DEPARTMENT OF CIVIL ENGINEERING

UNIVERSITY OF PATRAS

UNDERGRADUATE STUDIES

COURSE OUTLINES 2025-26

DEPARTMENT OF CIVIL ENGINEERING
UNIVERSITY OF PATRAS

GENERAL INFORMATION AND STRUCTURE OF THE DEPARTMENT

The Department of Civil Engineering was established by the Royal-Decree-Law 399 of 28 June 1972 and started operating within the framework of the Engineering School of the University of Patras from the academic year 1972-1973. Within the framework of Law 1268/82, the Department of Civil Engineering has been operating as an independent unit since 1983. Since its inception to date, about 5686 students have graduated from the Department of Civil Engineering, while the number of students enrolled in the Undergraduate Studies Program has grown over the last few years to about 1900.

The Department of Civil Engineering is located in a building with a total surface area of more than 16000 m^2 including classrooms, an auditorium, a design room, seminar rooms, a library room, a computer facility, staff offices, administrative areas, and laboratories of a total surface area of about 5000 m^2. The staff of the Department consists of 27 faculty members, 16 Professors Emeriti, 2 Teaching Associates, 4 Technical Associates, and 5 administrative members. In addition, the Department employs teaching associates and academic fellows on a contract basis.

The Department consists of three Divisions, nine Laboratories, a Seismic Simulator facility, and two Computer Centers. The staff and the various functions of the Department, with the exception of the Computer Centers and the Seismic Simulator, are integrated under the three Divisions.

Since September 1994, a Postgraduate Program and a Doctoral Studies Program have been operating in the Department of Civil Engineering. Following a modification in 2018, the Department awarded the following Postgraduate degrees:

- *Postgraduate Diploma in "Design of Resilient, Sustainable and Smart Infrastructures" with specialization in:*
  - *Specialization A΄: Resilient Materials, Structures and Geotechnical Infrastructures*
  - *Specialization B΄: Hydraulic and Environmental Engineering for Sustainable Infrastructures*
  - *Specialization C΄: Intelligent Systems in Transportation and Construction Project Management*
- *Doctorate Degree (PhD) in Civil Engineering.*

Since the beginning of the Department postgraduate and doctorate programs, 589 postgraduate diplomas and 133 PhD degrees have been awarded. The number of new students enrolled in these programs per year is approximately 35 for postgraduates and 10 for PhDs.

HEAD OF DEPARTMENT

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DEPUT HEAD

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SECRETARIAT

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DIVISIONS – LABORATORIES

Division A: **STRUCTURAL ENGINEERING**
Director: Prof. Thanasis Triantafillou

Division B: **GEOTECHNICAL AND HYDRAULIC ENGINEERING**
Director: Associate Prof. Stavroula Kontoe

Division C: **ENVIRONMENTAL ENGINEERING AND TRANSPORTATION**
Director: Associate Prof. Poluchronis Economou

Laboratories

- Structures
- Structural Materials
- Geotechnical Engineering
- Hydraulic Engineering
- Laboratory of Geodesy and Geodetic Applications
- Environmental Engineering
- Transportation and Ambient Mobility Systems Laboratory
- Construction, Infrastructure and City Management
- Building Physics and Construction Technology Laboratory

LIST OF FACULTY MEMBERS OF THE DEPARTMENT

Professors
Bousias Stathis
Chassiakos Athanasios
Dimas Athanasios
Karavasilis Theodoros
Manariotis Ioannis
Langousis Andreas
Papadakis Vagelis
Papanicolaou Corina
Stavridis Andreas
Triantafillou Thanasis
Zacharias Ierotheos

Associate Professors
Christoforou Zoi
Economou Polychronis
Genikomsou Katerina
Kontoe Stavroula
Petropoulou Eugenia

Assistant Professors
Dimakopoulos Aggelos
Favvata Maria
Iliopoulou Christina
Kotsovinos Panagiotis
Ntaikou Ioanna
Pappas Chtristoforos
Pelekis Panagiotis
Perdiou Aggeliki
Theocharis Alexandros
Tsoka Stella

Lecturers
Marathias Petros

PROFESSORS EMERITI

Anagnostopoulos Stavros
Antonopoulos Ioannis
Athanasopoulos George
Atmatzidis Dimistrios
Beskos Dimitrios
Giannopoulos Panayiotis
Demetracopoulos Alexandros
Dritsos Stefanos
Fardis Michael
Kaleris Vasileios
Karabalis Dimitrios

Koutrouvelis Ioannis
Papadakis Konstantinos
Stefanides George
Stiros Stathis
Theodorakopoulos Dimitrios

UNDERGRADUATE STUDIES PROGRAM

The undergraduate studies program includes the titles of the courses (compulsory and electives), the syllabi, the teaching hours per week, including the type of accomplished teaching work, and the sequence or interdependence of the courses. The content of all courses is available in the Department's website: civil.upatras.gr

The undergraduate program has been adapted to a minimum number of semesters required to obtain the degree. This number is 10 semesters.

Each semester course corresponds to a number of "teaching units" and a number of ECTS credits (European Credit Transfer and Accumulation System). One teaching unit corresponds to one lecture hour per week or one to three hours per week of additional educational work (e.g. laboratory or field work). ECTS credits are based on the workload of students per week in order to achieve the expected learning outcomes. The undergraduate studies program corresponds to a total of 300 ECTS credits.

Each semester includes 13 full weeks for teaching and a corresponding number of weeks for exams. The examination periods are three: January-February, June-July and September. The duration of the exams is three weeks for the January-February and June-July periods and four weeks for the September period. The first semester begins in the end of September (or early October) and the second semester ends in the first half of June. The exact dates are determined by the Senate of the University.

In the undergraduate studies program, there are four Tracks: (1) Structural Engineering, (2) Geotechnical Engineering - Infrastructure Works, (3) Hydraulic Engineering - Environmental Engineering, and (4) Sustainable Transport and Project Management Systems. In the 8th semester of study, each student selects a Track, which he follows in the 9th and 10th semesters as well. The student enrolls for 2, 4 and 2 Track courses in the 8th, 9th and 10th semester, respectively. When enrolling in the 9th and 10th semesters, the student has the option to choose up to two elective courses from the other Tracks or External Elective courses.

In the case of failure in a compulsory course, the student is obliged to repeat it in the following year. In the case of failure in an elective course, the student has the option either to change the elective course or to repeat the attendance and the examination of the course in the following year. In case the student fails in the examination of an elective course which will not be offered in the following year, her/his failure is not finalized before she/he is given the opportunity to repeat the examination in the September period.

Students work on their Diploma Thesis – analysis, design or case study – in their 9th and 10th semesters of study, in order to complete their education in their Track. It is possible for a student to work on herhis Diploma Thesis under the supervision of a faculty member external to the Track of the student or the Department as long as the topic of the thesis has a thematic - educational coherence with the Track of the student.

The student completes her/his studies and she/he is awarded the Diploma when she/he successfully completes all the required courses and congregates the required number of 300 ECTS credits, including the Diploma Thesis, according to all applicable terms.

The following tables include the titles, codes, teaching hours per week (lecture/laboratory), as well as the Teaching units and the ECTS credits of all courses of the undergraduate studies program.

COURSE SUMMARY TABLE

1st SEMESTER

TITLE	COURSE CODE	Hours / Week		Teaching units	ECTS credits	Page
		Lect.	Lab			
Applied Mathematics I	CIV_1105	4	1	5	6	24
Physics	CIV_1131	4	0	4	5	28
Computer Programming and Applications	CIV_2221	3	1	4	5	32
Engineering Mechanics - Statics	CIV_1215	4	0	4	6	37
Technical and Electronic Drawing	CIV_1709	3	3	4	5	41
English Language	CIV_1155	3	0	3	3	45
TOTAL (Weight Factor = 9.5)		21	5	24	30	

2nd SEMESTER

TITLE	COURSE CODE	Hours / Week		Teaching units	ECTS credits	Page
		Lect.	Lab			
Applied Mathematics II	CIV_2110A	3	1	4	6	49
Probability - Statistics	CIV_2120A	4	0	4	6	53
Introduction to Mechanics of Materials	CIV_3217	4	2	5	6	59
Geology for Civil Engineers	CIV_2138A	2	2	3	6	64
Building Technology	CIV_3710A	4	2	5	6	68
TOTAL (Weight Factor = 8.5)		17	7	21	30	

3rd SEMESTER

TITLE	COURSE CODE	Hours / Week		Teaching units	ECTS credits	Page
		Lect.	Lab			
Applied Mathematics III	CIV_3115A	4	0	4	4	73
Numerical Methods	CIV_3127A	3	2	4	4	78
Mechanics of Materials	CIV_4218	4	2	5	6	82
Structural Materials	CIV_4219	4	2	5	6	86
Introduction to Geodesy	CIV_3803	2	4+1*	5	6	91
Building Physics	CIV_4711A	3	0	3	4	95
TOTAL (Weight Factor = 10.5)		20	10+1	26	30	

* The "+1" corresponds to field exercises in addition to the laboratory hours.

4th SEMESTER

TITLE	COURSE CODE	Hours / Week		Teaching units	ECTS credits	Page
		Lect.	Lab			
Analysis of Framed Structures	CIV_5220A	4	0	4	6	100
Dynamics - Vibrations	CIV_2216	3	1	4	6	104
Fluid Mechanics	CIV_4410A	4	0	4	6	108
Traffic Engineering	CIV_5605A	4	1+1	6	6	112
Environmental Chemistry	CIV_4414	4	0	4	6	116
TOTAL (Weight Factor = 8)		19	2+1	22	30	

5th SEMESTER

TITLE	COURSE CODE	Hours / Week		Teaching units	ECTS credits	Page
		Lect.	Lab			
Matrix Analysis of Framed Structures	CIV_6221A	4	1	5	6	121
Design of Steel Structural Components	CIV_6235A	4	1	5	6	125
Soil Mechanics I	CIV_5310A	4	2	5	6	129
Hydraulics	CIV_5415A	4	2	5	6	133
Water Treatment	CIV_5505A	4	2+1	6	6	138
TOTAL (Weight Factor = 10)		20	8+1	26	30	

6th SEMESTER

TITLE	COURSE CODE	Hours / Week		Teaching units	ECTS credits	Page
		Lect.	Lab			
Design of Reinforced Concrete Linear Elements	CIV_6230A	4	2	5	6	142
Design of Steel Structures	CIV_7236	4	0	4	5	147
Soil Mechanics II	CIV_6315	4	0	4	5	151
Engineering Hydrology	CIV_6420	4	0	4	5	155
Wastewater Treatment	CIV_6510A	4	2+1	6	6	159
Technical Terminology in English Language	CIV_6610	3	0	3	3	163
TOTAL (Weight Factor = 10)		23	4+1	26	30	

7th SEMESTER

TITLE	COURSE CODE	Hours / Week		Teaching units	ECTS credits	Page
		Lect.	Lab			
Structural Dynamics	CIV_8223A	4	0	4	6	167
Design of Planar Reinforced Concrete Elements	CIV_7231A	4	0	4	6	172
Foundation Engineering	CIV_7320A	4	0	4	6	176
Harbour Works Analysis and Design	CIV_0480A	4	0	4	6	180
Road Design and Construction	CIV_7610A	4	0	4	6	184
TOTAL (Weight Factor = 7.5)		20	0	20	30	

8th SEMESTER

TITLE	COURSE CODE	Hours / Week		Teaching units	ECTS credits	Page
		Lect.	Lab			
Structural Analysis with the Finite Element Method	CIV_7222A	4	2	5	7	188
Design of Water Distribution, Sewage and Rainwater Drainage Networks	CIV_8435A	4	0	4	6	192
Construction Project Management	CIV_5716A	4	2	5	7	196
Track Core Course				3-4	5	
Track Elective Course				3-4	5	
TOTAL (Weight Factor = 8.5)				20-22	30	

8th SEMESTER - TRACK CORE COURSES

The Core Course of each Track is selected from the following list according to the student's track.

TITLE	COURSE CODE	Hours / Week		Teaching units	ECTS credits	Page
		Lect.	Lab			
1st Track: "Structural Engineering"						
Design of Reinforced Concrete Structures	CIV_8232A	4	0	4	5	201
2nd Track: "Geotechnical Engineering – Infrastructure Works"						
Geotechnical Erthquake Engineering	CIV_8355A	3	0+1	4	5	205
3rd Track: "Hydraulic Engineering – Environmental Engineering"						
Environmental Impact Assessment Studies of Technical Works	CIV_9560A	3	0	3	5	210
4th Track: "Sustainable Transportation and Project Management Systems"						
Transportation Systems Analysis and Design I	CIV_8665A	3	0	3	5	215

8th SEMESTER - 1st TRACK ELECTIVE COURSES

Students of the 1st Track select one elective course from the following list.

TITLE	COURSE CODE	Hours / Week		Teaching units	ECTS credits	Page
		Lect.	Lab			
Composite Structures	CIV_9269A	3	0	3	5	219
Earthquake Engineering and Earthquake Resistant Structures	CIV_9255A	3	0	3	5	222
Design and Repair of Masonry Structures	CIV_8268A	3	0	3	5	226

8th SEMESTER - 2nd TRACK ELECTIVE COURSES

Students of the 2nd Track select one elective course from the following list.

TITLE	COURSE CODE	Hours / Week		Teaching units	ECTS credits	Page
		Lect.	Lab			
Geotechnical Site Exploration Methods	CIV_9371A	2	2+1	4	5	230
Selected Topics in Foundation Engineering	CIV_8371A	3	0+1	4	5	234
Geodesy	CIV_8356A	2	2+1	4	5	239
Earthquake Engineering and Earthquake Resistant Structures	CIV_9255A	3	0	3	5	222

8th SEMESTER - 3rd TRACK ELECTIVE COURSES

Students of the 3rd Track select one elective course from the following list.

