SPECIAL TOPICS IN REINFORCED CONCRETE – PRESTRESSED CONCRETE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	41001	**SEMESTER**	10th
COURSE TITLE	SPECIAL TOPICS IN REINFORCED CONCRETE – PRESTRESSED CONCRETE		

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**
Lectures	4	6
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, specialised general knowledge, skills development*	Specialised general knowledge
PREREQUISITE COURSES:	There are no prerequisite courses. Students musthave knowledge of the courses“Reinforced Concrete I” and “Reinforced Concrete II”.
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes (in English)
COURSE WEBSITE (URL)	

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*

The aim of the course is to delve deeper intothe design and detailing of Reinforced Concrete Structures.

After the end of the course the Student will be able to:

- Design a reinforced concrete structurefor Serviceability Limit State.
- To apply the knowledge obtained by the course for designinginfrastructure construction projects such as retaining walls, tanksetc.
- To understand the principles of bridge design.
- To apply the technology of the prestressedconcrete.

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, with the use of the necessary technology	*Project planning and management*
Adapting to new situations	*Respect for difference and multiculturalism*
Decision-making	*Respect for the natural environment*
Working independently	*Showing social, professional and ethical responsibility and 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…*
	…….

Working independently

Production of free, creative and inductive thinking

Project planning and management

3. SYLLABUS

- Serviceability limit stateof reinforced concrete.
- Applications of reinforced concrete in infrastructure works. Retaining walls, tanks, culverts etc.
- Introduction to bridge engineering.
- Materials and technology of prestressed concrete.
- Description of prestressing systems.
- Ultimate limit state checks of prestressed concrete.
- Serviceabilitylimit state checks of prestressed concrete.
- Composition of prestressed concrete.

4. TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
Face-to-face, Distance learning, etc.</td><td>Face-to-face lectures</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>Use of ICT in some lectures.
Support of learning processthrough e-class electronic platform.</td></tr>
<tr><td>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</td><td>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures</td><td>52</td></tr>
<tr><td>Some individual essay writing</td><td>16</td></tr>
<tr><td>Independent study</td><td>82</td></tr>
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<tr><td>Course Total
(25 hours of workload per ECTS credit)</td><td>150</td></tr>
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<tr><td>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.</td><td>Written final exam (100%) of problem solving exercises with combined content.</td></tr>
</table>

5. ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Reinforced Concrete Design, Bill Mosley, John Bungey,Ray Hulse.
- Design of Prestressed Concrete Structures, Ch. Karagiannis, SofiaPublications. (in Greek)
- Prestressed Concrete, M.N.Fardis. (in Greek)
- Reinforced Concrete, M.N.Fardis, Volumes I, II, II. (in Greek)
- Prestressed Concrete,Th. Tassios, P. Giannopoulos, K. Trezos, S.Tsoukantas, Symmetria Publications. (in Greek)

ADVANCED TOPICS IN FINITE ELEMENTS AND BOUNDARY ELEMENTS

1. GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	41002	**SEMESTER**	10th
COURSE TITLE	ADVANCED TOPICS IN FINITE ELEMENTS AND BOUNDARY ELEMENTS		

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 (ECTS)**
Lectures (and optional Laboratory Exercises)	**4 hours/week *(LECTURES)***	**6**
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, specialised general knowledge, skills development*	Specialized General Knowledgecourse / Scientific Area course
PREREQUISITE COURSES:	There are no prerequisite courses, however, the students should already have attended the previous semesters' courses and especially the course "COMPUTER-AIDED STRUCTURAL ANALYSIS" and must also attend the current semester courses.
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES (In English)
COURSE WEBSITE (URL)	YES in the Open eClass platform (Asychronous eLearning platform) : https://eclass.uop.gr/modules/auth/opencourses.php?fc=82 https://eclass.uop.gr/courses/CIVIL108/ (For students with entrance before 2019 : https://eclass.pat.teiwest.gr/eclass/modules/auth/opencourses.php?fc=86 https://eclass.pat.teiwest.gr/eclass/courses/768171/)

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*

Upon successful completion of this course, the students should be able to:

- Delve deeper into the **Finite Element Method (FEM)**and the related computer programs.
- Get to know advanced topics in Finite Elements (surface/planar and solid/spatial structures, dynamic loads, soil-structure interaction, non-linearity, etc.).
- Understand the (static and dynamic)behavior of a structure and select the appropriate finite element model to simulate it.
- Simulate complex structures with the Finite Element Method.
- Analyze surface/planar structures and solid/spatial structuresby the Finite Element Method and the use of computer programs(software).
- Use the Finite Element Method and the related computer programs to solve Civil Engineering problems and structures (buildings, bridges, retaining walls, etc.).
- Delve deeper into the **Boundary Element Method (BEM)** and the related computer programs.
- Get to know advanced topics in Boundary Elements (surface/planar and solid/spatial structures, dynamic loads, soil-structure interaction, non-linearity, etc.).
- Understand the (static and dynamic) behavior of a structure and select the appropriate boundary element model to simulate it.
- Simulate complex structures with the Boundary Element Method.
- Analyze surface/planar structures and solid/spatial structuresby the Boundary Element Method and the use of computer programs (software).
- Use the Boundary Element Method and the related computer programs to solve Civil Engineering problems and 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, with the use of the necessary technology	*Project planning and management*
Adapting to new situations	*Respect for difference and multiculturalism*
Decision-making	*Respect for the natural environment*
Working independently	*Showing social, professional and ethical responsibility and 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… …….*

- Search for, analysis and synthesis of data and information, with the use of the necessary technology.
- Working independently.
- Team work.

