SYLLABUS

1. Data about the program of study

1.1	Institution	Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Automotive, Mechatronics and Mechanical Engineering
1.3	Department	Department of Mechatronics and Machine Dynamics
1.4	Field of study	Mechatronics and Robotics
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Mechatronics
1.7	Form of education	Full time

2. Data about the subject

2.1	Subject name			***Special Mathematics***		Subject code	**10.00**
2.2	Course responsible/lecturer			Lect. Dr. Daniela Marian daniela.marian@math.utcluj.ro			
2.3	Teachers in charge of seminars			Lect. Dr. Daniela Marian daniela.marian@math.utcluj.ro			
2.4 Year of study	1	2.5 Semester	2	2.6 Assessment			E
2.7 Subject category DID DOB	Formative category						DF
	Optionality						DOB

3. Estimated total time

3.1 Number of hours per week	3	of which	3.2 Course	2	3.3 Seminar	1	3.3 Laboratory		3.3 Project	
3.4 Total hours in the curriculum	42	of which	3.5 Course	28	3.6 Seminar	14	3.6 Laboratory		3.6 Project	

3.7 Individual study:	
(a) Manual, lecture material and notes, bibliography	10
(b) Supplementary study in the library, online and in the field	10
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	7
(d) Tutoring	3
(e) Exams and tests	3
(f) Other activities	

3.8 Total hours of individual study (sum (3.7(a)...3.7(f)))	33
3.9 Total hours per semester (3.4+3.8)	75
3.10 Number of credit points	3

4. Pre-requisites (where appropriate)

4.1	Curriculum	
4.2	Competence	

5. Requirements (where appropriate)

5.1	For the course	Course in electronic format
5.2	For the applications	Individual work themes

6. Specific competences

Professional competences	Theoretical knowledge, (What they need to know) C1.1 Identify concepts, describe theories and use specific language C1.2 Explain and interpret mathematical concepts correctly, using specific language C3.1 Identify basic concepts used in the construction and specification of algorithms C3.2 Interpret data and explain the steps involved in algorithmic problems Acquired skills: (What can do) C2.1 Identify basic concepts used to describe phenomena and processes C2.2 Interpreting the results of data processing Acquired skills: (What tools can be used) C1.3 Correct application of basic methods and principles in solving mathematical problems C1.4 Recognizing the main classes/types of mathematical problems and selecting appropriate methods and techniques for solving them C1.5 Elaboration of projects and papers presenting results and methods Define concepts, state fundamental theoretical results and apply them in solving simple problems C3.3 Applying specific techniques and methods for the design of algorithms
Cross competences	CT1 Applying rigorous and efficient work rules, showing responsible attitudes towards the scientific and didactic field, in order to make the best and creative use of one's own potential in specific situations, respecting the principles and rules of professional ethics. CT3 Efficient use of information sources and of communication and assisted professional training resources, both in Romanian and in a language of international circulation

7. Expected learning outcomes

Knowledge	Understanding the fundamental concepts of differential equations and their applications in various fields.
Skills	1. Correct application of basic methods and principles in solving differential equations 2. Recognition of the main types of differential equations and application of the appropriate algorithm to solve them 3. Development of projects and presentations on results and methods for solving higher-order differential equations. 4. Defining concepts, stating fundamental theoretical results, and applying them to solve simple problems
Responsibility and autonomy	1. Applying rigorous and efficient work practices and demonstrating a responsible attitude toward the scientific and educational fields, in order to make optimal and creative use of one’s own potential in specific situations, while adhering to the principles and standards of professional ethics. 2. The effective use of information sources and resources for communication and assisted professional training, both in Romanian and in an internationally used language.

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

8.1	General objective	Knowledge of basic results from the theory of differential equations, theory of complex functions and their applications in various fields
8.2	Specific objectives	- Recognizing the type of a quadratically integrable first order differential equation - Solving higher-order linear differential equations and systems of linear differential equations with constant coefficients. - Solving second order linear partial differential equations - Knowledge of the properties of the Laplace transform and the properties of the inverse Laplace transform - Applications of mathematics in other domains