TITLE	COURSE CODE	Hours / Week		Teaching units	ECTS credits	Page
		Lect.	Lab			
Computational Hydraulics	CIV_8460A	3	0	3	5	243
Energy Hydraulic Systems	CIV_8461A	3	+1	4	5	247
Solid Waste Management	CIV_0560	3	+1	4	5	251
Air Pollution	CIV_8555A	3	0	3	5	255

8th SEMESTER - 4th TRACK ELECTIVE COURSES

Students of the 4th Track select one elective course from the following list.

TITLE	COURSE CODE	Hours / Week		Teaching units	ECTS credits	Page
		Lect.	Lab			
Construction Project Organization and Management	CIV_0683A	3	0	3	5	260
Smart Cities, Infrastructure and Transportation	CIV_8658A	3	0	3	5	264
Environmental Impact Assessment Studies of Technical Works	CIV_9560A	3	0	3	5	210
Optimization and Applications	CIV_8659A	3	0	3	5	268

9th SEMESTER

TITLE	COURSE CODE	Hours / Week		Teaching units	ECTS credits
		Lect.	Lab		
Track Elective Course				3	5
Track Elective Course				3	5
Track Elective Course				3	5
Track Elective Course				3	5
Practical Training *	CIV_1000				(4)
Diploma Thesis I (3 courses of 5 TC each)	CIV_9811A			15	10
TOTAL (Weigh Factor = 6+6)				27	30

* Practical Training is optional.

10th SEMESTER

TITLE	COURSE CODE	Hours / Week		Teaching units	ECTS credits
		Lect.	Lab		
Track Elective Course				3-4	5
Track Elective Course				3-4	5
Practical Training *	CIV_1000				(4)
Diploma Thesis II (6 courses of 5 TC each)	CIV_9812A			30	20
TOTAL (Weight Factor = 3+12)				36-38	30

* Practical Training is optional.

Sum of weight factors of Courses +Diploma Thesis: 81+18=99

9th SEMESTER - 1st TRACK ELECTIVE COURSES

TITLE	COURSE CODE	Hours / Week		Teaching units	ECTS credits	Page
		Lect.	Lab			
Repair and Strengthening of Reinforced Concrete Structures	CIV_9263A	3	0	3	5	272
Prestressed Concrete	CIV_8262A	3	0	3	5	276
Fire Engineering and Fire Protection	CIV_9264A	3	0	3	5	280
Design of Energy Efficient Buildings	CIV_0276A	3	0	3	5	284
Timber Structures	CIV_0272A	3	0	3	5	288
Theory of Plates and Shells	CIV_0268A	3	0	3	5	291
External Elective Course Track_1_1	CIV_9111A	3	0	3	5	
External Elective Course Track_1_2	CIV_9112A	3	0	3	5	
External Elective Course Track_1_3	CIV_9113A	3	0	3	5	
External Elective Course Track_1_4	CIV_9114A	3	0	3	5	

9th SEMESTER - 2nd TRACK ELECTIVE COURSES

TITLE	COURSE CODE	Hours / Week		Teaching units	ECTS credits	Page
		Lect.	Lab			
Geology of Technical Works and Rock Mechanics	CIV_8357A	2	2	3	5	294
Computational Geotechnical Engineering	CIV_9372A	3	0	3	5	298
Ground Improvement and Reinforcement	CIV_9373A	3	1	4	5	303
Geodetic Applications	CIV_9810A	3	1	4	5	308
Coastal Hydraulics	CIV_9485A	3	0	3	5	312
Groundwater	CIV_9470A	3	0	3	5	316
External Elective Course Track_2_1	CIV_9121A	3	0	3	5	
External Elective Course Track_2_2	CIV_9122A	3	0	3	5	
External Elective Course Track_2_3	CIV_9123A	3	0	3	5	
External Elective Course Track_2_4	CIV_9124A	3	0	3	5	

9th SEMESTER - 3rd TRACK ELECTIVE COURSES

TITLE	COURSE CODE	Hours / Week		Teaching units	ECTS credits	Page
		Lect.	Lab			
Laboratory Topics in Hydraulic Engineering	CIV_9480A	2	2	3	5	320
Hydraulic and Flood Control Structures	CIV_7430A	3	1	4	5	324
Coastal Hydraulics	CIV_9485A	3	0	3	5	312
Groundwater	CIV_9470A	3	0	3	5	316
Natural Wastewater Treatment Systems	CIV_9576A	3	0	3	5	328
Pollution of Inland and Coastal Waters	CIV_8558A	2	2+1*	4	5	332
Environmental Analysis	CIV_9562A	2	2	3	5	337
External Elective Course Track_3_1	CIV_9131A	3	0	3	5	
External Elective Course Track_3_2	CIV_9132A	3	0	3	5	
External Elective Course Track_3_3	CIV_9133A	3	0	3	5	
External Elective Course Track_3_4	CIV_9134A	3	0	3	5	

9th SEMESTER - 4th TRACK ELECTIVE COURSES

TITLE	COURSE CODE	Hours / Week		Teaching units	ECTS credits	Page
		Lect.	Lab			
Transportation Systems Analysis and Design II	CIV_9668A	3	0	3	5	342
Transportation Infrastructure Management	CIV_9670A	3	0	3	5	350
Intelligent Transportation Systems	CIV_9669A	3	0	3	5	346
Environmental Analysis	CIV_9562A	2	2	3	5	337
Geodetic Applications	CIV_9810A	3	0+1	4	5	308
External Elective Course Track_4_1	CIV_9141A	3	0	3	5	
External Elective Course Track_4_2	CIV_9142A	3	0	3	5	
External Elective Course Track_4_3	CIV_9143A	3	0	3	5	
External Elective Course Track_4_4	CIV_9144A	3	0	3	5	

9th SEMESTER - EXTERNAL ELECTIVE COURSES

TITLE	COURSE CODE	Hours / Week		Teaching units	ECTS credits	Page
		Lect.	Lab			
Introduction to Economics	CIV_0711A	3	0	3	5	354
Introduction to Business Administration for Engineers and Scientists	CIV_0712A	3	0	3	5	358

10th SEMESTER - 1st TRACK ELECTIVE COURSES

TITLE	COURSE CODE	Hours / Week		Teaching units	ECTS credits	Page
		Lect.	Lab			
Design of Reinforced Concrete Structures*	CIV_8232A	4	0	4	5	201
Composite Structures	CIV_9269A	3	0	3	5	219
Earthquake Engineering and Earthquake Resistant Structures	CIV_9255A	3	0	3	5	222
Design and Repair of Masonry Structures	CIV_8268A	3	0	3	5	226
Principles of Sustainable Construction	CIV_0275A	3	0	3	5	363
Building Information Modeling	CIV_0274A	2	2	3	5	369
External Elective Course Track_1_5	CIV_9115A	3	0	3	5	
External Elective Course Track_1_6	CIV_9116A	3	0	3	5	

* Elective course only for the other tracks.

10th SEMESTER – 2nd TRACK ELECTIVE COURSES

TITLE	COURSE CODE	Hours / Week		Teaching units	ECTS credits	Page
		Lect.	Lab			
Geotechnical Erthquake Engineering*	CIV_8355A	3	1	4	5	205
Geotechnical Site Exploration Methods	CIV_9371A	2	2+1	4	5	230
Special Topics in Foundation Engineering	CIV_8371A	3	0+1	4	5	234
Earthquake Engineering and Earthquake Resistant Structures	CIV_9255A	3	0	3	5	222
External Elective Course Track_2_5	CIV_9125A	3	0	3	5	
External Elective Course Track_2_6	CIV_9126A	3	0	3	5	

* Elective course only for the other tracks.

10th SEMESTER – 3rd TRACK ELECTIVE COURSES

TITLE	COURSE CODE	Hours / Week		Teaching units	ECTS	Page
		Lect.	Lab			
Environmental Impact Assessment Studies of Technical Works*	CIV_9560A	3	0	3	5	210
Computational Hydraulics	CIV_8460A	3	0	3	5	243
Hydraulics of Energy Infrastructure	CIV_8461A	3	0	3	5	247
Solid Waste Management	CIV_0560	3	0	3	5	251
Air Pollution	CIV_8555A	3	0	3	5	255
External Elective Course Track_3_5	CIV_9135A	3	0	3	5	
External Elective Course Track_3_6	CIV_9136A	3	0	3	5	

* Elective course only for the other tracks.

10th SEMESTER – 4th TRACK ELECTIVE COURSES

TITLE	COURSE CODE	Hours / Week		Teaching units	ECTS	Page
		Lect.	Lab			
Transportation Systems Analysis and Design I*	CIV_8665A	3	0	3	5	215
Construction Project Organization and Management	CIV_0683A	3	0	3	5	260
Smart Cities, Infrastructure and Transportation	CIV_8658A	3	0	3	5	264
Optimization and Applications	CIV_8659A	3	0	3	5	268
Environmental Impact Assessment Studies of Technical Works	CIV_9560A	3	0	3	5	210
Building Information Modeling	CIV_0274A	2	2	3	5	369
Air Pollution	CIV_8555A	3	0	3	5	255
External Elective Course Track_4_5	CIV_9145A	3	0	3	5	
External Elective Course Track_4_6	CIV_9146A	3	0	3	5	

* Elective course only for the other tracks.

COURSE OUTLINE TABLES

1st SEMESTER

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF COURSE	UNDERGRADUATE		
COURSE CODE	CIV_1105	**SEMESTER**	1st
COURSE TITLE	APPLIED MATHEMATICS I		

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, seminars and laboratory work	4 (lect.) 1 (lab.)	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*	Foundation course
PREREQUISITE COURSES:	Typically, there are not prerequisite course. However the students should already have a satisfactory knowledge of algebra, vectors, analytic geometry, derivatives and integrals.
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek.
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBPAGE (URL)	https://eclass.upatras.gr/courses/CIV1657/

2. LEARNING OUTCOMES

Leraning 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*

By the end of this course the student will be able to:
To give the student in civil engineering the knowledge of advanced applied engineering mathematics that he/she needs in his/her science in the areas of differential and integral calculus of one variable, of linear algebra and of vector analysis. This knowledge is necessary and is used in many subsequent specialization courses in civil engineering. This knowledge is also useful in the two subsequent courses Applied Mathematics II and III of the 2nd and 3rd semesters respectively.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

By the end of the course the student will have developed the following skills/ competences:

1. To be able to efficiently use the differential and integral calculus, linear algebra and vector analysis in the subsequent courses in his/her studies in civil engineering as well as in related problems of civil engineering.
2. To be able to mathematically formulate problems of civil engineering which make use of the above mathematical areas.
3. To be able to efficiently use the computer and computer algebra software in mathematics and civil engineering applications.

3. SYLLABUS

1. Differential calculus of functions of a single variable
2. Integral calculus of functions of a single variable
3. Matrices and systems of linear equations
4. Teaching of a computer algebra system in the computing center

4. TEACHING AND LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>1. Teaching (4 hours/week): lectures using the blackboard concerning the theory, exercises and civil engineering applications.
2. Laboratory (1 hour/week in the computing center): practice in the course contents through applications by using the computer mainly in symbolic computations.
3. Solution of exercises (by hand and by using the computer) individually by each student.</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Teaching of a computer algebra system in the computing center</td></tr>
<tr><td>TEACHING METHODS
<i>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</i></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures (3 conduct hours per week x 13 weeks)</td><td>39</td></tr>
<tr><td>Exercises of representative problems (1 conduct hour per wk x 13 wks)</td><td>13</td></tr>
<tr><td>Laboratory work (1 conduct hours per week x 13 weeks)</td><td>13</td></tr>
<tr><td>Final examination</td><td>4</td></tr>
<tr><td>Hours for private study of the student and preparation of home-works</td><td>81</td></tr>
<tr><td><i>Total number of hours for the Course
(25 hours of work-load per ECTS credit)</i></td><td><i>150 hours (total student work-load)</i></td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i></td><td>1. Final written examination.
2. Laboratory examination.</td></tr>
</table>

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.*	

5. ATTACHED BIBLIOGRAPHY

1. Markellos, V. V., “Applied Mathematics”. Gotsis K & SIA E.E. Editions, Patras, 2013 (in Greek).
2. Moisiadis X., “Mathematics”. Editions, A. and P.Christodoulidi O.E., Thessaloniki, 2010. (in Greek).
3. Finney, R. L., Weir, M. D. and Giordano, F. R., “Thomas’ Calculus”, Vol. I. University Editions of Crete, 2009.
4. Papadakis, K. E., “Applied Mathematics & *Mathematica*”. Tziolas Editions, Thessaloniki, 2015 (in Greek).

COURSE OUTLINE

1. GENERAL

<table>
<tr><td>SCHOOL</td><td colspan="3">ENGINEERING</td></tr>
<tr><td>ACADEMIC UNIT</td><td colspan="3">CIVIL ENGINEERING</td></tr>
<tr><td>LEVEL OF STUDIES</td><td colspan="3">UNDERGRADUATE</td></tr>
<tr><td>COURSE CODE</td><td>CIV_1131</td><td>SEMESTER</td><td>1st</td></tr>
<tr><td>COURSE TITLE</td><td colspan="3">PHYSICS</td></tr>
<tr><td colspan="2">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></td><td>WEEKLY TEACHING HOURS</td><td>CREDITS</td></tr>
<tr><td colspan="2">Lectures</td><td>4</td><td>5</td></tr>
<tr><td colspan="2"></td><td></td><td></td></tr>
<tr><td colspan="2"></td><td></td><td></td></tr>
<tr><td colspan="2"><i>Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).</i></td><td></td><td></td></tr>
<tr><td>COURSE TYPE
<i>general background, special background, specialised general knowledge, skills development</i></td><td colspan="3">Background course</td></tr>
<tr><td>PREREQUISITE COURSES:</td><td colspan="3">-</td></tr>
<tr><td>LANGUAGE OF INSTRUCTION and EXAMINATIONS:</td><td colspan="3">Greek. Teaching may be however performed in English in case foreign students attend the course.</td></tr>
<tr><td>IS THE COURSE OFFERED TO ERASMUS STUDENTS</td><td colspan="3">No</td></tr>
<tr><td>COURSE WEBSITE (URL)</td><td colspan="3">https://eclass.upatras.gr/courses/CIV1651/</td></tr>
</table>

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 course is a basic introductory course on concepts of Thermodynamics, Waves and of Electromagnetism. This way the student receives a general knowledge which occurs across all spectrum of modern technology, especially in the civil engineering profession such as thermal losses in energy buildings, installation of electrical networks, acoustics etc.