- Working in an interdisciplinary environment.
- Production of new research ideas.
- Production of free, creative and inductive thinking.

3. SYLLABUS

- **The Finite Element Method.Advanced topics in Finite Elements** (surface/planar and solid/spatial structures, dynamic loads, soil-structure interaction, non-linearity, etc.). Structural analysis of surface/planarstructures and solid/spatialstructures by the Finite Element Method (FEM) and the use of computer programs (software). Applications of FEM in Civil Engineering problems and structures.
- **The Boundary Element Method. Advanced topics in Boundary Elements** (surface/planar and solid/spatialstructures, dynamic loads, soil-structure interaction, non-linearity, etc.). Structural analysis of surface/planarstructuresand solid/spatialstructuresby the Boundary Element Method (BEM) and the use of computer programs (software). Applications of BEM inCivil Engineeringproblems and structures.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face. Lectures. Exemplary solving of exercises. Practice exercises and exercises using a computer. Use of Information and Communication Technologies in Teaching. Classroom and Computer Center B4. Office hours for additional student support. A Textbook is provided (with a choice among 4 books) through the "Evdoxos" Electronic Service. Additional printed educational material is provided in the classroom. Additional educational electronic material is provided during teaching and / or through the Open eClass eLearning Platform. Exercises and computer-aided exercises are distributed, and their solutions are commented in detail in class. The additional educational material (printed and electronic) is updated and enriched (if required) on an annual basis. The laboratory exercises are enriched (if required) on an annual basis. The students are trained in the research process through weekly exercises and additional optional projects.

USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of the Information and Communication Technologies (ICT) in Teaching. Use of open source software. Specialized structural analysis software with the Finite Element Method. Specialized structural analysis software with the Boundary Element Method. Support of the learning process through the electronic e-class platform. Additional educational electronic material is provided during the teaching and through the Open eClass eLearning Platform (Electronic presentations/powerpoint, electronic multiple-choice exercises, exercises, etc.) Software related to the subject of the course: Free and open source software (from the official websites). Software trial versions (trial versions, evaluation versions) (from the official websites). Also, two of the textbooks (provided through the "Evdoxos" Electronic Service) are accompanied by a CD with program codes. The computer-aided exercises can be performed by the students at the Computer Center B4.

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***
Attendance of Lectures (4 hours x 13 weeks)	52
Participation in optional practice exercises or/and optional projects that are given in the classroom and focus on Civil Engineering applications	13
Participation inoptional computer-aidedexercises on Civil Engineering applications of the Computer-Aided Structural Analysis with FiniteElements and Boundary Elements.	26
IndependentStudy	56
Final examination (3 hours)	3
Coursetotal	***150***
(25 hours workload per credit)	***(6 ECTS x25) = 150***

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.

Written Final Examination at the end of the semester. Active systematic attendance of the Lectures of the course by the students and their successful participation in optional practice exercises can contribute "positively" the additional grade "**A**" at a rate of 5% in the final grade.

Successful participation of the students in additional optional exercises, optional projectsand optional computer-aided exercises: can contribute "positively" the additional grade "**P**" at a rate of 10% in the final grade.

The final grade of the course is calculated as follows:

Final Course Degree = min **[(FE** + 0.05**A**+ 0.1**P)**, 10**]**

where "**FE**" is the grade of the Written **F**inal **E**xamination which is not allowed to be less than 4 in order the grades "A" and "P" to be activated.

The above applies to the academic year in which the students declare the course for the first time. In case of failure or non-attendance at the Written Final Examination (in June and September), in each subsequent academic year the students are graded

	only on the basis of the written final examination of the course.

5. ATTACHED BIBLIOGRAPHY

- Ch. G. Provatidis, "Structural Optimization and Software for Computational Mechanics: Finite Elements, IsogeometricElements, Boundary Elements", A. Tziolas& Sons SA Publications, Athens, 2015. (Book Code in "Eudoxos" 50659719). [In Greek].
- M. Papadrakakis, "Structural Analysis with the finite element method", Papasotiriou Publications, Athens, 2001. (Book Code in "Eudoxus" 9629). [In Greek].
- I. Avramidis, A. Athanatopoulou, K. Morfidis, "THE FINITE ELEMENT METHOD Simulation and Structural Analysis", "Sophia" Publications, Thessaloniki, 2016. (Book Code in "Evdoxos" 59369378). [In Greek].
- I. Th. Katsikadelis, “Boundary Elements. Theory and Applications" (contains CD-ROM with computer programs), SYMMETRIA Publications - S. Athanasopoulos& Co. P.C., Athens, 2012. (Book Code in "Eudoxos" 22768988). [In Greek]. Available also in English: J. T. Katsikadelis, “The Boundary Element Method for Engineers and Scientists. Theory and Applications”, 2nd ed., Academic Press, Elsevier, U.K.(2016).
- D.-P. N. Kontoni, "Scientific-Educational Computer Programs for“Computer-aided Structural Analysis” in the Civil Engineering Specialty", Patras, 1985-2019.
- Extensive Bibliography in English on advanced topics of the Finite Element Method and the Boundary Element Method in problems of the Civil Engineering specialty.
- Scientific Publications in English authored by Dr. D.-P. N. Kontoni on advanced topics in Finite Elements and Boundary Elements.