minimum of 30 points.



Table 2 - Explanation of the credit values in evaluations

CREDITS:	Estimate based on attendance, seminar paper and two colloquies (or written exam) - [4 ECTS]*:	The final score [6 ECTS]*:
	Sufficient (2)	
	Good (3)	
	Very good (4)	
	Excellent (5)	

Information for students (scoring system, implementation plan, learning outcomes, syllabus, literature, consulting teachers, announcement of results of examinations or colloquium, and all other information):

- <https://moodle.srce.hr/2025-2026/> (<https://merlin.srce.hr>)
- <http://www.fpz.unizg.hr/isvu/2025-en/>