SYLLABUS

1. Program Information

1.1 Higher education institution	Technical University of Cluj-Napoca
1.2 Faculty	Faculty of Automation and Computer Science
1.3 Department	Department of Automation
1.4 Field of study	Automation, Applied Informatics and Intelligent Systems
1.5 Cycle of studies	Bachelor
1.6 Study Programme/Qualification	Intelligent Automation Systems (dual, in English language)
1.7 Form of education	IF – full-time education
1.8 Course code	4.00

2. Course information

2.1 Course title	**Mathematical Analysis**					
2.2 Course Lecturer	*Lecturer Math. Daniela Marian, PhD, Daniela.Marian@math.utcluj.ro*					
2.3 Seminar Lecturer	*Lecturer Math. Daniela Marian, PhD, Daniela.Marian@math.utcluj.ro*					
2.4 Year of study	1	2.5 Semester	1	2.6 Type of assessment		E
2.7 Course status	Formative category *(DF, DS, DC)*					DF
	Optionality *(DOB, DOP, DFac)*					DOB

3.Total estimated time

3.1 Number of hours per week	4	of which:	HEI	Lecture	2	Seminar	2	Laboratory	0	Project	0
			CO		0		0		0		0
3.2 Number of hours per semester	56	of which:	HEI	Lecture	28	Seminar	28	Laboratory	0	Project	0
			CO		0		0		0		0

3.3 Distribution of time allocation (hours per semester) for:	HEI	CO
(a) Study based on textbook, course support, bibliography, and notes	14	0
(b) Additional documentation in library, specialized electronic platforms, and fieldwork	13	0
(c) Preparation of seminars/laboratories, assignments, papers, portfolios and essays	14	0
(d) Tutoring	14	0
(e) Examinations	3	0
(f) Other activities:	10	0
3.4 Total individual study hours (sum (3.3(a)... 3.3(f)))	69	0
3.5 Total hours per semester (3.2+3.4)	125	0
3.6 Number of credits per semester	5	0

(HEI = Higher Education Institution, CO = Company)

4. Prerequisites (where applicable)

4.1 Curriculum Prerequisites	Basic knowledge of calculus
4.2 Competency Prerequisites	Elements of calculus: sequences, limits, derivatives, integrals (basic knowledge)

5. Conditions (where applicable)

5.1. Course Organization Conditions	Blackboard, Video Projector
5.2. Seminar / Laboratory / Project organization conditions	Blackboard

6. Specific Competencies Acquired

Professional Competencies	• PC02 Analyse test data • PC24 Think abstractly • PC27 Execute analytical mathematical calculations
Transversal Competencies	• TC02 Think analytically • TC05 Interpret mathematical information

7. Learning outcomes

Knowledge	• Understand fundamental concepts in calculus: sequences, series, convergence, continuity. • Master differential and integral calculus of one and several variables, including optimization and approximation. • Gain familiarity with ordinary and partial differential equations relevant to modeling in engineering. • Know how to apply vector calculus concepts, including line integrals and vector fields, to engineering problems.
Skills	• Perform multivariable calculus: compute partial derivatives, gradients, and extrema (with and without constraints). • Solve first- and second-order ODEs and basic PDEs using analytical methods. • Evaluate Riemann and improper integrals, and compute line integrals in scalar and vector fields. • Model engineering problems using differential and integral calculus.
Responsibility and autonomy	• Select and justify appropriate methods of analysis (e.g., series expansion, differentiation, integration). • Demonstrate autonomy in identifying and solving complex problems using mathematical reasoning. • Assess the limitations and applicability of mathematical methods in real-world systems.

8. Course Objectives

8.1 General objective of the course	A presentation of the concepts, notions, methods and fundamental techniques used in differential and integral calculus for engineering students.

8.2 Specific objectives	• Use of the differential and integral calculus in modelling and solving practical problems concerning spatial forms. • Knowledge of fundamental notions, methods, and techniques regarding ordinary differential equations, integrals, and special functions, their application in the mathematical modeling of engineering problems.