By the end of this course the student will be able to:

- Understand the different physical units which appear in any study like Calories, Joules, BTUs, Watts, Volts, Amperes, Decibels etc.
- To be able to easily convert from one unit to another, for example in air-conditioners convert BTUS in Watts
- To be familiar with various tables with materials properties such as thermal conductivity, Specific heat, Thermal expansion, Modulus of Elasticity, Density, Electromagnetic Spectrum, Magnetic Materials, so as to be able to choose the appropriate material for each application.
- To be able to do basic calculations in the problems of the class material, based on the formulas, on the above tables as well as figures which must be able to draw easily from the given data and the wanted questions of the respective problem.
- To be able to work with his fellow students to solve simple problems which are given weekly in order to gain a better understanding of matter.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

- Adaptation to new situations
- decision making
- Autonomous work
- Promotion of free, creative and inductive thinking

3. SYLLABUS

THERMODYNAMICS

- Basic concepts of Thermal measurements
- Thermodynamic properties of gases

- Effect of heat in matter
- Thermal engines & heat pumps

ELECTROMAGNETISM

- Electric fields & electric potential
- Capacitors and Dielectrics
- Current and Resistance
- DC & AC Circuits
- Magnetic fields & Electromagnetic induction

WAVES

- Mechanical Waves
- Harmonic Waves
- Power and Energy of Waves
- Sound
- Sound Intensity
- Decibel scale

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Class Lectures face to face.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Weekly Assignments in the form of 2-3 Problems via the electronic platform e-class
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*	see table below

Activity	***Semester workload***
Lectures (4 hours per week x 13 weeks)	52
Private study (3 hours per week x 13 weeks)	39
Eclass Assignments (2 hours per week x 13 weeks)	26
Final examination study	8
Total number of hours for the Course (25 hours of work-load per ECTS credit)	***125***
Course total	

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.*	I. Written final exam (90%) which includes:- Solving 4 problems which cover at least 70% of the class material II. Assignment Average (10%)

5. ATTACHED BIBLIOGRAPHY

1) Physics II, Edition: 1st (Greek), D. Kouzoudis – P. Petrides. ISBN: 978-960-266-393-6,
2) General Physics, Edition: 1st (Greek), Daniel Schaum, BS Carel W. van der Merwe, ISBN: 978-960-7610-23-2,
3) Physics (Combined), Edition: 1st (Greek), Halliday David, Resnick Robert, Walker Jearl, ISBN: 978-960-01-1651-9,
4) Basic College Physics, Edition: 3rd (Greek), P. Lianos, ISBN: 978-960-266-130-7.

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	Civil Engineering		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	CIV_2221	**SEMESTER**	1st
COURSE TITLE	Computer Programming and Applications		

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, specialised general knowledge, skills development*	
PREREQUISITE COURSES:	None
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1613/

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 course is the basic introductory course of computer programming and use.

The main purpose of the course is to familiarize students with computers and especially with the MATLAB to develop basic programming skills. More specifically, the course introduces the input-output commands, flow control and iterations, as well as script and function manipulation in MATLAB.

Finally, the course aim is the student to be able to use MATLAB to solve introductory problems and simple applications from other courses of civil engineering.

Upon successful completion of the course the student will be able to:

- use the MATLAB environment for both simple and complex mathematical problems.
- create flow charts (or pseudocode) and convert it into a MATLAB program.
- create script and functions files (.m files) to run complex programs
- solve mathematical problems as well as simple Civil Engineering problems using the PC.

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

Adapting to new situations

Project planning and management

Respect for difference and multiculturalism

Respect for the natural environment

Decision-making

Working independently

Team work

Working in an international environment

Working in an interdisciplinary environment

Production of new research ideas

Showing social, professional and ethical responsibility and sensitivity to gender issues

Criticism and self-criticism

Production of free, creative and inductive thinking

……

Others…

…….

- Search for, analysis and synthesis of data and information, with the use of the necessary technology

3. SYLLABUS

ii. Numerical operations, build-in functions and variables

iii. Script files, keeping a record (diary)

4. TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>At Amphitheatre and Computer Lab</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>MATLAB
Support learning through the e-class platform</td></tr>
<tr><td>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></td><td><table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td>13</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Exams study</td><td>21</td></tr>
<tr><td></td><td>125</td></tr>
</table></td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>
<i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem</i></td><td>Laboratory exam for the use of MATLAB which includes:
- Multiple choice questions
- Short answer questions</td></tr>
</table>

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.*	

5. ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

• Papaodisseys N., Kalovretis K., Mylonas K.. Matlab, A. Tziola and S. Y. AE, 2017 (In Greek)

• Gravanis G. and Giannoutakis K., Programming with the Use of Matlab, A. Papasotiriou & Co. OE, 2012 (In Greek).

• Hatzikos E., MATLAB for Scientists and Engineers, A. Tziola & Sons Publishing SA, 2010 (In Greek).

• Kalechman, M., Practical MATLAB Basics for Engineers, Taylor & Francis, 2008.

• Economou, P., & Papadopoulos, P. (2023). Introduction to
p

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF STUDIES	GRADUATE		
COURSE CODE	CIV_1215	**SEMESTER**	1st
COURSE TITLE	ENGINEERING MECHANICS - STATICS		

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	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*	Special background
PREREQUISITE COURSES:	none
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1535/

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 students should familiarize themselves with fundamental concepts of Mechanics, including:

- Elements of Vector Algebra
- Principles of Statics of Rigid (Non-deformable) Bodies
- Analysis of Trusses
- Analysis of static determinate frames and beams including drawing of MNV diagrams

After completing the course the students should be able to:

- analyze any statically determinate structure;
- draw internal action diagrams for any statically determinate beam or frame

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

- *Search for, analysis and synthesis of data and information, with the use of the necessary technology*

3. SYLLABUS

- Elements of vector algebra [Systems of Reference – Cartesian; Addition and Subtraction of Vectors;

Vector Products: Scalar & Vector Products;

Definition of force and moment vectors [Moment w.r.t. a point and w.r.t. an axis; couple of forces].

- Basic principles of statics.
- Equipollent sets of forces; reduction of sets of forces.
- Distributed force sets; center of mass; centroid; Pappus Theorems.
- Conditions of static Equilibrium of rigid (undeformable) bodies.
- Analysis of statically determinate trusses, beams and frames (including three-joint structures and Gerber beams).
- Determination of bending moment, shear force and axial force diagrams.

Depending on time availability:

- Flexible Cables

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face lectures in the classroom
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of e-class platform
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 – 52 Study – 98 Course total – ***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*	Three intermediate exams (30%) Final Exam (70%)

Specifically-defined evaluation criteria are given, and if and where they are accessible to students.	

5. ATTACHED BIBLIOGRAPHY

Vector Mechanics for Engineers: STATICS (12th Edition; 2017) by F.P. Beer, E.R. Johnston Jr. and E.R. Eisenberg (translated in Greek; ΕΚΔΟΣΕΙΣ ΤΖΙΟΛΑ). "Μηχανική του Απαραμόρφωτου Στερεού – ΣΤΑΤΙΚΗ" by A Βουθούνης

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF COURSE	UNDERGRADUATE		
COURSE CODE	CIV_1709	**SEMESTER OF STUDIES**	1st
COURSE TITLE	TECHNICAL AND ELECTRONIC DRAWING		

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, seminars and laboratory work	3 (lect.)+3(lab.)	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, specialised general knowledge, skills development*	Field of Science
PREREQUISITE COURSES:	There are not prerequisite course.
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1704/

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 course constitutes the basic course to engineering drawings and computer-aided design. The topics covered start with the application of drawing rules, according to international standard, for facets, sections, plans and other details. In the following, computer aided designed is covered using AutoCAD software. Various processing and design commands are shown and design strategies using layers and blocks are also developed. On the basis of the aforementioned topics, the student acquires complete knowledge regarding technical drawings and computer-aided designs.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

By the end of this course the student will, furthermore, have developed the following skills (general abilities):

- *Knowledge of using drawing instruments and materials.*
- *Selection and application of appropriate drawing scales.*
- *Knowledge to dimension the drawing.*
- *Knowledge to draw using appropriate scales.*
- *Knowledge to draw facets, sections, plans and other details.*
- *Knowledge of basic structural materials and their representation in drawings.*
- *Knowledge of elements of projective geometry.*
- *Knowledge of using the basic design and processing commands of AutoCAD.*
- *Knowledge of using layers and blocks for design purposes.*
- *Creating designs of facets, sections, plans and of other details.*
- *Dimensioning of drawings and designs.*
- *Printing of designs using appropriate scales.*

Generally, by the end of this course the student will, furthermore, have develop the following general abilities (from the list above):

Autonomous (Independent) work
Group work
Search for, analysis and synthesis of data and information, with the use of the

necessary technology *Work design and management*

3. SYLLABUS

- i. *Introduction to basic technical drawing for representation of objects and structural elements.*
- ii. *Elements of projective geometry*
- iii. *Organizing the design, standardization, symbols, dimensions*
- iv. *Drawing facets, plans, sections and other details.*
- v. *Introduction to AutoCAD.*
- vi. *Preparation of designs. Drawing strategies.*
- vii. *Basic commands in AutoCAD.*
- viii. *Design organization in layers.*
- ix. *Block of design objects.*
- x. *Creating (designing) facets, plans ,sections and other details in AutoCAD.*
- xi. *Inserting dimensions in designs.*
- xii. *Text in designs.*
- xiii. *Setting scales for printing. Printing of designs.*

4. TEACHING AND LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Lectures and laboratory applications. The laboratory applications are being held in groups at the computer center of the Civil Engineering Department and each student has a computer. The lecture is presented on a board, with simultaneous overhead projection of the unity-exercise. There is personal homework exercise for each student.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Some content of the course is uploaded on the webpage of the course where the students can download it provided that are registered.
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,*	see activity table below

Activity	***Semester workload***
Lectures (3 conduct hours per week x 13 weeks)	39
Laboratory - Performing drawings and preparing drawings for homework (3 conduct hours per week x 13 weeks)	39
Hours for private study of the student and	125 -47 =78

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*	preparation of home-works	
	Total number of hours for the Course (25 hours of work-load per ECTS credit)	***125 hours (total student work-load)***
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 examination after the end of the semester – 80% of the final grade. The examination involves theoretical parts and drawings performed in AutoCAD. Laboratory drawings performed throughout the semester – 20% of the final grade. Minimum passing grade: 5.	

5. ATTACHED BIBLIOGRAPHY

- *Introduction to AutoCAD 2015, I. Kappos, 2η Edition, KLEITHARITMOS EPE*
- *AutoCAD 2012, Manual, S. Onstott, 2η Edition, X. GKIOURTHA & SIA EE.*
- *Technical drawing with AutoCAD, I. Sarafis, S. Tsempeklis, I. Kazanidis, MOURGKOS IOANNIS*

COURSE OUTLINE

1. ΓΕΝΙΚΑ

SCHOOL	ENGINEERING		
DEPARTMENT	CIVIL ENGINEERING		
ΕΠΙΠΕΔΟ ΣΠΟΥΔΩΝ	UNDERGRADUATE		
COURSE CODE	CIV_1155	**SEMESTER**	1st
COURSE TITLE	ENGLISH LANGUAGE		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
	3	3

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	CORE CURRICULUM-FOREIGN LANGUAGE REQUIREMENT
PREREQUISITE COURSES:	NONE
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	TEACHING LANGUAGE: 20% IN GREEK, 80% IN ENGLISH ASSESSMENT LANGUAGE: 100% IN ENGLISH
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO
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

- Upon successful completion of the course, the students will have developed knowledge, abilities and skills so as to:
- use the English language in their oral and written communication, applying the appropriate terminology,
- have access to anglophone sources, journals and research studies and read, analyze and understand anglophone scientific articles,

- compose scientific texts and research articles in their field with clarity and ease,
- create reports and interpret data analyses results,
- communicate efficiently in an anglophone professional environment,
- identify and develop their own communication skills in the academic and professional field,
- discover and cultivate their own soft skills, as needed by their profession.

General Competences

TTaking 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 Adapting to new situations Decision-making Working independently Team work Working in an international environment Working in an interdisciplinary Project planning and management Respect for difference and multiculturalism Respect for the natural environment Showing social, professional and ethical responsibility and sensitivity to gender issues Criticism and self-criticism Production of free, creative and inductive thinking …… Course Outlines, Undergraduate Program, Dept. of Civil Engineering, University of Patras, 01/09/2024 42 environment Production of new research ideas Others…

3. SYLLABUS

Students are introduced into Academic Writing for Civil Engineering science through videos, exercises and printed notes.

Experts in the field will be invited to talk about soft skills and showcase tangible and real examples to the students.

A booklet of notes and exercises will be distributed to the students, and the learning methodology will include personal and group projects.

4. TEACHING and LEARNING METHODOLOGY ASSESSMENT

DELIVERY ***Face-to-face, Distance learning, etc.***	THREE CONSECUTIVE CONTACT/IN-CLASS HOURS PER WEEK
USE OF INFORMATION AND COMMUNICATIONS *TECHNOLOGY Use of ICT in teaching, laboratory education, communication with*	1. E-CLASS FOR: GENERAL COURSE RELATED ANNOUNCEMENTS AND COURSE MATERIAL 2. STUDENT ACCESS TO INSTRUCTOR'S EMAIL FOR EMERGENCY COMMUNICATION.