9. Contents

9.1. Lecture (syllabus)	Number of hours	Teaching methods	Notes
1. Examples leading to differential and partial differential equations. Notion of differential equation. Basic notions. The existence and uniqueness theorem.	22	Exhibition Discussion Explanations Classical thematic presentation Presentation using projector Interactive lecture with student participation Students are encouraged to ask questions	
2. First order differential equations. Equations with separable variables. Homogeneous equations. First order linear equations.	2		
3. Bernoulli equations. Riccati equations. Exact total differential equations. Integral factor	2		
4. Lagrange and Clairault equations. Other types of differential equations	2		
5. Differential equations of higher order. Higher order linear differential equations.	2		
6. Homogeneous linear differential equations of order n. Nonhomogeneous linear differential equations of order n. Method of variation of constants.	2		
7. Linear differential equations with homogeneous and inhomogeneous constant coefficients.	2		
8. Euler differential equations. Systems of differential equations. Cauchy problem. Solutions, prime integrals. Integration of systems in normal form. Solving equation.	2		
9. Symmetric systems.	2		
10. Sisteme liniare. Solutia sistemelor omogene si neomogene. Sisteme cu coeficienti constanti. Metoda Euler.	2		

11. Linear and quasilinear first order partial differential equations.	2		
12. Partial differential equations of second order. Reduction to canonical form. Classification.	2		
13. Method of separation of variables for a rope fixed at the ends. Mixed problem. Heat equation	2		
14. Laplace transform	2		

Bibliography

1. S. Chirita, Probleme de matematici superioare, EDP, Bucuresti, 1989
2. N. Lungu, D. E. Dumitras, V. Ile, Matematici aplicate in inginerie, Ed. Digital Data, Cluj-Napoca, 2007.
3. D. Marian, L. Blaga, Differential Equations. Theory and Problems, Ed. Mediamira, 2014.
4. A. Mitrea, Matematici speciale, Ed. Mediamira, Cluj-Napoca, 2007.

9.2. Seminars /Laboratory/Project	Number of hours	Teaching methods	Notes
1.Primitives. Definite integral	1	Practical issues Discuss Explanations Students are directly involved in solving problems and are encouraged to ask questions.	
2. Equations with separable variables. Homogeneous equations.	1		
3. First order linear equations.	1		
4. Bernoulli equations. Riccati equations.	1		
5. Exact total differential equations. Lagrange and Clairault equations	1		
6. Higher order equations. Homogeneous higher order linear equations	1		
7. Nonhomogeneous higher order linear equations	1		
8. Euler differential equations. Integration of systems in normal form. Solving equation.	1		
9. Symmetrical systems.1	1		
10. Systems with constant coefficients. Euler method.	1		
11. Linear and quasilinear first order partial differential equations	1		
12. Partial differential equations of second order. Reduction to canonical form.	1		
13. The vibrating string equation. Heat equation.	1		
14. Applications of the Laplace Transform	1		

Bibliography

1. S. Chirita, Probleme de matematici superioare, EDP, Bucuresti, 1989
2. N. Lungu, D. E. Dumitras, V. Ile, Matematici aplicate in inginerie, Ed. Digital Data, Cluj-Napoca, 2007.
3. D. Marian, L. Blaga, Differential Equations. Theory and Problems, Ed. Mediamira, 2014.
4. A. Mitrea, Matematici speciale, Ed. Mediamira, Cluj-Napoca, 2007.

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

11. Evaluation

Activity type	11.1 Assessment criteria	11.2 Assessment methods	11.3 Weight in the final grade
11.4 Course	Ability to answer theoretical questions and solve practical problems	Written work (marked with LS)	LS represents 80%
11.5 Seminars /Laboratory/Project	Ability to answer theoretical questions and solve practical problems	Seminar activity (marked with AS) Online/onsite Homework (marked with TA)	AS is 10% TA is 10%
11.6 Minimum standard of performance			
Minimum performance standard: N=0,8LS+0,1AS+0,1TA - Credit condition: N≥5; LS≥5			

Date of filling in:	**Responsible**	**Title Surname Name**	**Signature**
11.05.2026	Courses	Lect. Dr.Daniela Marian	
	Applications	Lect. Dr.Daniela Marian	

Approval from the Head of the Department coordinating the course, only if this is different from the department organizing the study program.	Head of Department **Prof. univ. dr. mat. Vasile Dorian Popa**

Date of approval in the Department of Mechatronics and Machine Dynamics 28.05.2026	Head of Department Prof.dr.eng. Mircea Bara
Date of approval in the Faculty of Automotive, Mechatronics and Mechanical Engineering 16.09.2026	Dean Prof.dr.eng. Nicolae Filip