9. Contents

9.1 Lectures	No. of hours	Teaching methods	Obs.
C1. Real numbers. Sequences of real numbers. Series	2	Explanation. Collaboration. Interactive activities.	-
C2. Tests of convergence for series of real numbers.	2		
C3. Series of functions. Power series. Taylor series. Fourier series.	2		
C4. Differential calculus for functions of one variable.	2		
C5. Functions of several variables. Limit and continuity.	2		
C6. Differential calculus for functions of several variables (partial derivatives, derivative of composite composite functions, gradient, directional derivatives, differential of functions of several variables).	2		
C7. Extrema for functions of several variables. Conditional extrema.	2		
C8. Ordinary differential equations (ODE).	2		
C9. Linear ODE of order n with constant coefficients.	2		
C10. First order partial differential equations (PDE).	2		
C11. Second order partial differential equations (PDE).	2		
C12. Primitives. Riemann integrals. Improper integrals.	2		
C13. Line integrals with respect to the arc length. Total mass, center of mass.	2		
C14. Paths. Vector fields. Line integrals with respect to the coordinates. Circulation. Work of the force.	2		

Bibliography

[1] M. Ivan. Elemente de calcul integral. Mediamira, Cluj-Napoca, 2003 (in TUCN library)

[2] D. Marian, Mathematical Analysis, Ed. Mega, 2012.

[3] D. Marian, L. Blaga, Differential Equations. Theory and Problems, Ed. Mediamira, 2014 (in TUCN library)

9.2 Seminar	Hours HEI	Hours CO	Teaching methods	Obs.
S1. Sequences of real numbers. Limits. Example of series of real numbers.	2	-	Interactive activities. Explanation	-
S2. Tests of convergence for series of real numbers.	2	-		
S3. Power series. Taylor series. Fourier series. Applications.	2	-		

S4. Differential calculus for functions of one variable. Geometric interpretation of derivative. Applications.	2	-		
S5. Limit and continuity. Applications.	2	-		
S6. Differential calculus for functions of several variables.	2	-		
S7. Extrema for functions of several variables. Conditional extrema. Contur plots and mesh plots.	2	-		
S8. Ordinary differential equations (ODE): differential equation with separable variables, homogenous differential equations of order one, Bernoulli and Riccati differential equations with applications.	2	-		
S9. Linear ODE of order n with constant coefficients: homogenous and non-homogenous. Applications.	2	-		
S10. First order partial differential equations (PDE). Applications.	2	-		
S11. Second order partial differential equations (PDE). Applications.	2	-		
S12. Primitives. Riemann integrals. Improper integrals. Applications.	2	-		
S13. Line integrals with respect to the arc length. Total mass, center of mass. Applications.	2	-		
S14. Paths. Vector fields. Line integrals with respect to the coordinates. Circulation. Work of the force. Applications.	2	-		
Bibliography [1]. D. Inoan, Problems in differential and integral calculus, Mediamira, Cluj-Napoca, 2007 (in TUCN Library) [2]. D. Marian, L. Blaga, Differential Equations. Theory and Problems, Ed. Mediamira, 2014.				

10. Correlation of course content with the expectations of the epistemic community representatives, professional associations, and major employers in the field related to the program

Calculus is a core discipline in mathematics. The discipline's content is almost identical to that of other technical universities in the country and abroad. Also, the content is adapted to the requirements in the field of engineering sciences.

11. Evaluation

Activity Type	Evaluation criteria	Evaluation methods	Weight in final grade
11.1 Lecture	Written examination	Written exam	70%
11.2 Seminar/ Laboratory/Project	Project in MATLAB Seminar activity	Project in MATLAB	30%
11.3 Minimum Performance Standard			

Grade = 70% Exam + 20% Project + 10% Seminar Activity. Minimum Performance Standard: Grade >= 5 and Exam >= 5.

Date of completion: 15.05.2025	Lecturers		Signature
	Course	Assoc. Prof. PhD Math. Daniela MARIAN	
	Applications	Assoc. Prof. PhD Math. Daniela MARIAN	

Date of approval by the Department of Automation Council 24.11.2025 _____ Date of approval by the Faculty of Automation and Computer Science Council 28.11.2025 _____	Director of the Department of Automation Prof.dr.ing. Honoriu VĂLEAN Dean Prof.dr.ing. Vlad MUREȘAN