

## 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	31.0

### 2. Data about the subject

2.1	Subject name				Beton armat si precomprimat I						
2.2	Course responsible/lecturer				Sl.Dr.Ing. Olar Radu-Ioan-Radu.Olar@dst.utcluj.ro						
2.3	Teachers in charge of seminars				Asist.Dr.Ing. Moldovan Dumitru Vasile-Dumitru.Moldovan@dst.utcluj.ro						
2.4	Year of study	2	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	5	3.2	of which, course:	3	3.3	applications:	
3.4	Total hours in the curriculum	70	3.5	of which, course:	42	3.6	applications:	
Individual study								hours
Manual, lecture material and notes, bibliography								20
Supplementary study in the library, online and in the field								10
Preparation for seminars/laboratory works, homework, reports, portfolios, essays								20
Tutoring								2
Exams and tests								3
Other activities								0
3.7	Total hours of individual study			55				
3.8	Total hours per semester			125				
3.9	Number of credit points			5				

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

4.1	Curriculum	
4.2	Competence	The strength of materials and static knowledges.

### 5. Requirements (where appropriate)

5.1	For the course	
5.2	For the applications	

## 6. Specific competences

Professional competences	<p>C1. Recognition of the elements and structures of constructions in the field of civil engineering, specific to the study program Civil, Industrial and Agricultural Constructions.</p> <p>C1.1. Identifying the structural and functional role of the elements of a civil, industrial and agricultural construction: slabs, beams, columns.</p> <p>C1.2. Explaining the constructive composition of the different categories of civil, industrial and agricultural constructions: structural systems of reinforced concrete frames.</p> <p>C1.3. Graphic representation and modeling of different types of civil, industrial and agricultural constructions in order to prepare a specific technical documentation: graphic representation of the reinforcement carcasses of the structural elements in order to elaborate the technical project for execution.</p> <p>C1.4. Assessing the quality of a civil, industrial and agricultural construction, using evaluation criteria specific to the field: checking the load-bearing capacity and the state of deformation and cracking of the reinforced concrete elements.</p> <p>C2. Dimensioning of construction elements in the field of civil engineering specific to the study program Civil, Industrial and Agricultural Constructions.</p> <p>C2.1. Identification of construction materials and types of structures in constructions: Concrete, reinforcements, additives, finishing substances for concrete structures.</p> <p>C2.2. Description of actions and establishment of loads by correlation with location factors: evaluation of loads and exposure classes and selection of related materials.</p> <p>C2.3. Using calculation methods specific to the types of structures and methods for sizing the components of a civil, industrial and agricultural construction in order to prepare a specific technical documentation: use of calculation methods in the ultimate limit state and in the service limit state for reinforced concrete elements components of a structure, such as plates, beams and columns for the elaboration of the technical project for execution.</p> <p>C2.4. Evaluation, selection and optimal use of different materials that make up the construction elements: evaluation of the type of concrete, the type of reinforcement, the size of the elements and the amount of materials needed to withstand loads specific to the functionality and location of a civil, industrial and agricultural.</p> <p>C2.5. The use of the results of sizing calculations in the technical documents of the project for civil, industrial and agricultural constructions: elaboration of execution plans, material requirements and technical memory for the reinforced concrete elements components of a structure, such as slabs, beams and columns for elaboration of the technical project for execution.</p> <p>C3. Technological and economic design for the execution, operation and maintenance of constructions in the field of civil engineering specific to the study program Civil, Industrial and Agricultural Constructions.</p> <p>C3.1. Description of the technological processes for the realization of a civil, industrial and agricultural construction: the composition of the concrete, ways of pouring per element and per structure.</p> <p>C3.2. Explanation of the properties of construction materials, construction materials and installation technologies for civil, industrial and agricultural constructions: shrinkage and slow flow of concrete with reinforcement, mechanical strength and their assurance.</p> <p>C3.3 Design of the technological processes specific to the different phases of realization of the elements of civil, industrial and agricultural constructions in view of the execution: the phases of</p>
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	<p>realization of the prestressed concrete.</p> <p>C4. Respecting the quality and sustainable development requirements specific to a civil, industrial and agricultural construction.</p> <p>C4.1. Identification and use of technical regulations specific to a civil, industrial and agricultural construction: SR EN 1992-1-1 and National Annex, SR EN 206-1: 2004, P100: 2013, CP012: 2007, NE012-1: 2007, NE012-2 : 2010.</p> <p>C4.2. Adapting the calculation methods used in civil, industrial, and agricultural constructions to their behavioral peculiarities.</p> <p>C4.3. Respecting the principles and using the methods of composition and calculation specific to a civil, industrial and agricultural construction and the requirements identified in the preparation of technical documentation: the principle <math>R \geq A</math>, where R means resistances affected by reduction factors and A means actions affected by multiplication factors.</p> <p>C4.4. Application of the provisions of the quality standards for the design of a civil, industrial, and agricultural construction: the provisions of the standards CP012: 2007, NE012-1: 2007, NE012-2: 2010 ensure the quality of the execution of the concrete works.</p>
Cross competences	<p>T1. Responsible execution of professional tasks, in conditions of limited autonomy and qualified assistance.</p> <p>CT1. Applying efficient and responsible work strategies, punctuality, seriousness and personal responsibility, based on the principles, norms and value of professional ethics for the elaboration of technical projects.</p> <p>T2. Familiarization with the roles and activities specific to teamwork and distribution of tasks for subordinate levels.</p> <p>CT2. Applying efficient teamwork techniques, on various hierarchical levels: the best prepared will benefit by teaching the weakest by fixing knowledge and the poorest will benefit from answers to problems in a short, real time.</p> <p>T3. Awareness of the need for lifelong learning: efficient use of learning resources and techniques for personal and professional development.</p> <p>CT3. Documentation in Romanian for professional and personal development, through continuous training and efficient adaptation to the new technical specifications: continuous review of the standards in force in order to ensure all design requirements and to monitor changes in standards.</p>

