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	Structural Mechanics
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	29.00

2. Data about the subject

2.1	Subject name			Strength of Materials II			
2.2	Subject area			Civil Engineering			
2.3	Course responsible/lecturer			Assoc. Prof. Anca Gabriela Popa Ph.D./Lect. Horatiu-Alin Mociran Ph.D.			
2.4	Teachers in charge of seminars			Lect. Horatiu-Alin Mociran Ph.D.			
2.5 Year of study	2	2.6 Semester	2	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					20
Supplementary study in the library, online and in the field					6
Preparation for seminars/laboratory works, homework, reports, portfolios, essays					30
Tutoring					6
Exams and tests					4
Other activities					-

3.7	Total hours of individual study	66
3.8	Total hours per semester	150
3.9	Number of credit points	6

4. Pre-requisites (where appropriate)

4.1	Curriculum	-
4.2	Competence	In-depth knowledge of Strength of Materials (I), Mechanics (I and II) and Special Mathematics

5. Requirements (where appropriate)

5.1	For the course	Lecture room with blackboard and multimedia devices (laptop, video projector, projection screen)
5.2	For the applications	Classroom with blackboard, access in the lab 'Actions on buildings and structures' to conduct experiments, scientific calculators

6. Specific competences

Professional competences	C1.1 Identification of the structural role of the members of the building C1.3 Graphical representation and modelling of different types of structural members and structures C2.1 Identification of the building materials and the types of structures used in construction C2.3 Use of computation methods specific to different types of structures and the appropriate design methods of structural members of civil, industrial and agricultural buildings with the aim of elaboration of a specific technical documentation C2.4 Evaluation, selection and optimal use of different building materials that are used for structural members
Cross competences	CT1. Application of effective and responsible work strategies, punctuality, seriousness and personal responsibility, based on the principles and values of professional ethics CT3. Documentation in English, for professional and personal development, through continuous training and efficient adaptation to the new technical developments

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

7.1	General objective	Developing abilities to identify, formulate and solve structural engineering problems
7.2	Specific objectives	Developing abilities to design or check structural members to fulfil strength, stiffness and stability requirements

8. Contents

8.1. Lecture (syllabus)	Teaching methods	Notes
Compound actions: skew bending	Lectures with discussions	Blackboard, video projector, projection screen
Compound actions: axial and bending action. The central core. Normal force applied with simple eccentricity. Materials with weak tensile strength		
Energy concepts. Strain energy. Energy principles		
Energy theorems and their applications		
Strength theories		
Plastic analysis: analysis of the sections beyond the elastic limit		
Plastic analysis: ultimate loads for structures.		
Non-linear problems: buckling of the straight bar axially loaded; buckling beyond the limit of proportionality		

Practical calculation for buckling. Economical cross-sections. Influence of shear force upon buckling		
Latticed columns. Columns with batten plates		
Compressed bent bars		
Dynamic actions. Impact		
Variable actions. Fatigue		
Beams on elastic foundation		

Bibliography

1. Pantel, E., Ioani, A., Popa, A., Nedelcu, M., *Strength of Materials. Theory and Problems, Part II*, Edit. Napoca Star, 2009.
2. Pantel, E., Ioani, A., Turda., D., Popa A., Lessons of Strength of Materials. Theory and Problems, Part II, Cluj-Napoca, 2004.
3. Gere, J.M, Goodno, B.J., *Mechanics of Materials*, Eighth edition, Edit. CENGAGE Learning, 2012.
4. Hibbeler, R.C., *Mechanics of materials*, Eighth edition, Pearson Prentice Hall, 2011.
5. Beer, F. P., Johnston Jr., E.R., DeWolf, J.T., Mazurek, D.F., *Mechanics of materials*, Sixth edition, McGraw-Hill, 2012.
6. Megson, T.G.H., *Structural and stress analysis*, Second Edition, Elsevier Butterworth-Heinemann, 2005.
7. da Silva, V. D., *Mechanics and strength of materials*, Springer-Verlag, 2006.
8. Boresi, A.P., Schmidt, R.J., Sidebottom, O.M., *Advanced mechanics of materials*, Fifth Edition, John Wiley & Sons, Inc., 1993.

