

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	37.0

2. Data about the subject

2.1	Subject name				Dinamica constructiilor						
2.2	Course responsible/lecturer				Prof.Dr.Ing. Alexa Pavel-Pavel.Alexa@mecon.utcluj.ro						
2.3	Teachers in charge of seminars				Sl.Dr.Ing. Prodan Ovidiu-Ovidiu.Prodan@mecon.utcluj.ro						
2.4	Year of study	3	2.5	Semester	1	2.6	Assessment	E	2.7	Subject category	DID/DI

3. Estimated total time

3.1	Number of hours per week	3	3.2	of which, course:	2	3.3	applications:	
3.4	Total hours in the curriculum	42	3.5	of which, course:	28	3.6	applications:	
Individual study								hours
Manual, lecture material and notes, bibliography								30
Supplementary study in the library, online and in the field								10
Preparation for seminars/laboratory works, homework, reports, portfolios, essays								28
Tutoring								6
Exams and tests								11
Other activities								0
3.7	Total hours of individual study		69					
3.8	Total hours per semester		125					
3.9	Number of credit points		5					

4. Pre-requisites (where appropriate)

4.1	Curriculum	Mechanics of Structures I & II Differential Equations Structural Analysis
4.2	Competence	Să formuleze și să rezolve ecuații diferențiale simple. / Ability to formulate and solve simple differential equations. Să utilizeze concepte de algebră liniară (valori și vectori proprii). / Ability to apply linear algebra concepts (eigenvalues and eigenvectors). Să realizeze schematizarea structurilor și formularea ecuațiilor de echilibru. / Ability to perform structural idealization and formulate

		<p>equilibrium equations.</p> <p>Capacitate de gândire critică și de interpretare a modelelor de calcul. / Critical thinking skills and the ability to interpret computational models.</p>
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5. Requirements (where appropriate)

5.1	For the course	<p>Săli de curs moderne, dotate cu videoproiector, tablă interactivă și infrastructură pentru înregistrarea/streamingul prelegerilor. / Modern lecture halls equipped with video projector, interactive board, and infrastructure for recording/streaming lectures.</p> <p>Acces la platforme de e-learning pentru distribuirea materialelor și colectarea temelor. / Access to e-learning platforms for distributing materials and submitting assignments.</p> <p>Utilizarea de software specializat (MATLAB, SAP2000, ETABS, OpenSees) pentru demonstrații și exemple aplicative. / Use of specialized software (MATLAB, SAP2000, ETABS, OpenSees) for demonstrations and applied examples.</p> <p>Promovarea învățării active prin discuții, exerciții interactive și studii de caz. / Active learning promoted through discussions, interactive exercises, and case studies.</p>
5.2	For the applications	<p>Laboratoare dotate cu calculatoare performante și licențe pentru programe de analiză structurală. / Laboratories equipped with high-performance computers and licenses for structural analysis software.</p> <p>Acces la echipamente experimentale (shake table, accelerometre, senzori) pentru demonstrații practice. / Access to experimental equipment (shake table, accelerometers, sensors) for practical demonstrations.</p> <p>Posibilitatea utilizării datelor experimentale și a bazelor de date internaționale în analiza proiectelor. / Possibility to use experimental data and international databases in project analysis.</p> <p>Spații pentru lucru în echipă și consultanță cu cadrele didactice. / Dedicated spaces for teamwork and consultation with instructors.</p>

6. Specific competences

Professional competences	<ol style="list-style-type: none"> 1. Thinking structural behaviour in motion 2. Engineering concepts of motion, of inertia and damping 3. Dynamic system of Civil Engineering structures under dynamic loads 4. Study of Natural Modes of vibrations 5. Computation of Dynamic response to several types of loads
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Cross competences	1. Perception of structures as masses in motion 2. Allotting degrees of freedom to structures under dynamic forces 3. Decomposition and synthesis of natural modes of vibrations 4. A general view of dynamic response in terms of associated static response
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7. Discipline objectives (as results from the *key competences gained*)

7.1	General objective	Structural Dynamics as the continuation of (static) structural analysis under dynamic loads
7.2	Specific objectives	Free vibrations Natural modes of vibrations Dynamic response

8. Contents

8.1. Lecture (syllabus)	Teaching methods	Notes
Elastic state expressed via stiffness and flexibility (coefficients, matrices)	-	-
Free vibrations of undamped SDOF systems		
Forced vibrations of undamped SDOF systems		
Damping. Influence of linear viscous damping on free vibrations of SDOF systems		
Influence of linear viscous damping on forced vibrations of SDOF systems		
MDOF dynamic systems. Degrees of freedom, matrix of inertia, stiffness matrix		
Condensation of stiffness matrix		
Analytical model of vibrations of MDOF systems. Short introduction into matriceal Calculus		
General solution of problem of eigen problems. Eigen values, eigen vectors		
Natural modes of vibrations of MDOF systems		
Computation of natural modes of vibrations via matriceal iteration		
Dynamic response of MDOF systems		
Introduction in Seismic Engineering		
Seismic response of SDOF and MDOF systems		
Bibliography		
Dynamics of structures - by Ail Chopra 5th edition		
Solution manual dynamics of structures - by Anil Chopra		
8.2. Applications/Seminars	Teaching methods	Notes
Short review of degrees of freedom of structures. Lumped masses. Dynamic actions	-	-
Stiffness and flexibility coefficients		
Free vibrations of SDOF systems		

Dynamic response of SDOF systems		
Damped dynamic response of SDOF systems		
Free vibrations of MDOF systems. Natural modes of vibrations.		
Flexibility matrix of given structure		
Stiffness matrix of individual structure		
Condensation of stiffness matrix		
Computation of natural modes via matrix iteration		
Computation of natural modes of vibrations via matriceal iteration		
Computation of dynamic response in bending moments		
Computation of seismic response		
Individual test		
Bibliography		

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

Dynamics of structures is the subject that asks the students to approach Civil Engineering structures as systems in motion and provides the students with adequate means to solve / to compute the dynamic response of usual Civ. Eng. structures.

Seismic engineering part introduce seismic action as a dynamic load and provide solutions to compute seismic response.

Dynamics (including its ‘‘seismic part’’) requires the students and helps them in the professional activity of conceiving adequate structures and solving the problems brought about by their dynamic behaviour.

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	Ability to approach and model dynamic state of engineering systems	Exam - written papers (T)	T = 40%; Q = 15% T = Theory Exam; Q = Quiz after each lecture
10.5 Applications	Ability to generate and apply dynamic and associated mathematical models of Civ. Eng. structural systems.	Exam - written papers (Ap) and Oral examination	A = 10%; P = 35% A = Exam Application; P = Project during semester
10.6 Minimum standard of performance			
Minimum 5 for individual subject.			
Weekly intermediate submissions of the project.			
Oral submission of the full project.			

Date of filling in:		Title Surname Name	Signature
	Lecturer	Prof.Dr.Ing. Alexa Pavel	
	Teachers in charge of application	Sl.Dr.Ing. Prodan Ovidiu	

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 Manea