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

7.1	General objective	<p>C1. Recognition of the elements and structures of constructions in the field of civil engineering, specific to the study program Civil, Industrial and Agricultural Constructions.</p> <p>C1.1. Identifying the structural and functional role of the elements of a civil, industrial and agricultural construction: slabs, beams, columns.</p> <p>C1.2. Explaining the constructive composition of the different categories of civil, industrial and agricultural constructions: structural systems of reinforced concrete frames.</p> <p>C1.3. Graphic representation and modeling of different types of civil, industrial and agricultural constructions in order to prepare a specific technical documentation: graphic representation of the reinforcement carcasses of the structural elements in order to elaborate the technical project for execution.</p>
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		<p>C1.4. Assessing the quality of a civil, industrial and agricultural construction, using evaluation criteria specific to the field: checking the load-bearing capacity and the state of deformation and cracking of the reinforced concrete elements.</p> <p>C2. Dimensioning of construction elements in the field of civil engineering specific to the study program Civil, Industrial and Agricultural Constructions.</p> <p>C2.1. Identification of construction materials and types of structures in constructions: Concrete, reinforcements, additives, finishing substances for concrete structures.</p> <p>C2.2. Description of actions and establishment of loads by correlation with location factors: evaluation of loads and exposure classes and selection of related materials.</p> <p>C2.3. Using calculation methods specific to the types of structures and methods for sizing the components of a civil, industrial and agricultural construction in order to prepare a specific technical documentation: use of calculation methods in the ultimate limit state and in the service limit state for reinforced concrete elements components of a structure, such as plates, beams and columns for the elaboration of the technical project for execution.</p> <p>C2.4. Evaluation, selection and optimal use of different materials that make up the construction elements: evaluation of the type of concrete, the type of reinforcement, the size of the elements and the amount of materials needed to withstand loads specific to the functionality and location of a civil, industrial and agricultural.</p> <p>C2.5. The use of the results of sizing calculations in the technical documents of the project for civil, industrial and agricultural constructions: elaboration of execution plans, material requirements and technical memory for the reinforced concrete elements components of a structure, such as slabs, beams and columns for elaboration of the technical project for execution.</p> <p>C3. Technological and economic design for the execution, operation and maintenance of constructions in the field of civil engineering specific to the study program Civil, Industrial and Agricultural Constructions.</p> <p>C3.1. Description of the technological processes for the realization of a civil, industrial and agricultural construction: the composition of the concrete, ways of pouring per element and per structure.</p> <p>C3.2. Explanation of the properties of construction materials, construction materials and installation technologies for civil, industrial and agricultural constructions: shrinkage and slow flow of concrete with reinforcement, mechanical strength and their assurance.</p>