<table>
<tr><td>student</td><td>3. 3. IN-CLASS ACCESS OF ON-LINE COURSE RELATED WEB MATERIAL, E.G. TED TALKS</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, Teaching Method Semester Workload PRESENTATION BY INSTRUCTOR 30% STUDENT IN-CLASS PARTICIPATION; READING 50% Course Outlines, Undergraduate Program, Dept. of Civil Engineering, University of Patras, 01/09/2024 43 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>Teaching Method</th><th>Semester Workload</th></tr>
<tr><td>INTERACTIVE PRESENTATION BY INSTRUCTOR / IN-CLASS PRACTICE</td><td>20%</td></tr>
<tr><td>CLASS ATTENDANCE</td><td>10%</td></tr>
<tr><td>MINI PROJECTS</td><td>20%</td></tr>
<tr><td>PRESENTATIONS/FINAL ASSIGNMENT</td><td>50%</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Total number of hours for the Course</td><td>100% (75ECTS)</td></tr>
</table>
</td></tr>
<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</td><td>-LANGUAGE OF ASSESSMENT: ENGLISH
50% OF THE FINAL GRADE COMES FROM A FINAL ASSIGNMENT/PRESENTATION / 50% COMES FROM A WRITTEN EXAM
-ALTERNATIVELY FOR STUDENTS WHO WILL NOT SUBMIT A FINAL ASSIGNMENT, THE FINAL GRADE WILL COME FROM A WRITTEN EXAM 100%
-CLASS ATTENDANCE AND PARTICIPATION IN IN-CLASS MINI PROJECTS PLAYS AN IMPORTANT ROLE IN THE FINAL GRADE</td></tr>
</table>

examination of patient, art interpretation, other Specifically-defined evaluation criteria are given, and if and where they are accessible to students	

5. SUGGESTED BIBLIOGRAPHY

1. Malivitsi, Z. (2025) Foundations in English for Architects, Civil Engineers, Surveyors, and Urban Planners. Εκδόσεις Αθανασίου Αλτιντζή.

2. Rizopoulou, N. (2024). Academic Writing. Disigma Pubs.

3. Stamison-Atmatzidi, M. (2006). Scientific English Structure and Sylve Contextualized for Civil Engineering. Klidarithmos Pubs.

2nd SEMESTER

COURSE OUTLINE

1. GENERAL

<table>
<tr><td>SCHOOL</td><td colspan="4">ENGINEERING</td></tr>
<tr><td>ACADEMIC UNIT</td><td colspan="4">CIVIL ENGINEERING</td></tr>
<tr><td>LEVEL OF STUDIES</td><td colspan="4">UNDERGRADUATE</td></tr>
<tr><td>COURSE CODE</td><td>CIV_2110A</td><td colspan="2">SEMESTER</td><td>SECOND</td></tr>
<tr><td>COURSE TITLE</td><td colspan="4">APPLIED MATHEMATICS II</td></tr>
<tr><td colspan="3">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></td><td>WEEKLY TEACHING HOURS</td><td>CREDITS</td></tr>
<tr><td colspan="3">Lectures, seminars and laboratory work</td><td>3+1</td><td>6</td></tr>
<tr><td colspan="3"></td><td></td><td></td></tr>
<tr><td colspan="3"><i>Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).</i></td><td></td><td></td></tr>
<tr><td colspan="3">COURSE TYPE
<i>general background, special background, specialised general knowledge, skills development</i></td><td colspan="2">General background</td></tr>
<tr><td>PREREQUISITE COURSES:</td><td colspan="4">There are no prerequisite courses. However the students should already have a satisfactory knowledge of the corresponding course of the first semester "Applied Mathematics I".</td></tr>
<tr><td>LANGUAGE OF INSTRUCTION and EXAMINATIONS:</td><td colspan="4">Greek</td></tr>
<tr><td>IS THE COURSE OFFERED TO ERASMUS STUDENTS</td><td colspan="4">No</td></tr>
<tr><td>COURSE WEBSITE (URL)</td><td colspan="4">https://eclass.upatras.gr/courses/CIV1554/</td></tr>
<tr><td></td><td colspan="4"></td></tr>
</table>

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*

This course is one of the basic courses of Applied Analysis taught in the Department and focuses on the field of multivariable calculus.
The goals are to give the student of civil engineering the knowledge of advanced applied engineering mathematics that he/she needs in his/her science in the areas of differential and integral calculus of functions of several variables and of vector analysis. This knowledge is necessary and is used in many subsequent specialization courses in civil engineering, as well as in the subsequent course Applied Mathematics III of the 3rd semester.

At the end of the course the student will have developed the following skills and competencies:

1. To be able to efficiently use the differential and integral calculus of multivariable functions, as well as vector analysis.
2. To be able to mathematically formulate and solve problems of civil engineering which make use of the above mathematical areas.
3. To be able to efficiently use the computer and computer algebra software in mathematics and civil engineering applications.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

- Working independently
- Team work
- Working in an interdisciplinary environment

3. SYLLABUS

i. Continuity at a point and in a region of multivariable functions.
ii. Partial derivative and differentiability of functions of several variables
iii. Functional determinant and implicit functions

iv. Taylor expansion v. Extremum points and conditional extremum points vi. Vector Analysis vii. Dot, cross and mixed product of vectors viii. Curves in space, Frenet formulas, Surfaces ix. Hamilton operator, directional derivative, vector operators x. Multiple integrals, curve and surface integrals, Green’s, Gauss’ and Stokes’ theorems.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Lectures, seminars and laboratory.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Special computer Algebra software in Mathematics. Support of the learning process by e-class
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*	see table below
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive,*	I. Final written examination (80%) II. Laboratory examination (20%)

Activity	***Semester workload***
Lectures	39
Laboratory	13
Preparation of home-works	40
Hours of private study	58
Course total	***150***

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.*	

5. ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Related academic journals:

- Papadakis, K. E., "Applied mathematics and *Mathematica*", 1st edition, Tziolas Editions, 2012 (in Greek).
- Hatzikonstantinou, P. M., "Mathematical Methods for Engineers and Scientists: Calculus of Functions of Several Variables and Vector Analysis", 1st edition, Gotsis Editions, 2017 (in Greek).
- Rassias, Th., Mathematics II, 2st edition, Tsiotras Editions, 2017 (in Greek).
- Philippakis M., Applied Analysis and fourier theory, 2st edition, Tsiotras Editions, 2017 (in Greek).

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	Civil Engineering		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	CIV_2120A	**SEMESTER**	2nd
COURSE TITLE	Probability - Statistics		

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	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*	General background
PREREQUISITE COURSES:	None
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1557/

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 course is the basic introductory course in Probability and Statistics. The main purpose of the course is to familiarize students with the basic laws of probability and the widely used functions and parameters of description of probability distributions. In addition, the course aims at acquainting with useful discrete and continuous distribution models for calculating probabilities of engineer problems and to present methods of data analysis using graphical tools and descriptive statistical measures. Finally, the course also aims to familiarize the students with the use of appropriate statistics for conducting hypothesis testing and create confidence intervals for population parameters and to introduce the use of regression models to describe the linear relationship between two variables and to predict the one of them based on the other's observation. Upon successful completion of the course the student will be able to: • select and apply appropriate discrete and continuous distribution patterns to find probabilities, percentage points and return periods. • analyzes data using descriptive statistics tools. • uses appropriate sampling measures to calculate confidence intervals for the mean, the variance, and proportions. • using the hypothesis testing and confidence interval procedures for making decision. • use Monte Carlo simulations and the Minitab statistical package for probability finding or statistical methods.
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

Adapting to new situations

Decision-making

Working independently

Team work

Working in an international environment

Working in an interdisciplinary environment

Production of new research ideas

Project planning and management

Respect for difference and multiculturalism

Respect for the natural environment

Showing social, professional and ethical responsibility and sensitivity to gender issues

Criticism and self-criticism

Production of free, creative and inductive thinking

……

Others…

…….

- Search for, analysis and synthesis of data and information, with the use of the necessary technology

3. SYLLABUS

1. The importance of probability and statistics in engineering problems

Objects of probability and statistics, the role of probability in statistics, examples of application in problems of the Civil Engineer.

2. Probability theory, random variables and distribution characteristics

Sample space and events, axiomatic foundation, basic notions of combinatorial theory, conditional probability, probability, probability density and distribution functions, mean, moments of higher order, covariance and correlation, Chebyshev’s inequality, use of Monte Carlo simulation.

Discrete distributions (binomial, hypergeometric, geometric, negative binomial, the Poisson distribution and the Poisson process), continuous distributions (normal, lognormal, uniform, exponential, gamma, Weibull, Gumbel, Pearson type III, log Pearson type III). Arithmetic measures, graphical methods of exploratory data analysis, use of the Minitab package. Normal population theory, central limit theorem, the t, chi-square and F distributions, problems of measurements theory, confidence intervals for means, variances and proportions with one and two samples, use of the Minitab package. Errors, characteristic curve and power of a test of hypotheses, tests for means, variances and proportions with one and two samples, tests of significance, relationship between tests and confidence intervals, use of the Minitab package. Model assumptions, the least squares method, coefficient of determination, tests, estimation and prediction in the simple linear model, correlation analysis of two variables, use of the Minitab package.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	At Amphitheatre and Computer Lab
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	MINITAB Support learning through the e-class e-class platform
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and*	

Activity	***Semester workload***
Exams study	76

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*	<table><tr><td>**Course total**</td><td></td></tr></table>
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 exam (80%) which includes: - Multiple choice questions - Short answer questions - Development questions - Problem solving

5. ATTACHED BIBLIOGRAPHY

- “Applied probability and statistics”, I.A. Koutrouvelis, Ekdoseis Gotsis, 2015.
- “Applied Statistics and Probability for Engineers”, D.C. Montgomery and G. C. Runger, Ekdoseis Tziola, 2017 (In Greek)
- “Probability and Statistics”, M.R. Spiegel, McGraw-Hill, 1975.
- “Probability Concepts in Engineering: Emphasis on Applications to Civil and Environmental Engineering”, A.H-S. Ang and W.H.Tang, Wiley; 2nd edition, 2006.
- Economou, P., Malefaki, S., & Batsidis, A. (2022). Probability - Statistics [Undergraduate textbook]. Kallipos, Open Academic Editions. https://dx.doi.org/10.57713/kallipos-101

COURSE OUTLINE

1. GENERAL

<table>
<tr><td>SCHOOL</td><td colspan="4">ENGINEERING</td></tr>
<tr><td>ACADEMIC UNIT</td><td colspan="4">CIVIL ENGINEERING</td></tr>
<tr><td>LEVEL OF STUDIES</td><td colspan="4">UNDERGRADUATE</td></tr>
<tr><td>COURSE CODE</td><td>CIV_3217</td><td>SEMESTER</td><td colspan="2">2nd</td></tr>
<tr><td>COURSE TITLE</td><td colspan="4">INTRODUCTION TO MECHANICS OF MATERIALS</td></tr>
<tr><td colspan="2">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></td><td colspan="2">WEEKLY TEACHING HOURS</td><td>CREDITS</td></tr>
<tr><td colspan="2">Lectures</td><td colspan="2">4</td><td>6</td></tr>
<tr><td colspan="2">Laboratory exercises</td><td colspan="2">2</td><td></td></tr>
<tr><td colspan="2"></td><td colspan="2"></td><td></td></tr>
<tr><td colspan="2"><i>Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).</i></td><td colspan="2"></td><td></td></tr>
<tr><td>COURSE TYPE
<i>general background, special background, specialised general knowledge, skills development</i></td><td colspan="4">Special background</td></tr>
<tr><td>PREREQUISITE COURSES:</td><td colspan="4">Typically, there are not prerequisite course. Essentially, the students should possess knowledge based on the course “Engineering Mechanics - Statics”</td></tr>
<tr><td>LANGUAGE OF INSTRUCTION and EXAMINATIONS:</td><td colspan="4">Greek</td></tr>
<tr><td>IS THE COURSE OFFERED TO ERASMUS STUDENTS</td><td colspan="4">Yes</td></tr>
<tr><td>COURSE WEBSITE (URL)</td><td colspan="4">https://eclass.upatras.gr/courses/CIV1514/</td></tr>
</table>

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 course deals with the mechanical behavior of materials and structural members subjected to simple loading cases which result in tensile or compressive stress, shearing and torsion.

The aim of the course is to educate the first-year students of the Department of Civil Engineering in basic concepts of mechanics of materials, such as stress and strain, but also the relations between them for the simple cases of axial and shear stress (including the torsion of axisymmetric cross-sections) .

At the end of this course the student will have developed the ability to:

- solve problems regarding axially loaded members.
- compute the magnitude of shear stresses in problems of pure shear loading (including those referring to thin cylindrical or spherical shells under internal pressure).
- transform stresses and strains from one coordinate system to another.
- solve problems using theories of failure of materials.
- solve problems regarding cylindrical axial members under pure torsion.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

- Working independently

3. SYLLABUS

i. General principles of mechanics of materials: the concept of stress, basic concepts of axial and shear loading, strength-based design principles of structural members, the concept of deformation.
ii. Stress-strain relationships for structural members under axial loading, methods for calculating displacements, basic principles of analysis of statically determinate and indeterminate structural assemblies with axially loaded members.
iii. Stress state in structural elements subjected to shear, general mathematical definitions for axial and shear strains, generalized stress-

strain relationships in the three-dimensional stress state, applications to stressed thin shells.

iv. Transformations of stresses and strains from one coordinate system to another.

v. Basic concepts of theories of failure of materials. Introduction to the theory of torsion (cylindrical axial members under pure torsion).

4. TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face-to-face in class and in lab</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Support of the learning process through the e-class electronic platform</td></tr>
<tr><td>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></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>52</td></tr>
<tr><td>Laboratory exercises</td><td>30</td></tr>
<tr><td>Series of individual technical reports (short projects) based on the laboratory exercises</td><td>30</td></tr>
<tr><td>Individual study</td><td>38</td></tr>
<tr><td>Course total</td><td><i>150</i></td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work,</i></td><td><u>For 1st-year students</u>: The final grade (T) is calculated as follows:

T=0.7*FiEx+(0.2*LabEx+0.1*LabEss), where:

FiEx = Final written test grade (test taken during the June exams period or - in case of failed test – during the September exams period). The final written test includes problem solving and (occasionally) questions requiring short answers.</td></tr>
</table>

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.*	LabEx = Mid-term written test grade (test taken at mid-spring semester); test material is related to the lab component of the course (lab classes). The mid-term written test includes problem solving and (occasionally) questions requiring short answers. Only 1st-year students are eligible for taking the mid-term test. LabEss = Average grade from a series of individual lab essays (technical reports based on lab exercises) delivered within strict deadlines. Only 1st-year students are eligible for attending lab classes and for delivering lab essays. Absentee students cannot deliver the lab essay corresponding to the lab class missed. The delivery of all lab essays (except maximum one) is necessary for the participation of 1st-year students in the final written test. This prerequisite is not applicable to the September exams period. For students in the 2nd year of studies or higher: The sum [0.2*LabEx+0.1*LabEss] is kept in the student's record until he/she passes the course. The multiplier of this sum is reduced to 50% for students in the 2nd year of their studies or higher; that is, the aforementioned sum accounts for 15% of the final grade (instead of 30%) whereas the final written test grade accounts for 85% of T (instead of 70%). Hence, the final grade (T) for students in the 2nd year of studies or higher is calculated as follows: T=0.85*FiEx+0.5*(0.2*LabEx+0.1*LabEss). For students admitted in October 2019 or before: The final grade is equal to the final written test grade.

5. ATTACHED BIBLIOGRAPHY

- *Suggested bibliography:*

1. "MECHANICS OF MATERIALS" (in Greek), Thanasis Triantafillou, ISBN: 978-960-92177-3-6, GOTSIS Editions.
2. "MECHANICS OF MATERIALS" (in Greek), Panagiotis Vouthounis, ISBN: 978-618-83280-0-6, Vouthouni Andtomahi (Ed.).
3. "MECHANICS OF MATERIALS AND STRUCTURAL ELEMENTS" (in Greek), Papanichos Euripides and Charalambakis Nikolaos, ISBN: 978-960-418-472-9, TZIOLA (Ed.).

4. “MECHANICS OF MATERIALS” (in Greek), Hibbeler, ISBN: 9789603307372, ΓΡΗΓΟΡΙΟΣ ΧΡΥΣΟΣΤΟΜΟΥ FOUNTAΣΣ (Ed.).
5. “MECHANICS OF MATERIALS” (in Greek), Beer F., Johnston R., DeWolf J. και Mazurek D., ISBN: 978-960-418-555-9, TZIOLA (Ed.).
6. “STATICS and MECHANICS OF MATERIALS”, Apostolos Polyzakis, ISBN: 978-960-98311-7-8, Apostolos Polyzakis (Ed.).

- Related academic journals:

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF COURSE	UNDERGRADUATE		
COURSE CODE	CIV_2138A	**SEMESTER**	2nd
COURSE TITLE	GEOLOGY FOR CIVIL ENGINEERS		

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 and Laboratory Work	2(L), 2(LW)	6

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Field of Science (Geology)
PREREQUISITE COURSES:	NO
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1684/

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 course is addressed to undergraduate students with no prerequisites on geology. The aim of the course is to introduce to the students an advanced knowledge and skills development on themes related with the recognition of common rocks and minerals. The students are also familiarised with the basic concepts of the geological time scale and the methodologies of measuring time of the rock's formation and evolution. The course also offers knowledge on the basic principles of deformation structures in rocks as well as the basic principles of earthquakes and their consequences in the natural and man-made environment. Additionally, the basic geotechnical characteristics of soils and rocks, elements of surface and subsurface water, creation and classification of landslides and engineering geological problems prevailing in the geological units of the Hellenic territory, are examined. Finally, the students learn about the more important geological parameters that influence the construction of technical works.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

- Search for, analysis and synthesis of data and information, with the use of the necessary technology decision making
- Adapting to new situations
- Decision making
- Working independently and in teams
- Working in an interdisciplinary environment
- Project planning and management
- Respect for the natural environment

3.SYLLABUS

- Elements of general Geology – Evolution of the planet earth
- Minerals
- Rocks
- The principal geological structures: Discontinuities, Faults, Folds
- Physical and mechanical properties of soils and rocks
- Surface and subsurface water and their influence on the geomaterials and technical works
- Geological mass movements – Landslides – Elements of the Hellenic Geology

and engineering geological problems in the Hellenic territory
- Important geological parameters in the construction of technical works

4.TEACHING AND LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face to face and Distance learning</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>• Use of Information and Communication Technologies (ICTs) in teaching (zoom and power point).
• Support of the Learning Process and Dissemination of the Educational Material through the e-class platform</td></tr>
<tr><td>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></td><td>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures (2 conduct hours per week x 13 weeks)</td><td>2×13=26</td></tr>
<tr><td>Laboratory work on rock recognition and map understanding focusing in the application of geological methodologies (in small student groups)</td><td>26</td></tr>
<tr><td>Autonomous study</td><td>98</td></tr>
<tr><td>Total number of hours for the Course</td><td>150 hours</td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<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,</i></td><td>I. Theory (70% of the total rate).
Written examination of graded difficulty after the end of the semester which includes: question of short answers related to lectures and development questions
II. Laboratory work (30% of the total rate)
1) Recognition of rocks form the collection of the Geology department (50% of the laboratory rate).
2) Understanding the use of geological maps (50% of the laboratory rate).</td></tr>
</table>

clinical examination of patient, art interpretation, other *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	

5.ATTACHED BIBLIOGRAPHY

- Suggested bibliography
- *Γεωλογία για Πολιτικούς Μηχανικούς, Ν. Δεπούντης, Ι.Κουκουβέλας, Δ.Παπούλης, 290 σελ,*
παρέχεται μέσω ΕΥΔΟΞΟΥ.
- *Γεωλογία Αρχές και Εφαρμογές, Θ. Δούτσος 421 σελ, παρέχεται μέσω ΕΥΔΟΞΟΥ*
- Scientific International Journals
- University Notes (E-CLASS)

COURSE OUTLINE

1. GENERAL

SCHOOL	POLYTECHNIC		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	CIV_3710A	**SEMESTER**	2nd
COURSE TITLE	BUILDING TECHNOLOGY		

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
Lab	2	
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*	Special background
PREREQUISITE COURSES:	Typically, there are no prerequisite courses. Essentially, students should have gained and consolidated the material provided in the "Technical and Electronic Drawing" course.
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
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 course comprises an introduction to terms and concepts of Building Technology, in order for the student to gain a global understanding of the subject, so that it is possible for him/her to receive and consolidate more in-depth knowledge in most of these concepts during his/her studies. Specifically, the course provides basic knowledge about: the structural and functional requirements of buildings, the types of buildings and uses thereof, the design procedure, the construction methods and related processes of buildings and the basic building materials. Sub-themes of the course material include: the positioning of the building on the site, the construction systems, the required plot preparations (including excavations and foundations), the load-bearing system and the building shell, the rooftop and base slabs, the roofs, the vertical access routes, the internal partitions, the installations and the protection of structures.

At the end of this course the student will have developed the ability to:

1. Distinguish the most basic types of buildings and uses thereof.
2. Understand the steps required during the design and construction process of a building.
3. Understand the basic criteria and the most important constraints that determine the options of positioning a building on the site.
4. Distinguish and comprehend the construction requirements and the time sequence of the most basic plot preparations.
5. Select construction systems and methods per case of building project and to select the load-bearing system and the most suitable building materials per case of building project.
6. Select the materials and the configuration of the exterior of a building.
7. Distinguish between different types of rooms, floors and roofs, means of vertical access routes, internal partitions and installations in buildings.
8. Identify the most important protection needs of structures and the basic means of achieving such protection.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility, and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking

- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Decision-making
- Project planning and management
- Respect for the natural environment
- Working independently but also within a team
- Production of free, creative and inductive thinking

3. SYLLABUS

1. Introduction
   Introduction to Building Technology, structural and functional requirements of buildings. Types of buildings and uses. Design procedure for buildings (brief presentation of codes). Construction methods for residential buildings (traditional, contemporary, industrialized). Construction processes. Brief presentation of basic construction materials.
2. Positioning of a building on a site – Layout.
   Topography, ground, vegetation, solar radiation, passive design, shading, natural light sources, water drainage, wind, noise, view, legislative issues, access, inclinations, retention walls, technical specifications, building diagram and basic terminology.
3. Site works – Earthworks (excavations, foundations):
   Survey plan, contour lines, site plans, building construction machinery, construction site setup. General excavation, special-type excavations. Excavations plan. Types of foundations, foundation elements.
4. Building envelope - Construction systems:
   Masonry constructions. Types, properties, materials, hygrothermal insulation, sound insulation of walls. Façades and claddings. Frames for windows, doors and apertures, definitions, categories, types, selection criteria, function, sun protection, safety features. Basement walls. Construction details.
5. Rooftop and base slabs, roofs:
   Rooftop slabs. Cold and warm roof. Pitched roofs. Roof slopes for water drainage. Base slabs (slabs on grade/ground and basement slabs).
6. Forms of vertical access routes:
   Types and design of stairs. Ramps. Elevators.
7. Internal partitions, linings, coatings, finishes:
   Drywall construction. Drywall finishing. Typical drywall details.
8. Installations and services:
   Mechanical, Electrical, Plumbing
9. Protection of structures:
   Waterproofing and thermal insulation (per type of building element), vapour condensation (in relation to thermal insulation), soundproofing, fire safety.

4.TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face-to-face in class, with support of PowerPoint presentations. Lab with applications of theory and tutorials with solving examples / exercises.</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Support of the learning process through the e-class platform</td></tr>
<tr><td>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></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures and labwork</td><td>85</td></tr>
<tr><td>Laboratory exercises</td><td>30</td></tr>
<tr><td>Series of individual technical reports (short projects) based on the laboratory exercises
Individual study</td><td>30
60</td></tr>
<tr><td>Course total</td><td><i>150</i></td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<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></td><td>I. Written final exam (50%) that includes:
- Evaluation questions, short-answer questions.
- Short study of the layout of the load-bearing system of a building or of a roof structure.
II. Laboratory (50%) that includes:
(30%) Work related to the delivery of a (A3) folder with a complete set of construction documents of a building (Teamwork) and
(20%) Weekly deliveries of individual and team exercises - presentations.
The student will take part in the laboratory component of the course during the first year of enrollment to the course.
A pass grade can only be achieved if the student achieves pass grades in both parts (I and II).</td></tr>
</table>

Specifically-defined evaluation criteria are given, and if and where they are accessible to students.	

5. ATTACHED BIBLIOGRAPHY

-Προτεινόμενη Βιβλιογραφία :

1. Schmitt Heinrich, Heene A., 1994. Κτιριακές κατασκευές. Χ. ΓΚΙΟΥΡΔΑ & ΣΙΑ ΕΕ. ISBN 978-960-512-5110.
2. Χρήστος Αθανασόπουλος, 2020. Κατασκευή Κτιρίων - Σύνθεση και τεχνολογία. Εκδόσεις Δίαυλος. ISBN-13: 978-960-531-441-5
3. Αγγ. Ζαχαριάδης, 2004. ΟΙΚΟΔΟΜΙΚΗ ΤΕΧΝΟΛΟΓΙΑ. UNIVERSITY STUDIO PRESS. ISBN : 960-12-1239-6.
4. Ernst Neufert, 2010. Οικοδομική & Αρχιτεκτονική Σύνθεση, ΓΚΙΟΥΡΔΑΣ Μ. ISBN 978-960-512-613-1.

-Συναφή επιστημονικά περιοδικά:

3rd SEMESTER

COURSE OUTLINE

1. GENERAL

SCHOOL	SCHOOL OF ENGINEERING
ACADEMIC UNIT	CIVIL ENGINEERING
LEVEL OF STUDIES	UNDERGRADUATE

COURSE CODE	CIV_3115A	**SEMESTER**	3RD

COURSE TITLE	APPLIED MATHEMATICS 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**
Lectures and laboratory work	4 (lectures)	4
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*	Basic Knowledge
PREREQUISITE COURSES:	Typically, there are no prerequisite courses. Essentially, the students should possess knowledge of differential and integral calculus, as well as of matrix theory.
LANGUAGE OF INSTRUCTION and	Greek. However, teaching may be in English for foreign (Erasmus) students attending the course.

EXAMINATIONS:	
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes (in English)
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1553/ http://www.civil.upatras.gr/en/ProptixiakhEkpaideysh/Mathimata/BEtos/entry/ee1f4ef9-b597-4c93-a570-88372ad50c58/?PageNo=0

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*
It is the basic course where differential equations are introduced to the students, together with analytic methods of their solutions. During the course, the basic ideas of differential equations are introduced, together with their applications in problems relevant to civil engineering. Basic methodologies are demonstrated for finding explicit analytical solutions of both ordinary and partial differential equations. Moreover, an introduction to the Laplace and Fourier transforms is carried out with an emphasis to their use for solving specific classes of differential equations. By the end of this course the student will be able to: • Recognize basic problems in civil engineering which can be modelled by differential equations. • Find explicitly analytical solutions of ordinary and partial differential equations. • Use the Laplace and Fourier transforms.
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	*Project planning and management* *Respect for difference and*

the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

By the end of this course the student will have developed the following skills (general abilities) (from the list above):

- *Promotion of free, creative and inductive thinking*
- *Searching, analysis and synthesis of facts and information, as well as using the necessary technologies*

3. SYLLABUS

The course covers basic notions of differential equations and methods for their solution. More precisely the course covers:

i. Basic notions of ODEs. 1st order ODEs: separable, linear, exact.
ii. Linear ODEs of 2nd order, with constant coefficients, homogeneous and nonhomogeneous.
iii. Boundary value problems and eigenvalue problems. Fourier series.
iv. Systems of ODEs. Basic notions. Solution of systems of ODEs with constant coefficients, homogeneous and nonhomogeneous, by means of eigenvalues and eigenvectors.
v. Basic notions and solutions of PDEs.
vi. Solution of PDEs using the separation of variables method.
vii. Laplace transform and its application to the solution of ODEs, systems of ODEs and PDEs.
viii. Fourier transform and its application to the solution of PDEs.
ix. Solution of differential equations using a scientific package of symbolic computations.
x. Applications of ODES, systems of ODEs and PDEs to problems regarding: beams, plates, oscillations, waves, heat transfer and environmental hydraulics.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face lectures in the classroom
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of a scientific package of symbolic computations. Use of slides during lectures. Support via the eclass platform
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*	see table below
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*	Written examination after the end of the semester

Activity	*Semester workload*
Lectures (4 contact hours per week x 13 weeks)	52
Hours for private study	48
Course total	***100***

Specifically-defined evaluation criteria are given, and if and where they are accessible to students.	

