COURSE OUTLINE

1. **GENERAL**

SCHOOL	**UNIVERSITY OF THESSALY**		
ACADEMIC UNIT	DEPARTMENT OF CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**ΔΟ1603**	**SEMESTER**	7th
COURSE TITLE	Structural Analysis III		

INDEPENDENT TEACHING ACTIVITIES *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*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialized general knowledge, skills development*	specialized general knowledge
PREREQUISITE COURSES:	Structural Analysis I, Structural Analysis II
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	https://eclass.uth.gr/courses/CULT_U_267

2. **LEARNING OUTCOMES**

Learning outcomes

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.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

- Formulation of stiffness and transformation matrices for 2-D and 3-D truss and beam elements.
- Application of the direct stiffness method for the 2-D analysis of trusses and frames.
- Application of modified stiffness matrices for the calculation of 2-D frames with internal hinges.
- Selection of appropriate Sub-structures for the analysis of complex structures.

General Competences

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?
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
Decision-making Showing social, professional and ethical responsibility and
Working independently sensitivity to gender issues
Team work Criticism and self-criticism
Working in an international environment Production of free, creative and inductive thinking Working in an interdisciplinary environment ……
Production of new research ideas Others…
…….

- 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	Introduction to the Direct Stiffness Method. Transformation matrices.
2	The Direct Stiffness Method for the 2D-truss element. Formulation of stiffness matrix of the element in the local and global coordinate systems
3	Formulation of nodal loads and nodal displacements matrices of a 2D-truss structure. Formulation of the total stiffness matrix of the structure. Calculation of nodal displacements.
4	Application of the direct stiffness method for the analysis of a plane truss with supports of arbitrary orientation.
5	The Direct Stiffness Method for the 2D-beam element. Formulation of stiffness matrix of the element in the local and global coordinate systems
6	Formulation of nodal loads and nodal displacements matrices of a plane frame structure. Formulation of the total stiffness matrix of the structure. Calculation of nodal displacements reactions.
7	The Direct Stiffness Method for the analysis of a plane frame structure with distributed loading, including temperature effects and support displacements.
8	3D-beam element. Formulation of the stiffness and transformation matrices of the element. Formulation of the stiffness matrices for 3D-truss elements and for grillage elements.
9	Internal hinges in plane frames.
10	Modified stiffness matrices.
11	Application of modified stiffness matrices for the calculation of frame structures with internal hinges.
12	Static Condensation.
13	Elements with variable cross sections.
14	Sub-structuring. Application in plane frames.

4. **TEACHING and LEARNING METHODS - EVALUATION**

DELIVERY ***Face-to-face, Distance learning, etc.***	Face-to-face lectures
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Communication via email, use of an online classroom system (eclass).
TEACHING METHODS *The manner and methods of teaching are described in detail.* *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.* *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*	

Activity	*Semester workload*
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 ***Description of the evaluation procedure*** *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* *Specifically-* *defined evaluation criteria are given, and if and where they are accessible to students.*	**Language of Evaluation:** 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: • Analyze complex structures using the direct stiffness method. • Calculate the stiffness matrix of modified elements. • Calculate the stiffness matrix of a variable cross-section element. • Use the sub-structure method in dealing with complex structures The evaluation criteria are explained in class at the beginning of the semester.

5. **ATTACHED BIBLIOGRAPHY**

-Suggested bibliography:

- *M. Papadrakakis- E. Sapoutzakis, Stuctural Analysis with Numerical Methods- The Direct Stiffness Method, Tsiotra, Athens 2016.*
- *P. Komodromos, Structural Analysis with Modern Methods, Papasotiriou, Athens 2009*