8.2. Applications/Seminars	Teaching methods	Notes
Simple actions: stresses and strains. Strength conditions and practical computations	Problems solving with discussions	Individual scientific calculator
Skew bending – all the forces lie in a single plane		
Skew bending – the forces don't lie in a single plane		
Axial and bending action. Eccentric tension/ compression		
Normal force applied with simple eccentricity. Verification of retaining walls and foundations		
Elastic displacements of straight bars (applications of Castigliano's theorem		
Elastic displacements of straight bars (applications of Maxwell-Mohr's formula		
Statically indeterminate structures (Menabrea's theorem and force method)		
Principal stresses and directions for bent bars. Verification of bars in various strength theories		
Plastic analysis: applications of the kinematic method (axially loaded structures)		
Plastic analysis: applications of the kinematic method (statically determinate and indeterminate beams)		
Buckling of the straight columns: verification, design, bearing capacity		
Buckling of the straight columns with batten-plates: verification, design, bearing capacity		
Verification at vertical and horizontal impact. Experimental test		

Bibliography
1. Pantel, E., Ioani, A., Popa, A., Nedelcu, M., *Strength of Materials. Theory and Problems, Part II*, Edit. Napoca Star, 2009.
2. Pantel, E., Ioani, A., Turda., D., Popa A., Lessons of Strength of Materials. Theory and Problems, Part II, Cluj-Napoca, 2004.
3. Hibbeler, R.C., *Mechanics of materials*, Eighth edition, Pearson Prentice Hall, 2011.

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

Acquired competences will be needed for civil engineers who work in design and buildings firms and are fundamental for those who will attend master and doctoral programmes in the field of Civil Engineering.

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	2 theory subjects	Oral examination (O) with the duration of 1 hour	40%
10.5 Applications	3 problems	Written examination (A) with the duration of 2 hours	60%

10.6 Minimum standard of performance

a) The condition of attending and doing the homework for admission to the examination: the presence at min. 10 (ten) laboratory works and min. 10 (ten) full homework submitted in time. If the condition is not fulfilled the students cannot take the exam and must re-contract the discipline in the next academic year.
b) If the previous condition is fulfilled, the application mark from the electronic catalogue (EA) is calculated with the following relationship: [(no. of presences at the laboratory works / no. of works) + (no. of submitted homework / no. of given homework)] x 10/2. If (EA) mark is not min. 5 (five), students cannot take the exam and must re-contract the discipline in the following academic year.
c) The mark of the written exam (A): min. 5 (five) and the correct solving in proportion of min. 50% of the problem from compound actions. If these criterions are not simultaneously fulfilled, the student is not allowed to take the oral exam and doesn't pass the exam. The written exam score (A) is calculated by summing the points obtained in each of the 3 problems, plus an ex officio bonus point. The mark of the written exam (A) is not recognized in the autumn session or in the next academic years sessions.
d) The mark of the oral exam (O): min. 5 (five). The mark of the oral exam (O) represents the average of the marks of the 2 subjects.
e) e) The final mark of the exam can be favorably influenced by the activity of the student during the semester (attendance at laboratory work, submitted homework, attendance at courses, engagement in class debates etc.).

Date of filling in:		Title Surname Name	Signature
01.10.2019	Lecturer	Lect. Horatiu-Alin MOCIRAN Ph.D.	
	Teachers in charge of application	Lect. Horatiu-Alin MOCIRAN Ph.D.	

Date of approval in the department of Structural Mechanics

October 2019

Head of department
Prof. Cosmin Gruia CHIOREAN Ph.D.

Date of approval in the faculty of Civil Engineering

October 2019

Dean
Assoc. Prof. Nicolae CHIRA Ph.D.