

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	Structural Mechanics
1.4	Field of study	Civil Engineering
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	CCIA English/Engineer
1.7	Form of education	Full time
1.8	Subject code	36.00

2. Data about the subject

2.1	Subject name				Statics and stability of constructions II			
2.2	Subject area				Fundamental of structural analysis			
2.3	Course responsible/lecturer				Prof. dr .ing. Mircea Petrina/Asist. ing.Moldovan Ilinca			
2.4	Teachers in charge of seminars				Asist. ing.Moldovan Ilinca			
2.5	Year of study	III	2.6 Semester	1	2.7 Assessment	Exam	2.8 Subject category	DID/DI

3. Estimated total time

3.1	Number of hours per week	5	3.2 of which, course:	3	3.3 applications:	2
3.4	Total hours in the curriculum	70	3.5 of which, course:	42	3.6 applications:	28
Individual study						hours
Manual, lecture material and notes, bibliography						28
Supplementary study in the library, online and in the field						12
Preparation for seminars/laboratory works, homework, reports, portfolios, essays						28
Tutoring						6
Exams and tests						6
Other activities						6
3.7	Total hours of individual study	80				
3.8	Total hours per semester	150				
3.9	Number of credit points	6				

4. Pre-requisites (where appropriate)

4.1	Curriculum	Courses of Mechanics, Strength of Materials, Statics I
4.2	Competence	Structural Calculation Models, and Fundamental Techniques for Analyzing Statically Determinate Structures.

5. Requirements (where appropriate)

5.1	For the course	Use also Microsoft TEAMS
5.2	For the applications	Use also Microsoft TEAMS, MATHCAD, MatLab

6. Specific competences

Professional competences	<p>Theoretical knowledge includes:</p> <ul style="list-style-type: none"> • Applying building and design codes to established loads. • Idealizing structures by creating simplified physical models of the structure, its supports, and the applied loads. • Evaluating the determinacy, indeterminacy, and stability of structures. • Creating free body diagrams. • Develop equilibrium and continuity equations. • Employing general methods of analysis for statically indeterminate structures. • Writing expressions for internal forces at any section in terms of external loads. • Constructing internal force diagrams. • Sketching the deflected shapes of loaded beams and frames. • Positioning live loads to maximize certain types of forces at designated sections of a structure. • Performing approximate analysis of frames and wall structures. • Conducting plastic analysis of continuous beams and frames. • Using strut-and-tie models in reinforced concrete structures (B- and D-regions). • Applying Computer Structural Analysis.
Cross competences	<p>The structural engineer collaborates closely with other engineers and architects, ensuring the creation of a structural system that aligns with various architectural designs. They size the structural elements to assess feasibility and estimate construction costs. Additionally, many structural engineers are involved in research.</p>

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

7.1	General objective	Students must master fundamental concepts to apply them to problem-solving using classical methods, which focus on specific modes of structural response and behavior, before advancing to more general matrix methods. Structural analysis trains students to determine a structure's response to specified loads and actions by establishing internal forces and deformations throughout the structure.
7.2	Specific objectives	The engineer will need to make numerous technical decisions regarding the structural system, including selecting an efficient, economical, and aesthetically pleasing structural form, evaluating its safety (in terms of stiffness and strength), and planning its erection under temporary construction loads.

8. Contents

8.1. Lecture (syllabus)		Teaching methods	Notes
1.	Elastic and linear elastic assumptions; principle of superpositions. Terms relating to actions, structural analysis and material property.	Lecture with discussions	