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		<p>C3.3 Design of the technological processes specific to the different phases of realization of the elements of civil, industrial and agricultural constructions in view of the execution: the phases of realization of the prestressed concrete.</p> <p>C4. Respecting the quality and sustainable development requirements specific to a civil, industrial and agricultural construction.</p> <p>C4.1. Identification and use of technical regulations specific to a civil, industrial and agricultural construction: SR EN 1992-1-1 and National Annex, SR EN 206-1: 2004, P100: 2013, CP012: 2007, NE012-1: 2007, NE012-2 : 2010.</p> <p>C4.2. Adapting the calculation methods used in civil, industrial, and agricultural constructions to their behavioral peculiarities.</p> <p>C4.3. Respecting the principles and using the methods of composition and calculation specific to a civil, industrial and agricultural construction and the requirements identified in the preparation of technical documentation: the principle <math>R \geq A</math>, where R means resistances affected by reduction factors and A means actions affected by multiplication factors.</p> <p>C4.4. Application of the provisions of the quality standards for the design of a civil, industrial, and agricultural construction: the provisions of the standards CP012: 2007, NE012-1: 2007, NE012-2: 2010 ensure the quality of the execution of the concrete works.</p>
7.2	Specific objectives	<p>T1. Responsible execution of professional tasks, in conditions of limited autonomy and qualified assistance.</p> <p>CT1. Applying efficient and responsible work strategies, punctuality, seriousness and personal responsibility, based on the principles, norms and value of professional ethics for the elaboration of technical projects.</p> <p>T2. Familiarization with the roles and activities specific to teamwork and distribution of tasks for subordinate levels.</p> <p>CT2. Applying efficient teamwork techniques, on various hierarchical levels: the best prepared will benefit by teaching the weakest by fixing knowledge and the poorest will benefit from answers to problems in a short, real time.</p> <p>T3. Awareness of the need for lifelong learning: efficient use of learning resources and techniques for personal and professional development.</p> <p>CT3. Documentation in Romanian for professional and personal development, through continuous training and efficient adaptation to the new technical specifications: continuous review of the standards in force in order to ensure all design requirements and to monitor changes in standards.</p>

## 8. Contents

8.1. Lecture (syllabus)	Teaching methods	Notes
1) Introductions. Hystorical background. Materials for reinforced concrete. Compressive strength of concrete.	-	-
2) Concrete tensile strength, short and long-term deformations, reinforcements		
3) Bond, exposure classes, concrete cover		
4) Work stages of bent elements		
5) The design of singly reinforced rectangular bent sections. The calculus of resistance moment.		
6) The design of double reinforced rectangular bent sections. The calculus of resistance moment.		
7) The calculus of the geometric characteristics of the flanged beams. The design of the singly reinforced bent flanged sections. The calculus of resistance moment.		
8) Shear force I		
9) Shear force II		
10) Shear force III		
11) The torsion design for reinforced concrete elements		
12) Example of statically determined beam reinforcement analysis, design and detailning to bending moment, shear force and torsion moment.		
13) Creep.		
14) Shrinkage.		
Bibliography Bibliography In the UTC-N library 1. T. Oneț, Radu OLAR – Reinforced Concrete Handbook part.1, UT Press 2010 2. T.Oneț, R.Olar – Beton Armat, UTPress 2003 3. Z. Kiss, T. Oneț – Proiectarea structurilor de beton după SR – EN 1992-1, Abel 2008 4. G. Viorel, C. Măgureanu, Z. Kiss – Îndrumător laborator, litografie IPCN, 1983 5. C. Măgureanu, T. Oneț – Betonul, UTPres, 1996 6. T. Oneț, T. Clipii, A. Cuciureanu – Betonul structural, Editura Societatea Academică MATEIU BOTEZ, Iași 2006 7. I. Cadar, T. Clipii, A. Tudor – Beton Armat, Timișoara, 1999 8. C. Măgureanu și colectivul – Beton Armat – Îndrumător de laborator, UT Press, 2007  Virtual didactic materials 1. Movies with tests on reinforced concrete elements.		
8.2. Applications/Seminars	Teaching methods	Notes
1) 1. Work safety. Presentation of laboratory works. Making the reinforcement case for the experimental elements.	-	-
2) Establishing the concrete recipe for the experimental elements. Casting of experimental elements and related samples. (Unforming is done later by technicians)		
3) Numerical applications regarding simply supported beams: Pre-sizing and constructive provisions.		

