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	Mechanics of Constructions
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 (English Language)/ Engineer
1.7	Form of education	Full time
1.8	Subject code	21.00

2. Data about the subject

2.1	Subject name			STRENGTH OF MATERIALS I			
2.2	Subject area			Civil Engineering			
2.3	Course responsible/lecturer			Conf. dr. eng. Anca Gabriela Popa			
2.4	Teachers in charge of seminars			Lecturer dr. eng. Horaţiu Mociran			
2.5 Year of study	2	2.6 Semester	1	2.7 Assessment	Exam	2.8 Subject category	DD/DI

3. Estimated total time

3.1 Number of hours per week	6	3.2 of which, course:	3	3.3 applications:	3
3.4 Total hours in the curriculum	84	3.5 of which, course:	42	3.6 applications:	42
Individual study					hours
Manual, lecture material and notes, bibliography					15
Supplementary study in the library, online and in the field					10
Preparation for seminars/laboratory works, homework, reports, portfolios, essays					35
Tutoring					6
Exams and tests					-
Other activities					-

3.7	Total hours of individual study	66
3.8	Total hours per semester	105
3.9	Number of credit points	6

4. Pre-requisites (where appropriate)

4.1	Curriculum	Special Mathematics, Mechanics, Building Materials
4.2	Competence	In-depth knowledge of the disciplines mentioned above

5. Requirements (where appropriate)

5.1	For the course	Lecture room with blackboard and media devices (projector, laptop)
5.2	For the applications	Lecture room with blackboard, access to the laboratory room 14, preparation of the specimens for testing, personal scientic

		calculators, design standards/ application manual, access to computers room 306.

6. Specific competences

Professional competences	C1.1 Identification of the structural role of the elements of a building; C1.3 Graphic representation and modelling of different types of building elements and structures; C2.1 Identification of the main building materials, the main strength elements and types of structures; C2.2 Description of actions and loads specific to the strength calculation; C2.3 Use of calculation methods specific to the problems of design, verification and bearing load capacity for the main types of structural elements; C2.4 Evaluation, selection and optimal use of the main building materials, in relation to the requirements of resistance and rigidity of the elements and structures.
Cross competences	CT1. Applying efficient and responsible work strategies, promoting the requirements regarding punctuality, seriousness and personal responsibility in the engineering activity, respecting the principles and values of professional ethics; CT3. Awareness of the need for continous training and professional development by documenting the latest scientific, technical and technological develpoments in the field of civil engineering at national and international level.

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

7.1	General objective	Development of competences regarding the formulation, verification and compliance with the requirements of resistance, rigidity and stability, under economic conditions, of the elements and structures of resistance in the field of constructions.
7.2	Specific objectives	Acquiring theoretical and practical knowledge regarding the main methods and methods of calculation (design / checking / determining the capable load, the displacement state) of an element or a structure of resistance specific to civil, industrial or agricultural constructions.

8. Contents

8.1. Lecture (syllabus)	Teaching methods	Notes
1. Introduction. Fundamental elements in the study of the deformable body. Classification of the strength elements. Necessary schematization: loads and supports. Displacements and	Lecture, participative discussions,	Blackboard, projector, screen.

strains. Internal forces: stresses and internal actions.	projection of relevant cases, formulation of conclusions, establishing the limits of application of the demonstrated results.	
2. Fundamental principles in solving the problems of Strength of Materials. Diagrams of the internal actions in the case of straight bars. Differential relationships between the internal actions and loads.		
3. Mechanical properties of the materials. Stretching test for the steel. Strain – stress diagram for ductile materials. Brittle materials. Behaviour of the materials subject to other actions.		
4. Basic assumptions in Strength of Materials. Methods of calculation. Problems of Strength of Materials.		
5. Axial action: strains and stresses. Strength condition and particularization of the problems of Strength of Materials (verification / design / bearing capacity). Account for dead weight.		
6. Statically indeterminate structures subject to axial loads.		
7. Shear. The duality of the shear stresses. Riveted / bolted joints. Welded joints.		
8. Pure bending. Navier's formula.		
9. Simple bending: prismatic bars with symmetrical cross-section. Jurawsky's formula. Strength calculation of the beams.		
10. Bending of non-symmetrical cross-sections. The shear centre. Longitudinal shearing force.		
11. Bending deformations: strains and displacements. The differential equation of the deformed axis. Direct integration. Method of the conjugate beam.		
12. Free torsion of circular and ring-shaped bars. Rectangular cross-section. Thin-walled open and hollow sections.		
13. State of stresses in 3-D. Principal stresses and directions. Extreme shear stresses. State of strains in space. Generalization of Hooke's law.		
14. Plane state of stresses. Particularization for bars.		

Bibliography

In UTC-N Libraty

1. Popa, AG – Strength of Materials. Theory and Practice, part 1 (to be published in 2019).

2. Panţel, E., Ioani, A. M. - Lecţii de Rezistenţa Materialelor (I), Ed. Napoca Star, Cluj-Napoca, 2002.

3. Gere, J. - Mechanics of Materials, Fifth edition, Brooks/Cole, Pacific Grove, CA, 2001.

On-line bibliography and in others libaries

1. Curs şi probleme de Rezistenţa Materialelor de la Universitatea Wisconsin (SUA).
http://physics.uwstout.edu/statstr/Strength/index.htm

2. Curtu, I., Repanovici, D. - Mecanică şi Rezistenţa Materialelor, Vol. 1 şi 2, Ed. Infomarket, Braşov, 2000, ISBN 973-99827-7-8.

