

SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Civil Engineering
1.3	Department	Mecanica constructiilor
1.4	Field of study	Civil Engineering
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Civil, Industrial and Agricultural Buildings /Engineer (English language)
1.7	Form of education	Full time
1.8	Subject code	10.0

2. Data about the subject

2.1	Subject name				Matematici speciale						
2.2	Course responsible/lecturer										
2.3	Teachers in charge of seminars										
2.4	Year of study	1	2.5	Semester	2	2.6	Assessment	E	2.7	Subject category	DF/DI

3. Estimated total time

3.1	Number of hours per week	4	3.2	of which, course:	2	3.3	applications:	
3.4	Total hours in the curriculum	56	3.5	of which, course:	28	3.6	applications:	
Individual study								hours
Manual, lecture material and notes, bibliography								43
Supplementary study in the library, online and in the field								0
Preparation for seminars/laboratory works, homework, reports, portfolios, essays								0
Tutoring								0
Exams and tests								0
Other activities								1
3.7	Total hours of individual study		44					
3.8	Total hours per semester		100					
3.9	Number of credit points		4					

4. Pre-requisites (where appropriate)

4.1	Curriculum	Mathematical skills from highschool about algebra, calculus and geometry.
4.2	Competence	Mathematical skills from highschool about algebra, calculus and geometry.

5. Requirements (where appropriate)

5.1	For the course	
5.2	For the applications	

6. Specific competences

Professional competences	<p>To know and understand the concepts, theory and the basic methods of the domain and appropriate use of those in professional communications.</p> <p>To use the basic knowledges to explain different types of concepts, situations, processes, projects associated to the domain.</p> <p>To apply some basic methods and concepts to solve problems/situations well defined, typical to the domain, in conditions of qualified assistance.</p>
Cross competences	Documentation in English and Romanian for personal and professional development; continuous improvement and efficient adapting to the technical specifications.

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

7.1	General objective	<p>Theoretical knowledge, (What the students must know) After finishing the classes students should know how:</p> <ul style="list-style-type: none"> -to recognize the types of the ordinary differential equations and the partial differential equations -to know how to solve different types of differential equation -to reduce a second order partial differential equations to the canonical form -to recognize a mathematical model applied in engineering
7.2	Specific objectives	<p>After finishing to study the subject involved, the students will be able to know:</p> <ul style="list-style-type: none"> -how to solve the first order ordinary differential equations of different types -to solve n order ordinary differential equations of constant coefficients and to know methods of solving ordinary differential equations of variable coefficients by reducing the order of the equation -to solve first order of linear and quasilinear PDE -resolution of some special types of differential equations -resolution of some special types of partial differential equations -to know how to use the Library and the Internet for finding interesting applications of the subject

8. Contents

8.1. Lecture (syllabus)	Teaching methods	Notes
Introduction: General presentation, goals. Short history, fundamental concepts.	Classical and computing methods	-
Part one		
Ordinary differential equations		
First order ordinary differential equations		
Total differential equations		

Ordinary differential equations of order n.		
Linear equations of nth order. Linear differential equations with constant coefficients		
Lagrange method; Method of undetermined coefficients		
Linear systems of ordinary differential equations		
Elimination method		
Euler’s method of solving a system of linear homogeneous equations of constant coefficients		
Symmetric systems of differential equations		
Part two		
Partial Differential Equations		
Linear and quasilinear PDE of first order		
PDEs of second order		
The canonical form of a second order PDE		
The mixed problem for the fixed chord equation; The mixed problem for the heat transfer equation; Dirichlet problem of the circle		
Examples of mathematical models and numerical methods applied in civil engineering		
Bibliography		
Bibliography		
1. L Rade, B Westrergren_Mathematics Handbook for Scince and Engineering, 5th Eition, Springer, 2004;		
2. F. Diacu, An introduction to differential equations. Order and chaos, Freeman and Co New-york, 2000		
3. N. Lungu, Ecuatii diferentiale si sisteme dinamice, UTPRES, 2005		
4. D. S. Cimpean, An introduction to advanced mathematics - Differential Equations, Mediamira 2010.		
5. D.S. Cimpean, Mathematical models applied in engineering, DigitalData 2009.		
8.2. Applications/Seminars	Teaching methods	Notes
Short presentation of the subject and its applications; examples. Exercises of first order ordinary differential equations. Separable equations, Euler equations	Classical and interactive methods	-
Linear equations of 1st order, Bernoulli equations, Riccati equations. Lagrange and Clairaut equations		
Total differential equations; Integrating factor		
Applications of ordinary differential equations of n order		
Ordinary differential equations of constant coefficients; Exercises		
Exercises with homogeneous and nonnhomogeneous linear equations with constant coefficients		
Nonhomogeneous systems of linear diffrential equations - exercises and problems with the elimination method		
Euler’s method for homogeneous systems of linear diffrential equations - exercises		
Symmetric systems of ordinary differential equations		
Linear and quasilinear PDE of first order problems and exercises		
PDEs of second order		
The mixed problems for the fixed chord equation -applications		
Applications of the mixed problem for the heat transfer equation		
Recapitulative exercises and problems		
Bibliography		

"Bibliography

6. N. Lungu, V. Dincuta, D. Inoan, A. Novac, M. Rus, Differential equations: collection of problems, Matrix Rom, 2009.
7. N. Lungu et al, Culegere de probleme, UTPRES, 2005
8. G. Toader, Capitole de matematici speciale, U.T.Pres, Cluj, 2004.
9. S. Toader, Ecuatii diferentiale, Editura Mediamira, Cluj, 2001.
10. D. S. Cimpean, An introduction to advanced mathematics - Differential Equations, Mediamira 2010."

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

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10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	80% the exam+ 20% the class activity	Written exam	Written exam
10.5 Applications			
10.6 Minimum standard of performance			
Understanding the theory and its application to solving problems.			

Date of filling in:		Title Surname Name	Signature
	Lecturer		
	Teachers in charge of application		

Date of approval in the department	Head of department conf.dr.ing. Anca-Gabriela POPA
19/06/2025	
Date of approval in the faculty	Dean prof.dr.ing Daniela MANEA
25/06/2025	