



**UNDERGRADUATE STUDY: TRANSPORT, ITS AND LOGISTICS,  
AERONAUTICS  
SEMESTER (II)**

**Syllabus**

Academic year 2021/2022

Course:		<b>Mathematics II</b>				
Head of course: Asst. Prof. <b>Tomislav Fratrović</b> , Ph.D. <b>Marijana Greblički</b> , Ph.D., Senior Lecturer						
Co-lecturers: <b>Radomir Lončarević</b> , mag.educ.math. et phys. <b>Jelena Rupčić</b> , Ph.D. <b>Diana Hunjak</b> , Ph.D.						
Semester: <b>II</b>	Course code: <b>19122</b>	Lectures: <b>45</b>	Auditory exercises: <b>45</b>	Laboratory exercises:	Seminars:	ECTS credits: <b>8</b>
Group for lectures: <b>120 students</b>			Group for auditory and laboratory exercises: <b>40 students</b>			

**Objective of the course:**

- Introduce students to matrix calculus, solving systems of linear equations, analysis of the function of two variables, double integrals and first and second order differential equations.

**Learning outcomes:**

After the completion of the course the students will be able to:

1. Perform basic algebraic operations with matrices and determine the inverse of a regular matrix.
2. Solve a system of linear equations by the Gauss-Jordan method.
3. Examine the convergence of an order of numbers or an order of functions and apply the Taylor order in calculating the values of an elementary function without the use of a calculator.
4. Determine the natural domain and partial derivatives of the function of two variables.
5. Calculate the gradient and differential of the function of two variables at a given point.
6. Look for local extremes of the function of two variables.
7. Define the area of integration of the double integral.
8. Calculate a simpler double integral in rectangular or polar coordinates.





9. Recognize the type of ordinary differential equation and choose the method of solving it.





## LECTURES, EXERCISES and SEMINARS

Week	Syllabus	Form of classes	Performed by	Lessons	Remark
1.	<ul style="list-style-type: none"> <li>▪ SERIES OF NUMBERS</li> <li>▪ CONVERGENCE AND SUM OF SERIES</li> <li>▪ CONVERGENCE CRITERIA</li> </ul>	L	Marijana Greblički	3	
	<ul style="list-style-type: none"> <li>▪ MATRIX</li> <li>▪ CALCULATION OPERATIONS WITH MATRIXES</li> </ul>	AE	Marijana Greblički	3	
2.	<ul style="list-style-type: none"> <li>▪ SERIES OF FUNCTIONS</li> <li>▪ AREA OF CONVERGENCE</li> <li>▪ CONVERGENCE CRITERIA</li> </ul>	L	Marijana Greblički	3	
	<ul style="list-style-type: none"> <li>▪ GAUSS-JORDAN ALGORITHM</li> <li>▪ INVERSE MATRIX</li> <li>▪ MATRIX EQUATIONS</li> </ul>	AE	Marijana Greblički	3	
3.	<ul style="list-style-type: none"> <li>▪ TAYLOR'S AND FOURIER'S SERIES</li> </ul>	L	Marijana Greblički	3	
	<ul style="list-style-type: none"> <li>▪ SYSTEMS OF LINEAR EQUATIONS</li> </ul>	AE	Marijana Greblički	3	
4.	<ul style="list-style-type: none"> <li>▪ DEFINITION AND GRAPH OF THE FUNCTION OF TWO VARIABLES</li> <li>▪ SURFACES</li> <li>▪ NATURAL DOMAIN</li> </ul>	L	Marijana Greblički	3	
	<ul style="list-style-type: none"> <li>▪ SERIES OF NUMBERS</li> <li>▪ SERIES OF FUNCTIONS</li> </ul>	AE	Marijana Greblički	3	





