



# 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	Structures
1.4	Field of study	Civil Engineering
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Civil Engineering
1.7	Form of education	Full time
1.8	Subject code	51.00

## 2. Data about the subject

2.1	Subject name	Reinforced Concrete Structures II.									
2.2	Subject area	Civil Engineering									
2.3	Course responsible/lecturer	Assoc.Prof, Attila PUSKAS, PhD									
2.4	Teachers in charge of seminars	Teach.assist. Jacint Virag, eng.									
2.5	Year of study	IV	2.6	Semester	2	2.7	Assessment	Exam	2.8	Subject category	DS/DOB

## 3. Estimated total time

3.1	Number of hours per week	2	3.2	of which, course:	2	3.3	applications:	3
3.4	Total hours in the curriculum	70	3.5	of which, course:	28	3.6	applications:	42
Individual study								hours
Manual, lecture material and notes, bibliography								28
Supplementary study in the library, online and in the field								14
Preparation for seminars/laboratory works, homework, reports, portfolios, essays								28
Tutoring								2
Exams and tests								4
Other activities								-
3.7	Total hours of individual study	60						
3.8	Total hours per semester	130						
3.9	Number of credit points	5						

## 4. Pre-requisites (where appropriate)

4.1	Curriculum	N/A
4.2	Competence	Reinforced and Prestressed Concrete II, Reinforced Concrete Structures I.

## 5. Requirements (where appropriate)

5.1	For the course	N/A
5.2	For the applications	N/A



## 6. Specific competences

Professional competences	<p>The student shall be familiar with reinforced concrete structural systems for single-story and multi-story building</p> <p>The student shall be able to use the up to date design norms and standards</p> <p>The student shall be familiar with the design tools and software used on the field</p>
Cross competences	<p>Responsible fulfilment of the professional duties, as autonomous entity but under qualified assistance</p> <p>Applying of the efficient and responsible strategies for consequent work, understanding the sense of the personal responsibility for achieving the result</p> <p>Acquaintance with the different roles, tasks and levels in a teamwork, establishing the proper strategies and attitudes</p> <p>Understanding the need for continuous learning, for efficient use of the available resources and techniques</p>

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

7.1	General objective	Design, control and realization of reinforced concrete structures built up by slabs, beams, columns and walls
7.2	Specific objectives	<p>Designing a multi-storey reinforced concrete frame structure</p> <p>Impact of the earthquake on the structure conformation</p> <p>Understanding the tolerances and deviations in reinforced concrete structures</p>

## 8. Contents

8.1. Lecture (syllabus)		Teaching methods	Notes
1.	RC columns - I: definition, structural solutions, mechanical behavior	Exhibit, discussions, case studies	Video-projector, design software
2.	RC columns - II: design, prescriptions		
3.	RC arches: structural solutions, design and detailing		
4.	RC frames - I: classification, structural solutions		
5.	RC frames - II: the influence of joints, member rigidity and rotation of foundations		
6.	Cast in place RC frames I: design and structural solutions for single level frames		
7.	Cast in place RC frames II: design and structural solutions for multilevel frames		
8.	Cast in place RC frames III: detailing and reinforcing		
9.	Prefabricated RC frames I: detailing and structural solutions for single level frames		
10.	Prefabricated RC frames II: detailing and structural solutions for multilevel frames		
11.	Prefabricated RC frames III: specific design issues		
12.	RC frames: design of joints, ductility conditions		
13.	Tubular structures		
14.	Sustainability of RC structures		



**Bibliography**

- Hangan N.: Construcții de beton armat, Editura Tehnică, București, 1963
- Ionescu A., Mircea C.: Manual pentru proiectarea plăcilor plane dreptunghiulare din beton armat, Editura Risoprint, Cluj-Napoca, 1998
- Mihailescu M, ș. a.: Construcții de beton armat și precomprimat, Partea I, Structuri liniare, Institutul Politehnic Cluj-Napoca, 1983
- Mihul A.: Construcții de beton armat, Editura Tehnică, București, 1980
- Mârșu O., Friedrich R.: Construcții de beton armat, Editura Tehnică, București, 1985
- Terteia I. ș. a.: Proiectarea betonului precomprimat vol. I, Universitatea Tehnică Cluj-Napoca, 1986
- C. Mircea: Înelători subțiri din beton armat - Abordarea în element finit., Ediție bilingvă engleză-română, Editura U.T.PRES, Cluj-Napoca, 2000
- C. Mircea, G. Petrovay, H. Nicoară : Calculul nelinier al elementelor de beton armat și precomprimat, Editura NAPOCA STAR, Cluj-Napoca, 2004
- A. Faur, A. Puskas, Moment plastic, moment ultim, moment capabil, Editura U.T.Press, 2014
- H. Bachmann, A. Steinle, V. Hahn, Bauen mit Betonfertigteilen im Highbau, Ernst&Sohn, 2010
- T. Draycott, P. Bullman, Structural elements design manual: Working with Eurocodes, Elsevier, 2009
- S.S.Ray, Reinforced Concrete Analysis and Design, Blackwell Science Ltd., 1995
- P100-1/2013: Cod de proiectare seismică — Partea I — Prevederi de proiectare pentru clădiri
- SR EN 1990-2004: Bazele proiectării structurilor
- SR EN 1992-1-1. Eurocod 2: Proiectarea structurilor de beton, 2004
- SR EN 1991-1-1-2004: Acțiuni asupra structurilor

