

COURSE OUTLINE

1. GENERAL

SCHOOL	UNIVERSITY OF THESSALY		
ACADEMIC UNIT	DEPARTMENT OF CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	AO1301	SEMESTER	8 th
COURSE TITLE	Elastoplastic Structural Analysis		
INDEPENDENT TEACHING ACTIVITIES <i>if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits</i>		WEEKLY TEACHING HOURS	CREDITS
		4	5
<i>Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).</i>			
COURSE TYPE <i>general background, special background, specialized general knowledge, skills development</i>	specialized general knowledge		
PREREQUISITE COURSES:	Strength of Materials I, Structural Analysis II, Structural Analysis III		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://eclass.uth.gr/courses/CULT_U_266		

2. LEARNING OUTCOMES

Learning outcomes <i>The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.</i> <i>Consult Appendix A</i> <i>Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area</i> <i>Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B</i> <i>Guidelines for writing Learning Outcomes</i>
- Understanding the theory of plastic bending - Determination of the collapse mechanisms of frames. - Calculation of the collapse load and the corresponding collapse mechanism of frames, using classical and modern plastic analysis methods - Evaluation of the problem data in order to select the appropriate combination of the simplest (independent) mechanisms, to calculate the collapse mechanism of a frame.
General Competences <i>Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below) at which of the following does the course aim?</i> <i>Search for, analysis and synthesis of data and information, Project planning and management with the use of the necessary technology Respect for difference and multi culturalism Adapting to new situations Respect for the natural environment</i> <i>Decision-making Showing social, professional and ethical responsibility and</i> <i>Working independently sensitivity to gender issues</i> <i>Team work Criticism and self-criticism</i> <i>Working in an international environment Production of free, creative and inductive thinking Working in an interdisciplinary environment</i> <i>Production of new research ideas Others...</i>

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- ANALYSIS AND SYNTHESIS - DESIGN OF STRUCTURES References are made in the course regarding the design of civil engineering projects. - DECISION-MAKING In addition to formal skills, the course is oriented towards cultivating decision-making skills regarding optimal design of structures. - WORKING INDEPENDENTLY - TEAM WORK Emphasis is given to independent work as well as teamwork. Moreover, during the lectures, critical questions are posed to encourage creative and critical thinking among students. - WORKING IN AN INTERNATIONAL ENVIRONMENT - WORKING IN AN INTERDISCIPLINARY ENVIRONMENT Lectures highlight young graduates' ability to work internationally, citing past examples. They also promote interdisciplinary collaboration, essential for creating high-quality projects.

3. SYLLABUS

1	Theory of plasticity for frame members. Calculation of the ultimate moment capacity and the shape coefficient for different cross sections.
2	Calculation of the elastoplastic boundary in beams with rectangular cross section.
3	Influence of shear forces to the ultimate capacity of the rectangular cross section.
4	Influence of axial forces to the ultimate moment capacity of the rectangular cross section.
5	Loading-Unloading and calculation of residual stresses.
6	Elastoplastic methods: The "step by step" method for the calculation of the displacements and the collapse load of the structure.
7	Classical methods of plastic analysis. Theorems of plasticity.
8	Determination of collapse mechanism and calculation of the corresponding collapse load through the combination of independent mechanisms for frame structures.
9	Improvement of real collapse mechanisms in frames with distributed loads.
10	The geometric method of plastic design with min weight.
11	Modern methods of plastic analysis with linear programming.
12	The matrix formulation of plastic analysis and plastic design problems.
13	The matrix formulation of the "step by step" method.
14	Examples of elastoplastic analysis with the use of "step by step" method in the context of structural analysis software.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY <i>Face-to-face, Distance learning, etc.</i>	Face-to-face lectures		
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY <i>Use of ICT in teaching, laboratory education, communication with students</i>	Communication via email, use of an online classroom system (eclass).		
TEACHING METHODS <i>The manner and methods of teaching are described in detail.</i> <i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i> <i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i>	<i>Activity</i>	<i>Semester workload</i>	
	Lectures	56 hours	
	Study of course material	28 hours	
	Extra examples for practice at home	20 hours	
	Term project	23 hours	
	Exam preparation	20 hours	
	Final exam	3 hours	
	Course total	150 hours	
STUDENT PERFORMANCE EVALUATION	Language of Evaluation:		

Description of the evaluation procedure <i>Language of evaluation, methods of evaluation, summative or conclusive, multiple-choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i> <i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i>	Greek (or English for Erasmus+ students) The performance evaluation is conducted through: (a) Semester term project (b) Final written examination at the end of the semester (theory and exercises, simple and complex problem-solving) Evaluation Breakdown: • Semester term project (30% of the final grade) • Written exams (70% of the final grade) Evaluation Criteria (applicable to both the semester project and written exams): The evaluator assesses the candidate's ability to: • Understand the possible collapse mechanisms of a frame. • Use the step-by-step method to calculate the collapse load and the corresponding collapse mechanism of a structure. • Make the appropriate combination of the simple, independent mechanisms to calculate the collapse mechanism of a frame. • Use modern methods of plastic analysis with linear programming to calculate the collapse mechanism of a frame. The evaluation criteria are explained in class at the beginning of the semester.
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5. SUGGESTED BIBLIOGRAPHY

-Suggested bibliography:

- K. Barkarakis, Analysis and Design of Frame Structures with the Theory of Plasticity, N.T.U.A., Athens 1985.
- M. Papadrakakis, Plastic Analysis of Frame Structures - Modern Methods, N.T.U.A., Athens 1996.
- B. Neal, The Plastic Methods of Structural Analysis, Chapman and Hall Ltd., 1977.