5. ATTACHED BIBLIOGRAPHY

1. E. N. Petropoulou, Differential equations and applications. With elements of matrix theory, special fuctions and integral equations, Gotsis, 2017 (in greek).
2. N. Ioakimidis, Applied mathematics II: Mathematics for civil engineers, Gotsis, 2012 (in greek).
3. N. Ioakimidis, Applied mathematics III: Mathematics for civil engineers, Gotsis, 2012 (in greek).
4. N. Mylonas & Ch. Schinas, Differential equations, transforms & complex functions, Tziolas, 2015 (in greek).
5. N. Stavrakakis, Ordinary differential equations. Linear and nonlinear theory with applications from nature and life, Papasotiriou, 1997 (in greek).
6. N. Stavrakakis, Differential equations: ordinary & partial, theory and applications from nature and life, 2015 (in greek).
7. P. Xatzikonstantinou, Mathematical methods for scientists and engineers: partial differential equations, Fourier series, boundary value problems, complex functions, Symmetria, 2008 (in greek).
8. P. Xatzikonstantinou, Mathematical methods for sceintists and engineers: ordinary differential equations, Symmetria, 2009 (in greek).
9. W. E. Boyce & R. C. DiPrima, Elementary differential equations, John Wiley & Sons, 1997.
10. S. J. Farlow, An introduction to differential equations and their applications, McGraw-Hill, 1994.
11. S. J. Farlow, Partial differential equations for scientists and engineers, John Wiley & Sons, 1982.

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	CIV_3127A	**SEMESTER**	3rd
COURSE TITLE	NUMERICAL METHODS		

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, seminars and laboratory work	3+2	4
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*	General background	

PREREQUISITE COURSES:	There are no prerequisite courses. However the students should already have a satisfactory knowledge of the courses "Computer programming and Applications" and "Applied Mathematics I, II, III".
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1663/

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*

This course provides the basic knowledge of Numerical Analysis and Computational Mathematics.
The goals are to give the student of civil engineering the ability to solve linear and no-linear problems as well as to apply numerical techniques for solving mathematical and engineering problems using a PC. This knowledge is necessary and is used in many subsequent specialization courses in civil engineering.

At the end of the course the student will have developed the following skills and competencies:

- To solve numerically linear and non-linear algebraic equations as well as systems.
- Know methods to interpolate (estimate) a value of a function between two known values and curve fitting.
- Know to approximate derivatives and definite integrals.
- Know to solve numerically initial and boundary value problems
- Know to use the multi-paradigm numerical computing environment of Matlab as well as to programming in it.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

- Working independently
- Team work
- Working in an interdisciplinary environment

3. SYLLABUS

i. Algebraic equations root finding and iterative solution methods for non-linear simultaneous equations
ii. Gaussian elimination, partial pivoting, iterative methods Gauss-Seidel and over-relaxation, algebraic eigenvalue problems

iii. Numerical integration
iv. Interpolation and curve fitting
v. Numerical solution of ordinary differential equations, Taylor - Euler - Runge-Kutta methods - Midpoint rule - multistep and predictor-corrector methods
vi. Numerical instability
vii. Two-point boundary value problems, finite differences and shooting methods

4. TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Lectures, seminars and laboratory.</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Computing environment of Matlab
Support of the learning process by e-class</td></tr>
<tr><td>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></td><td><table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>39</td></tr>
<tr><td>Laboratory</td><td>26</td></tr>
<tr><td>Preparation of home-works</td><td>13</td></tr>
<tr><td>Hours of private study</td><td>22</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td><i>100</i></td></tr>
</table></td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires,</i></td><td>I. Final written examination (80%)
II. Laboratory examination (20%)</td></tr>
</table>

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.*	

5. ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Related academic journals:

- Numerical Methods, Markellos, V., 1st edition, Gotsis Editions, 2013 (in Greek)
- Numerical Methods and Applications for Engineers, Sarris, I and Karakasidid, Th., 3d edition, Tziolas Editions, 2015 (in Greek)

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF COURSE	UNDERGRADUATE		
COURSE CODE	CIV_4218	**SEMESTER OF STUDIES**	3rd
COURSE TITLE	MECHANICS OF MATERIALS		

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 and Laboratory work	4 Lect. + 2 Lab.	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*	Field of Science
PREREQUISITE COURSES:	Good knowledge obtained in the courses “Introduction to Mechanics of Materials”, “Engineering Mechanics – Statics”
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1501/

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*

By the end of this course the student will know the mechanics of:

- Elastic bending of beams (calculation of stresses and deflections).
- Special problems in bending (non-prismatic beams, composite beams, inelastic bending, deflections due to shear, non-symmetric bending, shear center).
- Elastic torsion in members with circular, rectangular thin-walled closed sections.
- Inelastic torsion.
- Members under combined loading (bending moments, shear force, axial force, torsional moment).
- Elastic buckling and basic principles of inelastic buckling.

By the end of this course the student will have developed the ability to:

- Calculate stresses in problems of elastic beam bending.
- Calculate elastic deflections and rotations according to different methods.
- Understand the mechanics of special problems (non-prismatic beams, composite beams, inelastic bending, deflections due to shear, non-symmetric bending, shear center).
- Calculate shear stresses and rotations due to elastic torsion in members with circular, rectangular and thin-walled closed sections.
- Understand the mechanics of inelastic torsion.
- Calculate stresses and deflections in members subjected to combined actions (bending moments, shear force, axial force, torsional moment).
- Analyse problems of member buckling and to calculate the critical load.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

- Search, analysis and synthesis of data and information, as well as using the necessary technologies
- Autonomous (Independent) work

3. SYLLABUS

Bending theory: normal and shear stresses, deflection curve, energy methods. Special topics: non-prismatic beams, composite beams, inelastic bending, deflections due to shear, non-symmetric bending, shear center. Torsion: circular bars, rectangular bars, thin-walled closed sections, inelastic torsion, torsion of statically indeterminate members. Combined loading: axial, flexural, torsional. Buckling and stability: elastic and inelastic column behaviour. Laboratory testing: (a) strong and weak axis bending of timber beams, (b) inelastic bending of steel tube, (c) torsion of circular rod, (d) rebar buckling.

4. TEACHING AND LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Lectures: In the classroom
Laboratory: In the Structural Materials Laboratory</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Use of simple computer software for laboratory exercises, interaction with students through the electronic platform e-class</td></tr>
<tr><td>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></td><td><table>
<tr><th><i>Activity</i></th><th><i>Work Load per Semester (hours)</i></th></tr>
<tr><td>Lectures</td><td>52</td></tr>
<tr><td>Laboratory</td><td>26</td></tr>
<tr><td>Self-study and preparation of Lab. assignments</td><td>72</td></tr>
<tr><td><i>Total number of hours for the Course (25 hours of work-load per ECTS credit)</i></td><td><i>150</i></td></tr>
</table></td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires,</i></td><td>I. Final written examination (70%) on problem solving
II. Laboratory assignments (10%)
III. Mid-term examination (20%) on problem solving</td></tr>
</table>

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.*	

5. ATTACHED BIBLIOGRAPHY

Triantafillou, Ath., Mechanics of Materials, GOTSIS Publishers, 2015.

Beer, F., Johnston, E. R., DeWolf, J. and Mazurek, D., Mechanics of Materials, Tziolas Publishers, 2019 (Greek translation).

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	CIV_4219	**SEMESTER**	3rd
COURSE TITLE	STRUCTURAL MATERIALS		

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 and Laboratory exercises	6	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*	Special background
PREREQUISITE COURSES:	Typically, there are no prerequisite courses. Students should possess knowledge based on the course “Introduction to Mechanics of Materials”
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1502/

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 course aims at providing knowledge regarding physical, technological and mechanical characteristics of the main structural materials: natural stones, binders and mortars, concrete, steel and other metals, timber, ceramics, masonry, polymers.

At the end of this course the student will have developed the ability to:
- Know basic principles for the microstructure of materials.
- Define and know the main physical, thermal, mechanical and other properties of structural materials.
- Know about natural stones: physical, technological and mechanical properties, products.
- Know about binders and mortars: physical, technological and mechanical properties, applications.
- Know about concrete: microstructure, strength, deformations (short and long-term), durability, mix design, behaviour at fresh state.
- Know about metals: morphological, technological and mechanical characteristics, products, corrosion.
- Know about timber: technology, microstructure, basic properties, durability.
- Know about bricks: geometrical, physical, mechanical and other characteristics.
- Know about masonry: basic aspects of the mechanical behaviour and durability.
- Know basic technological, physical and mechanical properties of polymers (plain and reinforced) and cellular materials (foams).

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

- Working independently
- Respect for the natural environment

3. SYLLABUS

1. The microstructure of materials.
2. Physical, thermal and mechanical properties of materials.
3. Natural stones and their products.
4. Hydraulic and air-hardening binders and mortars.
5. Concrete: microstructure, constituents, strength, deformations, durability, mix design, fresh concrete.
6. Steel and other metals: technological and mechanical properties, corrosion.
7. Timber: technology, microstructure, mechanical properties, durability.
8. Ceramics: physical and mechanical characteristics of clay bricks and other products.
9. Masonry: mechanical behaviour, durability.
10. Polymers: basic properties, environmental effects, fiber reinforcement, cellular materials.

4. TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face-to-face in class and in lab</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Support of the learning process through the e-class electronic platform</td></tr>
<tr><td>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></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>30</td></tr>
<tr><td>Laboratory exercises</td><td>30</td></tr>
<tr><td>Series of individual technical reports (short projects) based on the laboratory exercises</td><td>30</td></tr>
<tr><td>Individual study</td><td>60</td></tr>
<tr><td>Course total</td><td><i>150</i></td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i></td><td><u>For2nd-yearstudents</u>: The final grade (T) is calculated as follows:

T=0.7*FiEx+(0.2*LabEx+0.1*LabEss), where:</td></tr>
</table>

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.*	FiEx = Final written test grade (test taken during the February exams period or - in case of failed test – during the September exams period). The final written test includes problem solving and (occasionally) questions requiring short answers. LabEx = Mid-term written test grade (test taken at mid-fall semester); test material is related to the lab component of the course (lab classes). The mid-term written test includes problem solving and (occasionally) questions requiring short answers. Only 2nd-year students are eligible for taking the mid-term test. LabEss = Average grade from a series of individual lab essays (technical reports based on lab exercises) delivered within strict deadlines. Only 2nd-yearstudentsareeligiblefor attending lab classes and for delivering lab essays. Absentee students cannot deliver the lab essay corresponding to the lab class missed. The delivery of all lab essays (except maximum one) is necessary for the participation of 2nd-year students in the final written test. This prerequisite is not applicable to the September exams period. For students in the 3rd year of studies or higher: The sum [0.2*LabEx+0.1*LabEss] is kept in the student's record until he/she passes the course. The multiplier of this sum is reduced to 50% for students in the 3rd year of their studies or higher; that is, the aforementioned sum accounts for 15% of the final grade (instead of 30%) whereas the final written test grade accounts for 85% of T (instead of 70%). Hence, the final grade (T) for students in the 3rd year of studies or higher is calculated as follows: T=0.85*FiEx+0.5*(0.2*LabEx+0.1*LabEss). For students admitted in October 2018or before: The final grade is equal to the final written test grade.

5. ATTACHED BIBLIOGRAPHY

“Structural Materials” (in Greek), T. Triantafillou, ISBN 978-960-9427-68-5, GOTSIS Publishers.

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF COURSE	UNDERGRADUATE		
COURSE CODE	CIV_3803	**SEMESTER**	3rd
COURSE TITLE	INTRODUCTION TO GEODESY		

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	2	2
Field training	4	3
Integrated field project	1	1
Total credits		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 knowledge
PREREQUISITE COURSES:	NO
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1700/

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 course is an introduction to Geodesy adapted to the needs of the modern Civil Engineer. The students get familiar with basic geodetic instruments and measurement techniques, methods of topographic surveying and basic principles of creating and analysing topographic maps.

Upon successful completion of the course the student will be able to:

(1) operate basic Geodetic instruments and understand their applications, capabilities, errors and limitations,

(2) understand the characteristics of the site where an engineering project is to be carried out and quantify the changes in relief that it will cause,

(3) organize and perform basic field work for surveying sites/constructions and laying out engineering works; and

(4) present the results of his/her work in a technical report.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

- Search for, analysis and synthesis of data and information, with the use of the necessary technology.
- Adapting to new situations.
- Decision-making.
- Work independently.
- Team work.
- Project planning and management.
- Criticism and self-criticism.
- Production of free, creative and inductive thinking.

3. SYLLABUS

(1) Historical background
(2) Cartography, Reference Systems, Projections, Scale
(3) Angle observations
(4) Distance measurements
(5) Levelling
(6) Fundamental Problems in Geodesy
(7) Traversing
(8) Topographic maps
(9) Area and Volume Calculations

(10) Theory of Errors in Observations
(11) Introduction to Satellite Geodesy and Geographic Information Systems (GIS).

4. TEACHING AND LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	(1) Face to face (2) Lectures with visuals, multimedia and interactive tools (3) Laboratory exercises and presentation of results in a technical report (4) Demonstration of typical applications during the integrated fieldwork
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Support of the learning process through the e-class platform and additional information (encouraging access to electronic literature and other material) with emphasis on current events (fires, earthquakes, landslides, etc.).
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*	see table below
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive,*	Grading based on a generalized average that weights the student's performance in the following components of the course: (1) comprehension exercises, (2) laboratory exercises, (3) comprehension tests, (4) mid-term progress exam, (5) final exam.