	Free body diagram. Deflections of Beams, Trusses and Frames. Work-Energy Method for Computing Deflections		
2.	Analysis of indeterminate structures by the flexibility (Forced) method: concept of a redundant, fundamentals of flexibility method.		
3.	Analysis of indeterminate structures by the flexibility method: support settlements, nonlinear temperature change and fabrication errors; continuous beams: three-moment equation; beam on elastic supports.		
4.	Analysis of indeterminate structures by the flexibility method: Truss structures, Arches, Plane structures loaded normal to their plane.		
5.	Analysis of indeterminate beams and frames by the Slope-Deflection Method and by Displacement Method: Beam Column Connections, Kinematic Indeterminacy. Analysis of structures without sidesway and analysis of structures that are free to sidesway.		
6.	Moment Distribution (Hardy Cross Procedure): frames without sidesway and frames with sidesway.		
7.	General Moment Distribution: temperature change (linear and nonlinear), elastic supports, support settlements, fabrication errors. Analysis of effects of displacements at the coordinates.		
8.	Approximate analysis of indeterminate structures: approximate analysis of a multistory rigid frame for given loads, analysis of unbraced frames for lateral loads by portal and cantilever method.		
9.	Influence lines for indeterminate structures: construction of influence lines using Muller-Breslau Principle. Qualitative influence lines for beams and frames. Influence lines for continuous beams, (forced method, moment distribution). Live load patterns to maximize forces in multistory buildings		
10.	Global analysis of wall structures. Single-Level Structures		
11.	Global analysis of wall structures. Multi-Storey Structures Outrigger-braced: High-rise buildings.		
12.	Plastic analysis of continuous beams and frames		
13.	Strut-and-tie models in reinforced concrete structures (B- and D-regions). Applications		
14.	Computer analysis of framed structures (element stiffness matrices, transformations matrices, equilibrium equations).		
8.2. Applications/Seminars		Teaching methods	Notes
1.	Slope Deflection Equation. Self Learning Exercise (SLE)	Problems solving	

2.	Analyzing the Beam Using the Forth Order Diferential Equation (Fixed End Moments="FEM")	with discussions, followed by SLE	
3.	The effect of Nonlinear Temperature Variation		
4.	Concrete Beam Deflection (Mathcad Application)		
5.	Flexibility method: Truss structures, Arches, Plane structures loaded normal to their plane.		
6.	First laboratory evaluation.		
7.	Slope-deflection method: frames with sidesway		
8.	Displacement Method Applications		
9.	Analysis of a Chimney Braced with Prestressed Tie Rods		
10.	General Moment Distribution (frames with sidesway): elastic supports, support settlements, fabrication errors.		
11.	Second laboratory evaluation. Influence Lines for a Continuous Beam.		
12.	Incremental Method for Rigid Plastic Analysis		
13.	Analysis of Shear-Wall Structures: Curved Bridge Deck		
14.	Third laboratory evaluation Analysis of a Prestressed Continuous Beam		

Bibliography

1. White, R.N., Gergely, P., Sexsmith, R.G., Structural Engineering, volume 1 and 2, John Wily&Sons, NY., 1976.
2. West,H.H., Fundamental of Structural Analysis, John Wily&Sons, NY., 1993.
3. Kassimali, A., Structural analysis, PWS-KENT publishing Co., Boston, 1993.
4. Gali, A., Neville, A.M., Structural Analysis-a unified classical and Matrix Approach, E&FN Spon , London, 1997.
5. Catarig, Al, Petrina, M., Statica Constructiilor-Metode de calcul si aplicatii, Ed. Dacia, Cluj-Napoca, 1991.
6. Mazilu, P., Statica Constructiilor, vol. 1 and 2, Ed. Tehnica, Bucuresti, 1955, 1959.
7. Catarig, Al, s.a., Statica Constructiilor(Teorie si aplicatii)- Structuri static determinate, Vol.1. Editura U.T.Pres, Cluj-Napoca,2003.

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

Acquired skills will be needed for civil engineers who work in design and buildings firms, and are fundamental for those who will follow master and doctoral programmes in the field of Civil Engineering.

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
Course	2 theory subjects	Written examination	25%
Applications	2 problems	Written examination	30%
Laboratory works (three evaluations), solving and submitting homework (30%+15%) =45%			

10.4 Minimum Standard of Performance To meet the minimum performance standards, students must achieve an average mark of at least 5 (five) in laboratory evaluations, as well as in two theory subjects and two problem sets. Attendance at laboratory sessions and meeting the minimum average mark are prerequisites for taking the final examination. Additionally, completing and submitting 12 homework assignments is mandatory in accordance with the ECTS Regulation.
10.5. In the week immediately following each laboratory application evaluation, students who were absent or wish to improve their grades can make up the evaluation. The make-up will take place outside of class or laboratory hours, on a day and time agreed upon by the students and the professor.

Date of filling in: 10.07.2025		Title Surname Name	Signature
	Lecturer	Prof. emerit dr. ing. Mircea Petrina	
	Teachers in charge of application	Prof. emerit dr. ing. Mircea Petrina	

Date of approval in the department 19/06/ 2025	Head of department Conf.dr.ing. Anca Gabriela Popa
Date of approval in the faculty 25.06.2025	Dean Prof.dr.ing. Daniela Lucia Manea