8.2. Applications/Seminars		Teaching methods	Notes
1.	Launching design theme: designing a multi-story reinforced concrete frame building. Presentation of the structure.	Exhibit, discussions, practice	Video- projector, FEM and CAD software,
2.	Interactive process for establishing and compiling floor, roof and wall subassemblies. Pre-dimensioning of horizontal structural elements.		
3.	Assessing wind and snow loads.		
4.	Evaluating the value of the seismic base shear value. Load cases.		
5.	Pre-dimensioning of columns. Setting the design simplifications and axes of the structure.		
6.	Presentation method of the FEM calculation model. Static calculation of the structure – example presentation.		
7.	Detailing rules for reinforced concrete slabs.		
8.	Detailing rules for reinforced concrete beams.		
9.	Ductility provisions for reinforced concrete frame structures.		
10.	Design of longitudinal reinforcements in beams. Ultimate bending moments. Shear design.		
11.	Design of longitudinal reinforcement in columns. Ultimate bending moments. Shear design		
12.	Detailing rules for concrete columns.		



13.	Formwork plan and reinforcement plan. Reinforcement drawing details.		
14.	Bill of quantities. Project evaluation.		
<b>Bibliography</b> <ul style="list-style-type: none"> <li>- Agent R., Dumitrescu D., Postelnicu D.: Îndrumător pentru calculul și alcătuirea elementelor de beton armat, Editura Tehnică, București, 1992</li> <li>- Z. Kiss, T. Oneț – Proiectarea structurilor de beton după SR – EN 1992-1, Abel 2008</li> <li>- A. Puskas, V. Jacint, A. Faur, Îndrumător pentru proiectarea structurilor în cadre din beton armat. Clasa de ductilitate medie, Editura U.T. Press, 2015</li> <li>- T. Draycott, P. Bullman, Structural elements design manual: Working with Eurocodes, Elsevier, 2009</li> <li>- J. Calavera, Manual for detailing reinforced concrete structures to EC2, Spoon Press, 2011</li> <li>- NE 012-1: 2007: Normativ pentru producerea betonului și executarea lucrărilor din beton, beton armat și beton precomprimat. Partea 1: producerea betonului</li> <li>- NE 012/2 - 2010: Normativ pentru producerea betonului și executarea lucrărilor din beton, beton armat și beton precomprimat. Partea 2: Executarea lucrărilor din beton</li> <li>- NE 013-2002: Cod de practică pentru execuția elementelor prefabricate din beton, beton armat și beton precomprimat</li> <li>- P100-1/2013: Cod de proiectare seismică — Partea I — Prevederi de proiectare pentru clădiri</li> <li>- SR EN 1990-2004: Bazele proiectării structurilor</li> <li>- SR EN 1992-1-1. Eurocod 2: Proiectarea structurilor de beton, 2004</li> <li>- SR EN 1991-1-1-2004: Acțiuni asupra structurilor</li> <li>- SR EN ISO 3766:2002 ver.eng. (Superseded Standard): Construction drawings - Simplified representation of concrete reinforcement (ISO 3766:1995)</li> </ul> <b>Virtual didactic materials</b> <ol style="list-style-type: none"> <li>1. SAP software package</li> <li>2. MS Office package</li> </ol>			

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

The accumulated knowledge consists a necessary package for the civil engineers on the construction market, as designer, consultant, project manager or site engineer, in private or public sector, for residential, public, agricultural or industrial projects

## 10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
Course	Solving a numerical problem and responding for 4÷5 theoretical question	Written testing – 1.5 hour evaluation	70%
Applications	Design application	Practical testing – evaluation of the design project (1/2 hour)	30%
10.4 Minimum standard of performance			
Successful submittal of the project, solving the numerical problem and responding for 2 theoretical questions			



Date of filling in	Teachers in charge	Title surname NAME	Signature
28.09.2019	Course	Conf.dr.ing. Attila PUSKAS	
	Applications	Assist.ing. Jacint VIRAG	

Date of approval in the department .....	Head of department Conf.dr.ing. Attila Puskas
_____	
Data of approval in Faculty Council	Dean Conf.dr.ing. Nicolae Chira