Activity	***Semester workload***
Lectures	40
Field training and technical reports	70
Individual exercises	30
Integrated field project	10
Total number of hours for the Course (25 hours of work-load per ECTS credit)	150

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.*	

5. ATTACHED BIBLIOGRAPHY

Notes on the e-class platform
Books selected through the EYDOXOS system (in alphabetical order):
Γεωδαισία Ι: Γεωδαιτικές μετρήσεις και υπολογισμοί
Σαββαΐδης Π., Υφαντής Ι, Δούκας Ι.
ISBN: 978-618-5105-92-1, Κωδικός Ευδόξου: 50662652
Εφαρμοσμένη Γεωδαισία
Πανταζής Γ., Λάμπρου Ε.
ISBN: 978-960-456-205-3, Κωδικός Ευδόξου: 11432
Μαθήματα Γεωδαισίας
Γεωργόπουλος Γ.
ISBN: 978-960-418-736-2, Κωδικός Ευδόξου: 86054250

COURSE OUTLINE

1. GENERAL

SCHOOL	POLYTECHNIC		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	CIV_4711A	**SEMESTER**	3rd
COURSE TITLE	BUILDING PHYSICS		

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	3	4
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*	Special background
PREREQUISITE COURSES:	Typically, there are no prerequisite courses. Essentially, students should have gained and consolidated the material provided in the "Building Technology" course.
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
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 course covers applied scientific topics related to hygrothermal, acoustic and light-related properties of structural elements (ceilings, façades, windows, etc.), structural cells (rooms), buildings and building complexes. In order to gain a fundamental understanding of the afore-mentioned properties, the course provides information on phenomena of heat, air and humidity transfer: (i) of materials, building elements and building assemblies; and (ii) between buildings and the external (outside of the building) environment. The syllabus of the course offers an outline of basic performance targets which are determined based on the requirements of the users for thermal, acoustic and visual comfort as well as on indoors hygienic environmental conditions, while at the same time they are limited by the requirements arising from architectural, technical (e.g. related to available construction materials), economic and environmental factors. Emphasis is given on the application of basic principles (e.g. using software to solve specific problems - theory as a tool and not as an end).

At the end of this course the student will have developed the ability to:

9. determine the external and internal environmental conditions of a building and their effects on the design of its shell;
10. calculate the transient thermal conductivity coefficients (U-values) of transparent and opaque structural elements;
11. identify thermal bridges in buildings and calculate the heat losses associated with them;
12. produce and interpret thermographic imaging using a thermal camera;
13. simulate the hygrothermal behaviour and determine the dynamic coefficients of thermal permeability of structural elements and to evaluate the deterioration mechanisms on structural elements due to moisture;
14. determine the quality characteristics of the indoor environment in buildings;
15. determine the degree of achievement of targets values for acoustic and visual comfort in buildings.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

- Search for, analysis and synthesis of data and information, with the use of the necessary technology

- Adapting to new situations (climatic change)
- Project planning and management (background knowledge)
- Respect for the natural environment
- Working independently but also within a team
- Production of free, creative and inductive thinking

3. SYLLABUS

10. Outdoor and indoor ambient conditions (climatic parameters, microclimates around buildings, climatic change and relevant implications to building enclosure design, indoors).
11. Heat transfer (basic principles: conduction, radiation, convection), heat storage in building elements, calculation of thermal transmittance (U-value) for transparent and opaque parts, thermal bridges in buildings (theory and calculation, principles of thermal imaging and use of thermal camera).
12. Moisture transfer (moisture transfer mechanisms to the inside of buildings and moisture storage in building elements, introduction to psychrometrics, water vapour condensation on the internal surfaces of building components, evaluation of deterioration mechanisms due to water vapour condensation on the surface of building components, water vapour condensation within building components, computational tools for: simulating the hygrothermal behaviour of building elements, calculating transient U-values of building elements and quantifying the deteriorating effects of moisture on them).
13. Air transfer / ventilation of buildings [air pressure differentials, thermal buoyancy, air permeability of materials and elements, air flow through apertures, natural ventilation in buildings (computation and design principles), airtightness].
14. Health and indoor air quality in buildings.
15. Building acoustics (acoustic properties of materials, acoustics of closed spaces, sound absorbing means, acoustic transmission and soundproofing/sound insulation in buildings).
16. Illumination [optical properties of materials, photometry, light sources (position of the sun, natural/artificial light sources), calculation of illuminance, requirements regarding building illumination (optical comfort)].

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face in class, with support of PowerPoint presentations. Tutoring using software and solving examples / exercises.
USE OF INFORMATION AND COMMUNICATIONS	Support of the learning process through the e-class platform

<table>
<tr><td>TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td></td></tr>
<tr><td>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></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>50</td></tr>
<tr><td>Laboratory exercises</td><td>30</td></tr>
<tr><td>Series of individual technical reports (short projects) based on the laboratory exercises
Individual study</td><td>30
60</td></tr>
<tr><td>Course total</td><td><i>100</i></td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<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></td><td>1. Written final exam (70%) that includes:
- Evaluation questions, questions requiring short theory development and multiple choice questions.
- Problem-solving related to heat, humidity and air transfer phenomena.
2. Semester work (30%).</td></tr>
</table>

5.ATTACHED BIBLIOGRAPHY

-Προτεινόμενη Βιβλιογραφία :

5. Παπαμανώλης, Ν. 2015. "Δομική Φυσική και Αρχές Περιβαλλοντικού Σχεδιασμού Κτιρίων". Σύνδεσμος Ελληνικών Ακαδημαϊκών Βιβλιοθηκών. ISBN 978-960-603-072-7.
6. Hens, H.S., 2016. Applied building physics. Ernst & Sohn.
7. Hens, H.S., 2017. Building physics-heat, air and moisture: fundamentals and engineering methods with examples and exercises. John Wiley & Sons.
8. Pinterić, M., 2017. Building Physics: from physical principles to international standards. Springer.

-Συναφή επιστημονικά περιοδικά:

1. Journal of Building Physics. SAGE Publications Ltd. ISSN 17442591.

4th SEMESTER

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEER		
LEVEL OF COURSE	UNDERGRADUATE		
COURSE CODE	CIV_5220A	**SEMESTER**	4th
COURSE TITLE	ANALYSIS OF FRAMED STRUCTURES		

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, seminars and laboratory work	4 (lect.)	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*	Field of Science
PREREQUISITE COURSES:	‘Engineering Mechanics-Statics’’.
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek.
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/

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*

This course introduces the student to the analysis of plane, statically determinate and indeterminate structures together with the calculation of axial/shear force and bending moment diagrams. The influence lines of statically determinate structures are also covered in length. The course, after reviewing force and moment diagrams, focuses on the Principle of Virtual Work for the calculation of deformations. A large fraction of the course is dedicated on the analysis of statically indeterminate structures. The student is introduced systematically to the process of structural analysis and the effectiveness of energy methods.

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*

By the end of this course the student will, furthermore, have developed the following skills (general abilities):

- *To understand the role of various support conditions and construct the free-body diagram of structures.*
- *To calculate reactions of statically determinate structures and to draw force and moment diagrams.*
- *To calculate influence lines of statically determinate beams, frames and trusses.*
- *To calculate deformations of statically determinate structures with the Principle of Virtual Work.*
- *To calculate reactions of statically indeterminate structures and calculate/draw detailed force and moment diagrams.*
- *To calculate deformations of statically indeterminate structures.*

Generally, by the end of this course the student will, furthermore, have developed the following general abilities (from the list above):
Autonomous (Independent) work
Group work
Analysis and Design of Structures

3. SYLLABUS

Idealization of structures
Supports of plane structures
Free body diagram, Equations of Equilibrium
Linearity and Superposition
Analysis of Statically Determinate Beams, Frames, Trusses
Axial/ Shear Force and Bending Moment Diagrams

Symmetric and Antisymmetric Loading
Influence Lines
Elastic Line
Principle of Virtual Work
The Unit-Load Method
Calculation of Displacements with the Unit-Load Method
The Betti-Maxwell Reciprocity Theorem
Analysis of Statically Indeterminate Structures
Approximate Analysis of Statically Indeterminate Structures

4. TEACHING AND LEARNING METHODS – EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Lectures
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Course Material is offered through 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*	see table below
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure*	Written final exam = 100% of the Final Grade Minimum Passing Grade = 5

Activity	***Semester workload***
Lectures (4 conduct hours per week x 13 weeks)	52
Additional lectures (2 conduct hours per week x 5 weeks) - solving of representative problems	10
Problems for homework (2 conduct hours per week x 4 weeks)	8
Hours for private study of the student and preparation of home-works	150 -70 =80
Total number of hours for the Course (25 hours of work-load per ECTS credit)	***150 hours (total student work-load)***

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.*	

5. ATTACHED BIBLIOGRAPHY

- *Structural Analysis , Hibbeler, Edition Fountas, 2010*
- *Structural Analysis, Vol. 2, Ioannis Avramidis, 'Sofia' Editions, 2017*

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
DEPARTMENT	CIVIL ENGINEERING		
LEVEL OF COURSE	UNDERGRADUATE		
COURSE CODE	CIV_2216	**SEMESTER**	4th
COURSE TITLE	DYNAMICS - VIBRATIONS		

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	3	6
Laboratory	1	
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*	Field of Science
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1751/

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*

By the end of this course the student will be able to:

1. Handle the equations of motion of SDOF systems
2. Calculate the dynamic characteristics of systems and find their free-vibration response
3. Calculate the response of SDOF systems to dynamic excitations
4. Understand the role of each of the system's parameters (stiffness, damping etc.) in their dynamic response

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

1. Ability to work autonomously
2. Ability to make decisions
3. Ability to work in groups
4. Design of structures

3. SYLLABUS

1. Dynamic degrees of freedom of structural systems
2. Structural properties related to the dynamic response
3. Equations of motion for a SDOF system
4. Free vibrations of structural systems
5. Structural response to harmonic excitations
6. Structural response to general dynamic excitations

4. TEACHING AND LEARNING METHODS – EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Lectures
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Learning supported through the e-class internet platform

<table>
<tr><td></td><td></td></tr>
<tr><td>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></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>52</td></tr>
<tr><td>Group project on case studies</td><td>50</td></tr>
<tr><td>Autonomous study</td><td>48</td></tr>
<tr><td><i>Total number of hours for the Course (25 hours of work-load per ECTS credit)</i></td><td><i>150 hours (total student work-load)</i></td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<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></td><td>I. Final exam (70%) includes:
- Multiple choice questions
- Short answer questions
- Problem solving
II. Group project (30%)</td></tr>
</table>

5. ATTACHED BIBLIOGRAPHY

1. “Στατική των Κατασκευών , Μέρος Α’” , Αρίσταρχος Οικονόμου
2. “Στατική των Κατασκευών , Μέρος Β’” , Αρίσταρχος Οικονόμου
3. “Ανάλυση Γραμμικών Φορέων” , Πέτρος Μαραθιάς
4. “Dynamics of Structures”, Ray W. Clough, Joseph Penzien

5. “ Dynamics of Structures ”, Anil K. Chopra

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF COURSE	UNDERGRADUATE		
COURSE CODE	CIV_4410A	**SEMESTER OF**	4th
COURSE TITLE	FLUID MECHANICS		

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, seminars and laboratory work	4 (lect.)	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*	Field of Engineering	
PREREQUISITE COURSES:	There are no formal prerequisites. Knowledge, however, of basic Mathematical Analysis (Applied Mathematics I and II, as well as some material covered in Applied Mathematics III) is required.	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek.	
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No	
COURSE WEBSITE (URL)	http://www.civil.upatras.gr/el/ProptixiakhEkpaideysh/Mathimata/BEtos/entry/cc57b914-e4b4-4087-b819-5e7f9ee002a0/?PageNo=0 https://eclass.upatras.gr/courses/CIV1558/	

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*

Students are intended to become familiar with:

- Basic concepts of Fluid Mechanics
- Statics for incompressible fluids
- Equations of incompressible fluid dynamics: equation of continuity (differential and integral form) and equations of energy and momentum (integral form)
- Equations of incompressible ideal fluids (Euler and Bernoulli equations).
- Vorticity and potential flow
- Dimensional Analysis and Hydraulic Similitude
- Elements of Boundary Layer flow

Students are expected to develop the following skills:

- Ability to determine the pressure distribution in static fluids and to calculate forces on surfaces in contact with static fluids.
- Analyze fluid flow using control volume methods
- Ability to use elementary potential flow solutions
- Ability to use dimensional analysis and hydraulic similitude.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…

…….
Independent study *Analysis and synthesis of problem parameters*

3. SYLLABUS

Definition and properties of fluids. Fluid statics. Manometers. Kinematics, stream lines, steak lines, path lines. The concept of System and Control Volume. Integral analysis. Continuity, energy, momentum equations. Ideal fluid flow, Euler and Bernoulli equations. Applications. Vorticity, velocity potential, stream function, Laplace equation. Real fluid flow, laminar, turbulent flow. Dimensional analysis, Buckingham theorem, similitude. Boundary layers.

4. TEACHING AND LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Blackboard lectures, supplemented with projection of video movies (Britannica, N.S.F. U.S.A.)
Solution of sample problems</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Use of selected excerpts from video movies (Britannica, N.S.F. U.S.A.) is made. These excerpts which are analyzed during the lectures are made available to students in the course Web page.</td></tr>
<tr><td>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></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures (4 hours per week x 13 weeks)</td><td>52</td></tr>
<tr><td>Hours for private study of the student</td><td>98</td></tr>
<tr><td><i>Total number of hours for the Course (25 hours of work-load per ECTS credit)</i></td><td><i>150 hours (total student work-load)</i></td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>
<i>Language of evaluation, methods of evaluation,</i></td><td>Final written examination (100%), during which solution of problems and answer of questions is required.</td></tr>
</table>

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.*	

5. ATTACHED BIBLIOGRAPHY

- Streeter, V.L., Wylie, E.B., Bedford, K.W., Fluid Mechanics, Fountas Books (in Greek).
- Liakopoulos, A. (2011) Fluid Mechanics, Tziolas Publications (in Greek).
- Prinos, P. (2014) Fluid Mechanics, Ziti Publications (in Greek).