4) Numerical applications regarding the dimensioning of the simply reinforced section of a simply supported beam and the calculation of the resistance moment.		
5) Numerical applications regarding the dimensioning of the simply reinforced section of a simply supported beam and the calculation of the resistance moment.		
6) Numerical applications regarding the dimensioning of the bent flanged section of a simply supported beam and the calculation of the the resistance moment.		
7) Test 1. 1) The dimensioning of a simply supported beam for the bending moment (static calculation, predimensioning b and h, Aseff, MRd). 2) Checking the load-bearing capacity at bending. Discussions.		
8) Numerical applications for shear reinforcement. Elements that do not require shear force calculations. Constructive provisions.		
9) Numerical applications for shear reinforcement. Elements that require shear force calculations and design.		
10) Numerical applications for shear reinforcement. Elements that require shear force calculations and design.		
11) The torsion design for reinforced concrete elements		
12) Test 2. 1) The design of a simple beam supported to shear force (static calculation, reinforcements design and constructive reinforcement). 2) Checking the load-bearing capacity to shear force. Discussions		
13) Experimental test. Physical-mechanical determinations on the concrete samples. The testing of the simply supported beam.		
14) Tests and laboratories recoveries.		
Bibliography Bibliography 1) T. Oneț, Radu OLAR – Reinforced Concrete Handbook part.1, UT Press 2010 2) EN 1992-1-1:2004 – Eurocode 2 3) EN 206 – 2002 4) Z. Kiss, T. Oneț – Proiectarea structurilor de beton după SR – EN 1992-1, Abel 2010 5) C. Măgureanu și colectivul – Beton Armat – Îndrumător de laborator, UT Press, 2007 6) C. Măgureanu, T. Oneț – Betonul, UTPres, 1996		

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

During the semester period, visits on the construction sites can be organised to present to students the practical aspects related with the execution and structural design of the structural reinforced and prestressed elements. Direct contact with the representatives of the companies is possible.

**10. Evaluation**

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	Theory questions and subjects	Onsite test duration 1 hour and 20 minutes	60%

10.5 Applications	<b>Problem solving</b> The average of test 1 and test 2 marks: (Test1+Test 2)/2	Onsite test - duration 1 hour and 20 minutes Verification during the semester, Onsite written test	20% 20%
<b>10.6 Minimum standard of performance</b> (a) Eligibility condition for the exam: attendance at laboratory work and passing the tests during the semester. (b) Tests Marks (Tes): min. 5 (five); Tes = (Test1+Test2)/2 ; Test1 min. 5 (five); Test2 min. 5 (five); Tes - It is registered in the electronic catalog (c) Problem (Pr): min. 5 (five) (d) Theory (T): min. 5 (five)  Final Mark: $E = 0.60 \cdot (T) + 0.20 \cdot (Pr) + 0.20 \cdot (Tes)$ ; E- It is registered in the electronic catalog OBS: At the final grade evaluation, the student's involvement during the semester will also be taken into account: participation in debates, scientific sessions, frequency, etc.			

Date of filling in:		Title Surname Name	Signature
	Lecturer	Sl.Dr.Ing. Olar Radu-Ioan	
	Teachers in charge of application	Asist.Dr.Ing. Moldovan Dumitru Vasile	

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