3. Simulescu, I. - Lectures in Mechanics of Materials (I), Ed. Conspress, Bucureşti, 2004, ISBN 973-7797-25-6.

8.2. Applications/Seminars	Teaching methods	Notes
1. Schematization of elements and loads. Reactions in the supports of statically determined bars.	Presentation and solving of typical problems, individual application solving, experimental testing, participative discussions	Design standards, application manual, individual scientific calculator
2. Internal actions in the cross-section of statically determined bars. Simple diagrams of the internal actions		
3. Diagrams of the internal actions. Superposition of effects. Use of the symmetry and non-symmetry.		
4. Diagrams for columns, Gerber beams.		
5. Stretching test for the mild steel (experimental work). Strain – stress diagram. Determination of the mechanical characteristics: yielding stress, ultimate stress, modulus of elasticity, necking. Geometrical characteristics for plane figures.		
6. Axial action: verification, design and bearing capacity.		
7. Axial action: internal actions in statically indeterminate structures (loads, variation of temperature, inaccuracy of execution etc.).		
8. Riveted / bolted joints: verification, design, bearing capacity.		
9. Welded joints: verification, design, bearing capacity.		
10. Strength calculation for beams (verification, design).		
11. Bearing capacity of beams. Capable force. Diagrams of normal and shear stresses in a cross-section.		
12. Deflection of bent beams: the method of the conjugate beam. Synthesis problems for bending.		
13. Torsion: strength calculation for circular and ring-shaped cross-sections. Free torsion of thin-walled bars with open profile.		
14. Free torsion of bars with hollow cross-section. Recapitulation.		

Bibliography

In UTC-N Library

1. Popa, AG – Strength of Materials. Theory and Practice, part 1 (to be published in 2019).

2. Popa, AG, Besoiu, T, Botez, M, Buru, M, Marchis, A – Indrumator de lucrari Rezistenta materialelor (I), UTPRESS, 2017

3. Gere, J. - Mechanics of Materials, Fifth edition, Brooks/Cole, Pacific Grove, CA, 2001.

4. Ille, V., Bia, C., şi alţii - Rezistenţa Materialelor, culegere de probleme, Litografia IPC-N, Cluj-Napoca, 1987.

5. Marţian, I., Cucu, H. L. - Probleme de sinteză din Rezistenţa materialelor; Ed. U.T. Pres, 2004.

6. Popa, A.G. - Rezistenţa Materialelor (I). Îndrumător de lucrări (editie pe CD), UTPRESS, Cluj-Napoca, 2010.

On-line bibliography and in others libaries

1. Curs şi probleme de Rezistenţa Materialelor de la Universitatea Wisconsin (SUA).
http://physics.uwstout.edu/statstr/Strength/index.htm

2. Vlad, I.M. - Strength of Materials. Selected Problems, Ed. Tehnopress, Iaşi, 2004, ISBN 973-702-028-6.

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

Acquired competences are necessary for the civil engineers who activate both in design and execution enterprises and are fundamental for the students attending the master programs or Ph. D. in Civil Engineering.

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	Two theoretical subjects	Oral presentation and examination Duration: 1 hour	40%
10.5 Applications	Three practical applications (problems)	Written examination Duration: 2-2.5 hours (closed book)	60%

10.6 Minimum standard of performance

Graphical representation of the construction elements, the actions as well as the results of the strength calculation (internal actions' diagrams, stress diagrams, deformed axis, characteristic curves of the material, etc.).
Design, checking and determining the capable load for the main strength elements, made of classic materials and subjected to standard loads.

(a) Minimum conditions to be admitted at the examination: minimum 8 precences at the application sessions and minimum 8 homeworks submitted in time.
The application mark* (in the electronic catalogue): minimum 5 (five)
*is calculated with the following relationship:
[(nr.of presences at the application sessions/nr. of sessions) + (nr. of submitted homeworks/nr.of given homeworks)] x 10/2.

(b) **Application mark (A): minimum 5 (five). If the mark is < 5, the student is eliminated from the oral examination.**

(c) **Oral examination mark (O): minimum 5 (five).**

Examination Mode	The examination (**E**) is sustained in the examination session, refers to the whole curricula and consists in 2 tests: - A written test of 2 -2.5 hours; the students has to solve 3 problems with medim degree of complexity (**P** = mark for the written test) - An oral test consisting in the prsentation of the theoretical aspects for 2 subjects extracted aleatory (**O** = mark for theoretical konwlege).
Components of the mark	1) The application mark (**A**) has 2 components: **A = P + (EV**), where: - **P** is the mark for the written test (applications) - **(E**V) is the evaluation during the semester and is calulated as follows: (EV) = [(nr.of presences at the application sessions/nr. of sessions) + (nr. of

	submitted homeworks/nr.of given homeworks) + (nr. of participations at the courses/nr. of courses] x 1/3. This component influence favourably the final notation for the written test and is taken into account only if (EV) ≥ 0.5. Below this value the activity during the semester is considered unsaitsfatory and is not taken into account. **If the application mark A < 5 (five) the student is not eligible for the oral examination.** 2) The mark for the oral examination (**O**) is the arithmetic medium of the 2 theoretical subjects presented.
Formula for calculation of the final mark	**E= 0.6(A) + 0.4(O).** The discipline is passed and the student obtains the credits only if: E ≥ 5, with the restriction that A ≥ 5 and O ≥ 5. **OBSERVATIONS:** The written examination mark (P) ≥ 5 is recognized during all examinations organized in the same session.

Date of filling in:		**Title Surname Name**	**Signature**
01.10.2019	Lecturer	Conf. dr. eng. Anca Gabriela POPA	
	Teachers in charge of application	Lecturer dr. eng. Horatiu Mociran	

Date of approval in the department Mechanics of Constructions October 2019	Head of department Prof.dr.ing. Cosmin Gruia CHIOREAN
Date of approval in the faculty of Civil Engineering October 2019	Dean Conf.dr.ing. Nicolae CHIRA