

SYLLABUS

1. Data about the program of study

1.1	Institution	Technical University of Cluj-Napoca
1.2	Faculty	Automation and Computer Science
1.3	Department	Mathematics
1.4	Field of study	Automation, Applied Informatics and Intelligent Systems
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Automation and Applied Informatics, English
1.7	Form of education	Full time

2. Data about the subject

2. Data about the subject												
2.1	Subject name					Mathematical Foundations of Artificial Intelligence				Subject code	8.00	
2.2	Subject area					Mathematics						
2.3	Course responsible/lecturer					Conf. dr. Alina Ramona Baias						
2.4	Teachers in charge of applications					Conf. dr. Alina Ramona Baias						
2.5	Year of Study	I	2.6	Semester	2	2.7	Assessment	exam	2.8	Subject category	DF/OB	

3. Estimated total time

3.1	Number of hours per week	4	of which:	3.2	Course	2	3.3	Seminar	2	3.3	Laboratory	0	3.3	Project	0
3.4	Total hours in the teaching plan	56	of which:	3.5	Course	28	3.6	Seminar	28	3.6	Laboratory	0	3.6	Project	0
3.7	Time distribution (hours per semester) for:														
	(a) Manual, lecture material and notes, bibliography														18
	(b) Supplementary study in the library, online and in the field														15
	(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays														30
	(d) Tutoring														3
	(e) Exams and tests														3
	(f) Other activities:														0
3.8	Total hours individual study hours (sum of (3.3(a)...3.3(f)))					69									
3.9	Total hours per semester (3.2+3.4)					125									
3.10	Number of credits points					5									

4. Pre-requisites (where appropriate)

4.1	Curriculum	Basic knowledge Integral Calculus
4.2	Competence	Competence in elementary Integral Calculus: primitives, definite integrals.

5. Requirements (where appropriate)

5.1	For the course	
5.2	For the applications	

6. Specific competences

Professional competences	C1 – Operating with basic Mathematical, Engineering, and Computer Science concepts C1.1 – Recognizing and describing concepts that are specific to the fields of calculability, complexity, programming paradigms, and modeling computational and communication systems C1.3 – Building models for various components of computing systems C1.5 – Providing a theoretical background for the characteristics of the designed systems
Cross competences	N/A

7. Learning outcomes

Knowledge	Describe, identify, and synthesize elementary concepts and methods related to: - differential equations with constant coefficients - functions of several real variables; continuity, partial derivatives, gradients - extrema of functions of several real variables - differentiation of composite functions - line or double integrals
Skills	Solve problems involving the theoretical concepts mentioned above: - Calculate the gradient and the differential of a function. - Calculate the derivatives of composite functions. - Calculate line integrals. - Calculate double integrals and apply integral formulas.
Responsibility and autonomy	Demonstrate honorable, responsible, and ethical conduct, in accordance with the law, in order to uphold the reputation of the profession

8. Discipline objectives (as results from the *key competences gained*)

7.1	General objective	A presentation of the concepts, notions, methods and fundamental techniques used in integral calculus.
7.2	Specific objectives	Use of the integral calculus in order to solve problems in engineering.

9. Contents

9.1. Lecture (syllabus)		Teaching methods	Notes
1	Higher-order differential equations with constant coefficients	Explanation	
2	Functions of several variables. Limits. Continuity		
3	Partial derivatives. The differential of a function, differential operators and the gradient.	Demonstration	
4	The derivative of a complex function. The Cauchy-Riemann condition.	Collaboration	
5	The derivative of composite functions.	Interactive activities	
6	Taylor's formula for functions of several variables		
7	Extrema of functions of several variables		
8	Conditional extrema		
9	Line integrals with respect to the first kind (with respect to the arc length)		
10	Line integrals with respect to the second kind (with respect to the coordinates)		
11	Double integrals		
12	The change of variable in a double integral		
13	Applications of line integrals		
14	Applications of double integrals		
Bibliography			
1. Mircea Ivan. Elemente de calcul integral. Mediamira, Cluj-Napoca, 2003. ISBN 973-9357-40-7.			
2. Dumitru Mircea Ivan. Calculus. Editura Mediamira, Cluj-Napoca, 2002. ISBN 973-9358-88-8.			
3. D. Inoan, Elemente de calcul integral, Ed. U.T.Press, 2006			
9.2. Applications (Seminars)		Teaching methods	Notes
1	Homogeneous and nonhomogeneous differential equations with constant coefficients	Explanation	
2	Examples of functions of several variables. Continuity study.		
3	Gradient, partial derivatives, differential.		
4	Cauchy-Riemann conditions.	Demonstration	
5	Chain rule for the derivative of composite functions.	Collaboration	
6	Taylor's formula for functions of several variables		
7	Nonconditional extrema of functions of several variables		
8	Conditional extrema	Interactive activities	
9	Line integrals with respect to arc		
10	Line integrals with respect to the coordinates		

11	Calculus by iteration of double integrals		
12	Change of variable in a double integral		
13	Applications of line integrals		
14	Revision		
Bibliography			
1. Dumitru Mircea Ivan, et al. Analiză matematică - Culegere de probleme pentru seminarii, examene și concursuri. Editura Mediamira, Cluj-Napoca, 2002. ISBN 973-9357-20-2.			
2. Mircea Ivan et al. Culegere de Probleme Pentru Seminarii, Examene și Concursuri. UT Press, Cluj-Napoca,			
3. D. Inoan, Elemente de calcul integral, Ed. U.T. PRES, 2006			
4. N. Lungu, A. Chis, D.Inoan, M. Rus, V. Dincuță, Ecuații diferențiale. Culegere de probleme, U.T. PRES, 2007 2000.			

10. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field

Collaboration with engineers in order to identify and solve problems raised by the market.
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11. Evaluation

Activity type	Assessment criteria	Assessment methods	Weight in the final grade
Course	Abilities of understanding and using creatively the concepts and proofs	Written/oral examination	30%
Applications	Abilities of solving problems and applying algorithms	Written/oral examination	70%
Minimum standard of performance			
Ability to present coherently a theoretical subject and to solve problems with practical content.			

Date of filling in:		Title Firstname NAME	Signature
01.07.2026	Course	Conf. dr. Alina Ramona Baias	
	Aplications	Conf. dr. Alina Ramona Baias	

Date of approval by the Department Board	Head of Automation Departament Prof.dr.ing. Honoriu VĂLEAN
Date of approval by the Faculty Council	Dean Prof.dr.ing. Vlad Muresan