

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	47.1

2. Data about the subject

2.1	Subject name				Bazele modelarii si calculului structurilor prin metoda elementului finit						
2.2	Course responsible/lecturer										
2.3	Teachers in charge of seminars										
2.4	Year of study	3	2.5	Semester	2	2.6	Assessment	C	2.7	Subject category	DID/DO

3. Estimated total time

3.1	Number of hours per week	2	3.2	of which, course:	1	3.3	applications:	
3.4	Total hours in the curriculum	28	3.5	of which, course:	14	3.6	applications:	
Individual study								hours
Manual, lecture material and notes, bibliography								6
Supplementary study in the library, online and in the field								4
Preparation for seminars/laboratory works, homework, reports, portfolios, essays								6
Tutoring								2
Exams and tests								4
Other activities								0
3.7	Total hours of individual study		22					
3.8	Total hours per semester		50					
3.9	Number of credit points		2					

4. Pre-requisites (where appropriate)

4.1	Curriculum	Strength of materials
4.2	Competence	-

5. Requirements (where appropriate)

5.1	For the course	Video-projector, blackboard.
5.2	For the applications	Video-projector, computer lab classrooms.

6. Specific competences

Professional competences	<p>After completing the discipline, students should know:</p> <ul style="list-style-type: none"> -- Specific terminology, concepts, and basic principles of the Finite Element Method (FEM). -- Finite element types/categories. -- How to use structural analysis programs based on FEM. <p>After completing the discipline, students will be able to:</p> <ul style="list-style-type: none"> -- Understand and use in a proper manner the specific terminology of FEM. -- Choose/use correctly the types of finite elements in modelling a structure. -- Correctly understand the obtained results from a numerical analysis. -- Compare the obtained results with the results obtained from other experimental or analytic analyses.
Cross competences	-- Conception, development of a numerical model in a structural analysis program.

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

7.1	General objective	Understanding the basics and applying the Finite Element Method (FEM) in structural analysis.
7.2	Specific objectives	Structural analysis using commercial software packages (SAP2000, Robot Structural Analysis, Etabs, etc.).

8. Contents

8.1. Lecture (syllabus)	Teaching methods	Notes
C1. Basics of the Finite Element Method (FEM). Introduction. The concept of FEM. Finite elements and nodes. Mesh generation for 2D (and 3D) domains.	Theoretical presentation	-
C2. Mathematical formulation of the FEM. Stiffness method: Direct Approach, Variational Approach.		
C3. Derivation of the stiffness matrix for a bar / truss element, beam-column element. Assembly of the global stiffness matrix.		
C4. Derivation of the stiffness matrix for a bar / truss element, beam-column element. Assembly of the global stiffness matrix.		
C5. Nodal displacements determination of a truss structure through FEM: example.		
C6. 1D/2D finite elements: truss element connected to a plane element – stiffness matrix determination (basic notions)		
C7. Exam.		
Bibliography		
Bibliography		
1. BIA C., ILLE V., SOARE M.V. - Rezistenta materialelor si Teoria elasticitatii, E.D.P. ,1983.		

2. PANTEL E., BIA C. - Metode numerice in proiectare - Metoda Elementelor Finite - Litografia UTC-N, 1992		
3. CHIOREAN, C.G., http://bavaria.utcluj.ro/~ccosmin – GFAS - Manuale de utilizare, 2009.		
4. CHIOREAN, C.G., http://bavaria.utcluj.ro/~ccosmin : Metoda elementului finit. Note de curs online.		
5. CHIOREAN, C.G.,-Aplicatii software pentru analiza neliniara a structurilor in cadre, Ed. UTPRES, 2006.		
6. PACOSTE, C., STOIAN, V., DUBINA, D. - Metode moderne in mecanica structurilor, Ed. Stiintifica si Encicolpedica, Bucuresti, 1988.		
7. PASCARIU I. - Elemente finite. Concepte-Aplicatii - Ed.Militara, 2006.		
8. BATHE K-J. - Finite Element Procedures - Prentice Hall,2007.		
9. ZIENNKIEVICZ, O.C. - The finite element method - Mc-Graw Hill, 2004.		
8.2. Applications/Seminars	Teaching methods	Notes
L1. Introduction. Basic notions about the modelling process (materials, geometry, etc.).	Presentation, discussions by means of using the software applications.	-
L2. 1D / 2D finite elements: element definition, mesh generation, etc.		
L3. Displacement assessment of a 1D elements structure using various mesh sizes. Results comparison.		
L4. Displacement/stress assessment of a 2D elements structure using various mesh sizes. Results comparison.		
L5. Numerical modelling of a complex structure using 1D and 2D elements: displacement/stress assessment.		
L6. Numerical modelling of a complex structure using 1D and 2D elements: displacement/stress assessment.		
L7. Exam.		
Bibliography		
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1. BIA C., ILLE V., SOARE M.V. - Rezistenta materialelor si Teoria elasticitatii, E.D.P. ,1983.		
2. PANTEL E., BIA C. - Metode numerice in proiectare - Metoda Elementelor Finite - Litografia UTC-N, 1992		
3. Computers and Structures, Inc. CSI Analysis Reference Manual (SAP2000). Berkeley, 2011		
4. PACOSTE, C., STOIAN, V., DUBINA, D. - Metode moderne in mecanica structurilor, Ed. Stiintifica si Encicolpedica, Bucuresti, 1988		

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

Skills acquired in this class are useful in structural analysis of buildings in specialised design companies for civil engineering.

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	Solving four or five theoretical subjects.	Written exam (1h max.).	40%
10.5 Applications	Completion of a project during the semester that will involve analyzing a structure composed of bar-type FE using the Finite Element Method (FEM) principles, respectively solving a structure (2D or 3D) using a structural analysis software package.	Oral exam/discussion: project presentation (5-10 min for each candidate).	60%
10.6 Minimum standard of performance			
Closed book exam. To receive the credits the grade should be > 50% for each exam component (course / laboratory).			

Date of filling in:		Title Surname Name	Signature
	Lecturer	Sl.Dr.Ing. Botez Mircea Daniel	
	Teachers in charge of application	Sl.Dr.Ing. Botez Mircea Daniel	

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	