

## 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	Structuri
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	45.0

### 2. Data about the subject

2.1	Subject name				Inginerie seismica						
2.2	Course responsible/lecturer				Prof.Dr.Ing. Nagy Zsolt-Zsolt.Nagy@dst.utcluj.ro						
2.3	Teachers in charge of seminars				Sl.Dr.Ing. Faur Andrei-Andrei.FAUR@dst.utcluj.ro						
2.4	Year of study	3	2.5	Semester	2	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						18
Supplementary study in the library, online and in the field						3
Preparation for seminars/laboratory works, homework, reports, portfolios, essays						7
Tutoring						2
Exams and tests						3
Other activities						0
3.7	Total hours of individual study		33			
3.8	Total hours per semester		75			
3.9	Number of credit points		3			

### 4. Pre-requisites (where appropriate)

4.1	Curriculum	Strength of Materials, Statics and dynamics of constructions
4.2	Competence	N/A

### 5. Requirements (where appropriate)

5.1	For the course	Cluj-Napoca, str. Barițiu, Nr. 25 – Room with video-projector
5.2	For the applications	Cluj-Napoca, str. Barițiu, Nr. 25 – Room 157

## 6. Specific competences

Professional competences	<ul style="list-style-type: none"> <li>-- To determine seismic response for different structural systems - methods with minimal character, mandatory standards;</li> <li>-- To understand the methods of seismic analysis for structures;</li> <li>-- To know the overall seismic principles governing the conceptual design against seismic hazard;</li> <li>-- To use data from engineering seismology - the seismic response calculations;</li> <li>-- To determine the relative story drifts and be able to decide if needed second order calculation;</li> <li>-- To be able to apply torque effect (simplified method) ;</li> <li>-- To choose a system of passive seismic response control.</li> </ul>
Cross competences	<ul style="list-style-type: none"> <li>-- Linking knowledge of design calculation and construction erection with the results of the structural seismic analysis;</li> <li>-- Application of the engineering seismology data;</li> <li>-- Drafting and presentation of a technical report including design calculation for the seismic response of a building structure.</li> </ul>

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

7.1	General objective	To achieve skills in earthquake design and seismic protection of building structures in the context of sustainable development
7.2	Specific objectives	Specific skills in the analysis and conceptual EQ design: <ul style="list-style-type: none"> <li>- Seismic response of building structures</li> <li>- Structural and non-structural systems in seismic areas</li> <li>- Conception of seismic protection systems</li> </ul>

## 8. Contents

8.1. Lecture (syllabus)	Teaching methods	Notes
1. Introduction in earthquake engineering	-	-
2. Structural dynamics -SDOF		
3. Structural dynamics -forced vibrations		
4. Seismic spectres		
5. Dynamic response of inelastic systems		
6. Systems with MDOF		
7. Damped systems with MDOF / Modal analysis		
8. Design of structures to EQ actions		
9. Structural configuration for EQ actions		
10. Ductility concept in structural design		
11. EQ design of steel structures		
12. EQ design of concrete structures		
13. Performance-based design in earthquake engineering		
14. Case studies		
Bibliography		
References		
Chopra, A. (2001). "Dynamics of Structures: Theory and Applications to Earthquake Engineering", Prentice-Hall, Upper Saddle River, New Jersey. ISBN 0-13-086973-2		
EN 1998-1 (2004). "Design of structures for earthquake resistance. Part 1: General rules, seismic actions and rules for buildings". CEN - European Committee for Standardization		
P100-1 (2013). "Cod de proiectare seismică - Partea I - Prevederi de proiectare pentru clădiri". Monitorul Oficial, Partea I nr. 558 bis din 03.09.2013		

8.2. Applications/Seminars	Teaching methods	Notes
Evaluation of the base shear load $F_b$ according to P100-2013 Code, The procedure of equivalent static force applied for a cantilever roof structure, covering a platform in a railway station.	-	-
The seismic force on transversal direction for an industrial building. To resolve the seismic response in acceleration, velocity and displacement using the $\beta$ -Newmark method and a time-history analysis (SAP2000 or ROBOT), using the accelerogram E-V Vrancea 1977. To present the graphs of seismic response for the $\beta$ -Newmark method and time history analysis results.		
To compute the seismic load according to P100 - 2013 Code, the procedure of equivalent lateral force (hand calculation) for a 6 story residential building. The structure has transversal and longitudinal frames of reinforced concrete.		
The modal response spectrum analysis of the structure (SAP2000)		
The lateral displacement check		
Seismic compliance of the structure and structural elements		
The seismic response in acceleration, velocity and displacement for a SDOF system (single story framework model) subjected to unidirectional translation - experimental analysis on shaking table.		
11. EQ design of steel structures		
Bibliography		
Bibliography		
1. Verdeş Doina, Bompa Dan, Bindea Mihai – Metode de calcul si experimentare in proiectarea seismica, UT-PRESS Cluj-Napoca, 2013.		
2. Tudor Postelnicu, Proiectarea structurilor de beton armat în zone seismice, editura MarLink, Bucureşti, 2012.		
3. P100-1/2013.		
4. EC8.		

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

Accumulated skills will be necessary for those employees who will be involved in private or public institutions activities dealing with construction works, project management or quality assurance for residential or industrial constructions

**10. Evaluation**

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	Questionnaire with 30 questions	Min. 15 correct answers	60%
10.5 Applications	Laboratory papers evaluation	Oral test – compulsory condition to the exam entrance	40%
10.6 Minimum standard of performance			

•  $T=(30 \times 0.3)/2+1 \geq 5$ ; Applications:  $L=(L1+L2+L3+L4)/4 \geq 5$ ; Final:  $F=0,6 \times T+0,4 \times L \geq 5$

Date of filling in:		Title Surname Name	Signature
	Lecturer	Prof.Dr.Ing. Nagy Zsolt	
	Teachers in charge of application	Sl.Dr.Ing. Faur Andrei	

Date of approval in the department .....	Head of department
18/06/2025	conf.dr.ing. Attila Puskas
Date of approval in the faculty .....	Dean
25/06/2025	prof.dr.ing Daniela MANEA