5.	<ul style="list-style-type: none"> <li>DEFINITION AND PROPERTIES OF PARTIAL DERIVATIONS</li> <li>DIFFERENTIAL, GRADIENT</li> </ul>	L	Marijana Greblički	3	
	<ul style="list-style-type: none"> <li>DOMAIN OF THE FUNCTION OF TWO VARIABLES</li> <li>EQUATION OF PLANE</li> </ul>	AE	Marijana Greblički	3	
6.	<ul style="list-style-type: none"> <li>THE AVERAGE VALUE THEOREM</li> <li>TANGENTIAL PLANE AND NORMAL</li> </ul>	L	Marijana Greblički	3	
	<ul style="list-style-type: none"> <li>CALCULATION OF PARTIAL DERIVATIONS</li> <li>FIRST AND SECOND DIFFERENTIAL</li> <li>TANGENTIAL PLANE AND NORMAL</li> </ul>	AE	Marijana Greblički	3	
7.	<ul style="list-style-type: none"> <li>TAYLOR'S FORMULA</li> <li>LOCAL EXTREMES</li> </ul>	L	Marijana Greblički	3	
	<ul style="list-style-type: none"> <li>CONDITIONAL EXTREMES</li> <li>EXERCISE FOR A COLLOQUIUM</li> <li>(written check of the 1st and 2nd HW)</li> </ul>	AE	Marijana Greblički	3	
8.	<ul style="list-style-type: none"> <li>EXERCISE FOR A COLLOQUIUM</li> </ul>	L	Marijana Greblički	3	
	<ul style="list-style-type: none"> <li>FIRST COLLOQUIUM</li> </ul>	AE	Marijana Greblički	3	
9.	<ul style="list-style-type: none"> <li>DOUBLE INTEGRALS</li> <li>(INTEGRATION BOUNDARIES, INTEGRATION ORDER IN RECTANGULAR COORDINATES)</li> </ul>	L	Marijana Greblički	3	
	<ul style="list-style-type: none"> <li>DOUBLE INTEGRAL</li> <li>(BY RECTANGULAR AND TRIANGLE)</li> </ul>	AE	Marijana Greblički	3	



10.	<ul style="list-style-type: none"> <li>DOUBLE INTEGRALS (POLAR COORDINATES)</li> <li>APPLICATION TO SURFACES AND VOLUME</li> </ul>	L	Marijana Greblički	3	
	<ul style="list-style-type: none"> <li>INTEGRATION ORDER REPLACEMENT</li> <li>POLAR COORDINATES</li> </ul>	AE	Marijana Greblički	3	
11.	<ul style="list-style-type: none"> <li>COMMON DIFFERENTIAL EQUATIONS</li> <li>DEFINITION OF SOLUTION, INITIAL CONDITIONS</li> <li>EXAMPLES (SEPARATION OF VARIABLES AND HOMOGENEOUS EQUATIONS)</li> </ul>	L	Marijana Greblički	3	
	<ul style="list-style-type: none"> <li>APPLICATION OF DOUBLE INTEGRAL</li> <li>DIF. FIRST ROW EQUATIONS (SEPARATED, HOMOGENEOUS)</li> </ul>	AE	Marijana Greblički	3	
12.	<ul style="list-style-type: none"> <li>FIRST ORDER LINEAR DIFFERENTIAL EQUATIONS</li> <li>EXACT DIFF. EQUATIONS</li> </ul>	L	Marijana Greblički	3	
	<ul style="list-style-type: none"> <li>CONSTANT VARIATION METHOD</li> <li>EXACT DIFF. EQUATIONS</li> <li>REDUCING THE ORDER OF THE EQUATION</li> </ul>	AE	Marijana Greblički	3	
13.	<ul style="list-style-type: none"> <li>DIF. HIGHER ORDER EQUATIONS</li> <li>LIN. DIF. HIGHER ORDER EQUATIONS WITH CONSTANT COEFFICIENTS</li> </ul>	L	Marijana Greblički	3	
	<ul style="list-style-type: none"> <li>LIN. DIF. HIGHER ORDER EQUATIONS WITH CONSTANT COEFFICIENTS (INDEFINITE COEFFICIENT METHOD)</li> </ul>	AE	Marijana Greblički	3	
14.	<ul style="list-style-type: none"> <li>LIN. DIF. HIGHER ORDER EQUATIONS WITH CONSTANT COEFFICIENTS (CONSTANT VARIATION METHOD)</li> <li>EXAMPLES</li> </ul>	L	Marijana Greblički	3	



	<ul style="list-style-type: none"><li>(written check of the 3rd and 4th HW)</li><li>EXERCISE FOR A COLLOQUIUM</li></ul>	AE	Marijana Greblički	3	
15.	<ul style="list-style-type: none"><li>SYSTEMATIZATION OF MATERIALS</li><li>PREPARATION FOR WRITTEN AND ORAL EXAM</li></ul>	L	Marijana Greblički	3	
	<ul style="list-style-type: none"><li>SECOND COLLOQUIUM</li></ul>	AE	Marijana Greblički	3	

