COURSE SYLLABUS

1. Program details

1.1 Higher education institution	Technical University of Cluj-Napoca
1.2 Faculty	Automation and Computer Science
1.3 Department	Automation
1.4 Field of study	Systems Engineering
1.5 Cycle of study	Bachelor's Degree
1.6 Program of study / Qualification	Automation and Applied Informatics
1.7 Mode of study	FT – Full-time learning

2. Course details

2.1 Course title	**Mathematical Analysis**			Course code	**1.00**
2.2 Course coordinator	Prof. dr. Dorian Popa – Popa.Dorian@math.utcluj.ro				
2.3 Seminar/laboratory/project coordinator(s)	Prof. dr. Dorian Popa – Popa.Dorian@math.utcluj.ro Assoc. prof. dr. Alina Baias – Alina.Baias@math.utcluj.ro				
2.4 Year of study	1	2.5 Semester	1	2.6 Type of assessment *(E – exam, C – colloquium, V – verification)*	E
2.7 Regimul disciplinei	*DF – fundamental, DD – in the field, DS – specialty, DC – complementary*				DF
	DOB – compulsory, DO – optional, DFac – elective				DOB

3. Estimated total time

3.1 Number of hours per week	4	of which:	3.2 Lecture	2	3.3 Seminar	2	3.3 Laboratory	0	3.3 Project	0
3.4 Număr de ore pe semestru	56	of which:	3.5 Lecture	28	3.6 Seminar	28	3.6 Laboratory	0	3.6 Project	0

3.7 Time distribution (hours per semester) for:	
(a) Study using textbook, course materials, bibliography and notes	18
(b) Additional documentation in the library, on specialized electronic platforms and in the field	15
(c) Preparation for seminars / laboratories, homework, reports, portfolios and essays	30
(d) Tutoring	3
(e) Examinations	3
(f) Other activities:	0
3.8 Total 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	5

4. Prerequisites (where applicable)

4.1 curriculum-related	-
4.2 competence-related	elementary mathematics knowledge acquired in high school, differential calculus, elements of set theory, limits of sequences and functions

5. Conditions (where applicable)

5.1. for the lecture	-
5.2. for the seminar / laboratory / project	-

6. Specific competences acquired

Professional competences	C1. Use of knowledge in mathematics, physics, measurement technology, technical graphics, mechanical, chemical, electrical and electronic engineering in systems engineering. C1.2 Explaining the problems to be solved and arguing the solutions in systems engineering, by using the techniques, concepts and principles of mathematics, physics, technical graphics, electrical engineering, electronics. C1.3 Solving common problems in the field of systems engineering by identifying appropriate techniques, principles, methods and by applying mathematics, with an emphasis on numerical calculation methods. C1.4 Assessing the potential, advantages and disadvantages of methods and procedures in the field of systems engineering, the level of scientific documentation of projects and the consistency of applications using mathematical techniques and other scientific methods. C1.5 Developing projects in the field of systems engineering, selecting and applying mathematical methods and other domain-specific scientific methods.

Transversal competences	

7. Learning outcomes

Knowledge	Describes, identifies and synthesizes elementary concepts and methods related to: - sequences of real numbers; - series of real numbers; - power series, Taylor series, Fourier series; - differential calculus of real functions of one real variable; - elementary complex functions.
Skills	Solves problems involving the theoretical concepts mentioned above. Calculates sums of series, analyzes various series and uses convergence tests. Calculates derivatives of functions, determines local and global extremum points of functions. Calculates Riemann integrals, improper integrals. Determines the convergence of improper integrals. Calculates integrals using special functions.
Responsibility and autonomy	Demonstrates honorable, responsible, and ethical behavior, in compliance with the law, to maintain the reputation of the profession.

8. Course objectives (resulting from the grid of specific acquired competences)

7.1 General objective of the course	Presentation and use in professional communication of fundamental mathematical concepts, notions, methods, and techniques used in differential calculus.
7.2 Specific objectives	Using differential calculus methods in modeling and solving mathematical or engineering problems. Acquiring the skill to study sequences of real numbers; to apply certain convergence criteria for series and to calculate, where possible, their sums. Acquiring the skill to calculate the radius of convergence of power series, to expand certain functions into Taylor or Fourier series. Acquiring the skill to calculate integrals of one variable, improper integrals. Acquiring the skill to use special functions in calculating integrals.

9. Course contents

9.1 Lecture	Teaching methods	Notes
1. Real numbers. Sequences of real numbers.	Lecture, exposition, exemplification, problem-based learning	
2. Series of real numbers (properties, examples).		
3. Functions of one real variable. Limits, continuity and differentiability.		
4. Differentiable functions – Fermat's Theorem, Taylor's formula.		
5. Sequences and series of functions (pointwise convergence, uniform convergence).		
6. Power series (definition, radius of convergence, Taylor series).		
7. Elementary complex functions.		
8. Trigonometric series. Fourier series (definition, calculation method).		
9. Fourier series - properties.		
10. Integrable functions. Properties.		
11. Improper integrals.		
12. Euler's Gamma and Beta functions.		
13. First-order differential equations. The Cauchy problem.		
14. First-order differential equations integrable by quadratures.		
Bibliography D. M. Ivan, Calculus, Mediamira, Cluj-Napoca, 2002 (Book stock of the Department of Mathematics)		

D. Inoan, A.Novac, D.Popa, Probleme de analiză matematică, Ed. Mega, 2011 (UTCN Library, 10 copies) D. Popa, Analiza matematica-Calcul diferenţial, Transilvania Press, Cluj-Napoca, 2000 (UTCN Library, 10 copies) D. Inoan, Analiza Matematica I, lecture notes, MicrosoftTeams		
9.2 Seminar / laboratory / project	Teaching methods	Notes
1. Calculation of limits of sequences.	Exemplification, exercise, mathematical modeling, problem-based learning.	
2. Calculation of certain sums of series.		
3. Study of series convergence. Positive series or series with arbitrary terms.		
4. Functions of one real variable.		
5. Applications of derivatives to the study of functions, extrema.		
6. Power series.		
7. Expansion of certain functions into Taylor series.		
8. Elementary complex functions.		
9. Applications of Fourier series.		
10. Antiderivatives (Primitives). Calculation methods.		
11. Improper integrals.		
12. Integrals with parameters.		
13. Euler's Gamma and Beta functions.		
14. Differential equations.		

10. Corroboration of course contents with the expectations of the epistemic community, professional associations and representative employers in the field of the program

Collaboration with engineers to identify those mathematical contents that have wide applicability in technical and engineering sciences.

11. Evaluation

Activity type	11.1 Evaluation criteria	11.2 Evaluation methods	11.3 Weight in the final grade
11.4 Lecture	Ability to understand and creatively use concepts and proofs.	Written/oral exam during the examination period.	20%
11.5 Seminar/Laboratory	Capacity to solve problems and applications in mathematical analysis.	Continuous assessment throughout the semester. Final written test/oral exam.	80%
11.6 Minimum performance standard			
Ability to coherently present a theoretical topic and to solve problems. Solving at least 40% of the proposed topics.			

Date of completion:	**Course type**	**Title Forename SURNAME**	**Signature**
30.06.2026	Lecture	Prof. dr. Dorian Popa	
	Applications	Prof. dr. Dorian Popa Assoc. prof. dr. Alina Baias	

Date of approval in the department	Head of department, Prof.dr.eng. Honoriu VALEAN
Date of approval in the Faculty Council	Dean, Prof.dr.eng. Vlad MUREȘAN