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





## STUDENT OBLIGATIONS AND EXAMS

### Conditions for obtaining signatures:

The first and basic step is to meet the conditions for achieving the status of the subject "listened", which is a prerequisite for taking the exam. This is achieved if the student has fulfilled and fulfilled all obligations towards the course throughout the semester. The conditions for the case to receive the status are completed (10 + 10 + 10):

- 10 drawn of student card on the lectures
- 10 drawn of student card on the exercises
- 10 points from two written homework tests (out of a total of 20 points!)

### Written Examination:

In addition to written homework tests, students also write two colloquia for exemption from the written part of the exam. Out of a total of 20 points from these two colloquia, a minimum of 10 points (50%) must be collected for exemption from the written part of the exam. In addition to the total number of points for exemption from the written part of the exam through the colloquium, the condition that the student has more than zero points in each colloquium must be met!

Exemption from the written exam is permanent and is valid for all exam terms.

Colloquia can be attended by repeaters, but only if they join the exercises at the beginning of the semester, add to the list of new students and meet all the requirements as full-time students who are taking the course for the first time (homework, attendance at exercises).

If he does not pass the colloquium, the student must access the written part of the exam during the exam deadlines consisting of 5 tasks. Then the pass is conditioned with at least 5 points obtained out of a total of 10 (50%).

The grade of the written part of the exam is obtained on the basis of the total number of points and depends on whether it is a colloquium or a written exam.

### Colloquium scoring:

POINTS	GRADE
10 - 12,99	sufficient (2)
13 - 15,99	good (3)
16 - 17,99	very good (4)
18 - 20	excellent (5)

### Written exam scoring:

POINTS	WRITTEN EXAM GRADE
0 - 4,99	insufficient (2)





5 - 6,49	sufficient (2)
6,5 - 7,99	good (3)
8 - 8,99	very good (4)
9 - 10	excellent (5)

### Oral examination:

After successfully passing the written part of the exam, in the oral part, students also solve tasks and/or answer questions. Depending on the questions asked to the student, the grade obtained from the written part may be lowered at the final exam, and the student may be referred to retake the exam.

## LITERATURE

### a) Obligatory literature:

1. Ivanković, Fratrović, D. Rupčić, J. Rupčić: MATHEMATICS 2 - selected chapters for application in traffic, FPZ, 2015.

### b) Recommended literature:

1. B.P. Demidovič et al: Tasks and solved examples from mathematical analysis for technical faculties, 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.

## METHODOLOGY OF THE IMPLEMENTATION OF THE COURSE PLAN

### 1. LECTURES

Frontal form of teaching with the use of presentations and problem solving on the board. Individual work of students on solving simpler tasks that check the comprehensibility of the material and the possibility of further independent work.

### 2. AUDITORY EXERCISES

After the demonstration of solving tasks and getting acquainted with the various methods available, students solve tasks individually or in a group depending on their abilities.





### 3. DOCUMENTATION

Through continuous monitoring, students have access to scoring written tests of homework and colloquia, as well as course activities. Grades of written and oral exams, as well as records of the number of exam applications are available through the ISVU system.

Notices to students, presentations in pdf format and materials accompanying the course, as well as official formulas and tables that may be used in exams are available through the Merlin system and the e-course Mathematics 1.

### 4. SCORING SYSTEM

During the semester, students' activity is recorded through the SAN system (by dragging x-s), scoring solved tasks in colloquia and written tests of compulsory homework. In the lectures, students are given optional short homework assignments each week to check new material

Assessment and evaluation of student work during classes and at the final exam:

Successfully passed course brings 8 ECTS credits, calculating that one ECTS credit is equivalent to approximately 25-30 hours of work.

**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.			
<i>Points for the realization of the condition: Courses requirements achieved*</i>							
1.	Realization of conditions for signature and related activities					2	
2.	Lectures + exercises, activities					3	
3.	First colloquium	= Written exam				1	2
4.	Second colloquium		1				
5.	Oral exam					1	
Σ	<i>Overall points:</i>				<i>Overall ECTS points:</i>	8	

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

- <http://www.fpz.unizg.hr>