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF COURSE	UNDERGRADUATE		
COURSE CODE	CIV_5605A	**SEMESTER**	4th
COURSE TITLE	TRAFFIC ENGINEERING		

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 and seminars	4	6
Laboratory exercises, field training and project	1+1	
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 & skills development
PREREQUISITE COURSES:	Applied Mathematics and Statistics
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek. Teaching may be performed in English if foreign students attend the course.
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1771/

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 objective of this course is to introduce students to basic concepts, methods, and tools of traffic engineering.

By the end of this course the student will be able to:

1. Understand the physics of traffic phenaomena, along with their causes and consequences
2. Describe traffic state with analytical expressions
3. Simulate traffic phenaomena using software
4. Apply quantitative and qualitaitice methods of analysis
5. Propose corrective measures for traffic management

Evaluate the performance of road netwroks

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

By the end of this course the student will have developed the following skills (general abilities):

- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Adapting to new situations
- Decision-making
- Working independently
- Team work

Working in an interdisciplinary environment

3. SYLLABUS

1. Introduction to properties and organization of traffic systems. Basic concepts of traffic systems.
2. Traffic characteristics and measurements.
3. Fundamental relationships between the basic traffic dimensions (traffic flow, density, speed).
4. Traffic capacity of sections of the road network.
5. Special traffic studies (pedestrian studies, parking, accident studies).

6. Traffic signalisation (features, conditions, regulation, control, evaluation).
7. Introduction to autonomous traffic systems.

4. TEACHING AND LEARNING METHODS – EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face-to-face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>- Specialised software for traffic systems analysis and management
- Learning support through electronic platform e-class</td></tr>
<tr><td>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></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>52</td></tr>
<tr><td>Practical exercises</td><td>26</td></tr>
<tr><td>Field training, laboratory practice</td><td>8</td></tr>
<tr><td>Project on laboratory/field trianing</td><td>5</td></tr>
<tr><td>Independent study</td><td>59</td></tr>
<tr><td><i>Total number of hours for the Course (25 hours of work-load per ECTS credit)</i></td><td><i>150</i></td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<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,</i></td><td>Written examination: 80%
Field work and project: 20%
The written examination and the project must be passed. Passing grade for the two written tests is 50 out of 100.</td></tr>
</table>

clinical examination of patient, art interpretation, other *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	

5. ATTACHED BIBLIOGRAPHY

- Suggested bibliography: «Κυκλοφοριακή Τεχνική», Γκόλιας, Φραντζεσκάκης, Πιτσιάβα, εκδόσεις Παπασωτηρίου, Αθήνα 2009. «Τεχνική της Κυκλοφορίας», Ε. Ματσούκης, εκδόσεις Συμμετρία, Αθήνα 2008. *-- Related academic journals:*

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF COURSE	UNDERGRADUATE		
COURSE CODE	CIV_4414	**SEMESTER**	4th
COURSE TITLE	ENVIRONMENTAL CHEMISTRY		

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*	Field of Science (Chemistry) and Skills Development (Environment)
PREREQUISITE COURSES:	There is not prerequisite course.
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek. Teaching may be however performed in English in case foreign students attend the course.
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1747

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*

This course is an introduction in chemistry and environmental studies.

Environmental Chemistry is an exceptionally useful course. After reviewing basic chemical concepts, quickly progresses to more advanced and contemporary applications including ozone depletion, physiochemical and biological treatment of pollutants, and green chemistry.

The chemistry of processes of the atmosphere, lithosphere and hydrosphere are covered in detail and the effects of pollutants on each of these chemical processes are extensively considered, as are their effects on the biosphere. The course includes an array of environmental chemistry experiments that can be performed at the microscale level. Ideas for additional open-ended projects are provided, and a thorough introduction to environmental experimentation.

The course presents chemical analyses of our most pressing waste, pollution, and resource problems for the undergraduate students. The distinctive holistic approach provides both a solid ground in theory, as well as a laboratory introductory and experimental applications. This course fulfills an urgent need for an introductory knowledge in environmental chemistry combining theory and practice and is a valuable tool for preparing the next generation of environmental engineers.

By the end of this course the student will be able to:

1. Explain the Chemistry Fundamentals
2. Analyze the Chemistry of Processes in the Atmosphere
3. Analyze the Chemistry of Processes in the Lithosphere
4. Analyze the Chemistry of Processes in the Hydrosphere
5. Collect all the necessary information for Natural Biochemical Processes and Organisms in the Biosphere
6. Explain the Effects of Pollutants on the Chemistry of the Atmosphere, Hydrosphere and Lithosphere
7. Explain the Effects of Pollutants on the Biosphere: Biodegradability, Toxicity, and Risks
8. Use Physicochemical and Physical Treatment of Pollutants and Wastes
9. Use Biological Treatment of Pollutants and Wastes
10. Explain the Minimization and Prevention of Pollution; Green Chemistry

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism

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

By the end of this course the student will, furthermore, have developed the following skills (general abilities):

1. Ability to exhibit knowledge and understanding of the essential facts, concepts, theories and applications which are related to Environmental Chemistry.
2. Ability to apply this knowledge and understanding to the solution of problems related to Environmental Chemistry of non-familiar nature.
3. Ability to adopt and apply methodology to the solution of non-familiar problems of Environmental Chemistry.
4. Study skills needed for continuing professional development.
5. Ability to interact with others in environmental chemical or interdisciplinary problems.

Generally, by the end of this course the student will, furthermore, have develop the following general abilities (from the list above):
Searching, analysis and synthesis of facts and information, as well as using the necessary technologies
Adaptation to new situations
Decision making
Autonomous (Independent) work
Group work
Exercise of criticism and self-criticism
Promotion of free, creative and inductive thinking
Respect to natural environment
Work design and management

3. SYLLABUS

The course contents are the following:

1. Introduction to Environmental Chemistry
2. Chemistry Fundamentals
3. The Chemistry of Processes in the Atmosphere
4. The Chemistry of Processes in the Lithosphere
5. The Chemistry of Processes in the Hydrosphere
6. Natural Biochemical Processes and Organisms in the Biosphere
7. Effects of Pollutants on the Chemistry of the Atmosphere, Hydrosphere and Lithosphere
8. Effects of Pollutants on the Biosphere: Biodegradability, Toxicity, and Risks
9. Physicochemical and Physical Treatment of Pollutants and Wastes
10. Biological Treatment of Pollutants and Wastes
11. The Minimization and Prevention of Pollution; Green Chemistry

4. TEACHING AND LEARNING METHODS – EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Lectures and seminars.</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Use of Information and Communication Technologies (ICTs) (e.g. powerpoint) in teaching. The lectures content of the course for each chapter are uploaded on the internet, in the form of a series of pdf files, where from the students can freely download them using a password which is provided to them at the beginning of the course.</td></tr>
<tr><td>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></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures (4 conduct hours per week x 13 weeks)</td><td>52</td></tr>
<tr><td>Final examination (3 conduct hours)</td><td>3</td></tr>
<tr><td>Hours for private study of the student and preparation of home-works (3 per semester)</td><td>95</td></tr>
<tr><td><i>Total number of hours for the Course
(25 hours of work-load per ECTS credit)</i></td><td><i>150 hours
(total student work-load)</i></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<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></td><td><i><u>ENVIRONMENTAL CHEMISTRY (EC)</u></i>

1. Optionally preparation of home-work from each student. After every lecture there are about 50 questions-exercises to be answered-solved in order to better understand the lecture. The students who do that they are well prepared to write the 50% of the final exam which is very similar to those exercises.

2. Written examination after the end of the semester - final grade.

Minimum passing grade: 5.</td></tr>
</table>

Specifically-defined evaluation criteria are given, and if and where they are accessible to students.	

5. ATTACHED BIBLIOGRAPHY

1. Environmental chemistry, fundamentals, 2008, Authors: **Ibanez,** J.G., **Hernandez-Esparza,** M., **Doria-Serrano,** C., **Fregoso-Infante**, A., **Singh**, M.M.
2. PDF's from the ppt's of the lectures
3. 400 questions & exercises from the lectures
4. Notes of lecturers in Greek.

5th SEMESTER

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	CIV_6221A	**SEMESTER**	5th
COURSE TITLE	MATRIX ANALYSIS OF FRAMED STRUCTURES		
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 AND SOLUTION OF EXERCISES		4	6
Computational Laboratory		1	
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:	«Mathematics – subjects of Lianear Algebra», «Mechanics of Materials», and «Structural Analysis with Classical Methods»		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No		
COURSE WEBSITE (URL)	https://eclass.upatras.gr/modules/document/?course=CIV1680		

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*

By the end of this course the student will have develop the following abilities:
1. Express structure loads as equivalent nodal loads.
2. Recognize the significant degrees of freedom of a structure and to evaluate the effect of various bending and axial deformations on the nodal deformations of interest.
3. Construct the stiffness matrix of a structure and compute nodal deformations and reactions.
4. Enter the data of the geometry and the loads of a given frame into the commercially available software , SAP2000 and perform the static analysis of the frame on a computer.
5. Interpret the analysis results presented in the form of diagrams.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

- Project planning and management
- Production of free, creative and inductive thinking

3. SYLLABUS

Matrix Algebra, Nodal forces and nodal displacements, The stiffness matrix of a linear spring in the local coordinate system. The stiffness matrix of two springs in series. Properties of the stiffness matrix. Calculation of the internal forces in the members of plane frames.
The direct stiffness method.
Analysis of trusses: The pinned bar element. Transformation of coordinates from the local to the global coordinate system. The transformation matrix. The stiffness matrix of a bar in the global coordinate system. Application of the direct stiffness method for the analysis of plane trusses.
Beams and frames: The beam element, Calculations of the element stiffness matrix with the unit load method. Analysis of continuous beams subjected to nodal and distributed loads. The stiffness matrix of beams in the global coordinate system. Analysis of frames with the direct stiffness method.
Special Topics: Internal Member Releases, Member End Length Offsets, Diaphragms.

4. TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face-to-face – in classroom</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Specialized structural analysis software.
Support the learning process through the e-class platform.</td></tr>
<tr><td>TEACHING METHODS
<i>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</i></td><td><table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>52</td></tr>
<tr><td>Solution of thematic exercise</td><td>13</td></tr>
<tr><td>Independent Study</td><td>85</td></tr>
<tr><td><i>Course total</i></td><td><i>150</i></td></tr>
</table></td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION</td><td>I. Written final exam (50%) which includes:</td></tr>
</table>

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.*	- Solution of 2 or 3 exercises II. Delivery of thematic exercise (20%) III. Computational Laboratoty exam (30%)

5. ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Related academic journals:

Course notes entitled "Matrix Analysis of Framed Structures", by Manolis Sfakianakis, University of Patras, 2005.
"Matrix Analysis of Framed Structures – Direct Stiffness Method", by M. Papadrakakis & V. Sapountzakis.

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF COURSE	UNDERGRADUATE		
COURSE CODE	CIV_6235A	**SEMESTER**	5th
COURSE TITLE	DESIGN OF STEEL STRUCTURAL COMPONENTS		

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
Laboratory work	1	
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*	Field of Science
PREREQUISITE COURSES:	None. The students should possess fundamental knowledge in Mechanics of materials.
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek. Offered also in English in the form of a coursework and meetings in the office of the instructor.
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1541/

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 objective of the course is to teach the theoretical background and the actual design guidelines of EN1993-1-1. It offers an introduction in steel structures and the methods of fabrication and erection. It starts with the main design principles of Eurocodes followed by theoretical lectures on the mechanical behaviour and properties of steel. The core of the course is the calculation of the strength of steel cross-sections and the calculation of the buckling strength of steel members. Finally, the course offers lectures focusing on practical aspects such as preparation of engineer's drawings for steel structures and effective communication with fabricators and constructors for the successful completion of a project.

After successful completion of the course, the student will be able to:

- *Define the class of a steel cross-section.*
- *To calculate the strength of a steel cross-section.*
- *To calculate the buckling strength of a steel member.*
- *To calculate the local buckling strength of a steel member.*
- *To use EN1993-1-1 for designing steel structural members.*

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

By the end of this course the student will have developed the following general abilities (from the list above):

- Criticism and self-criticism
- Project planning and management
- Production of free, creative and inductive thinking

3. SYLLABUS

i. Introduction to steel structures. Structural steel. Basic design principles of Eurocode 3.
ii. Classification of steel sections. Resistance of sections in tension, compression, shear, bending, torsion.
iii. Resistance of sections in combined stresses. Final design equations for sections.

iv. Flexural, torsional and flexural-torsional buckling.
v. Lateral-torsional buckling and lateral restraints.
vi. Shear buckling of thin-web members, local instability effects.
vii. Resistance of members in combined buckling phenomena. Final design equations for members.

4. TEACHING AND LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Lectures and Laboratories</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>E-class teaching platform</td></tr>
<tr><td>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></td><td><table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures (4 contact hours per week x 13 weeks)</td><td>52</td></tr>
<tr><td>Laboratory Exercises</td><td>13</td></tr>
<tr><td>Hours for private study of the student and preparation of problem sets</td><td>85</td></tr>
<tr><td><i>Total number of hours for the Course
(25 hours of work-load per ECTS credit)</i></td><td><i>150 hours
(total student work-load)</i></td></tr>
</table></td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<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</i></td><td>Written examination that counts for 100% of the final grade. The examination involves problems that combine several contents of the course.
Minimum passing grade: 5.</td></tr>
</table>

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.*	

5. ATTACHED BIBLIOGRAPHY

- Design of steel structural members according to EN1993-1-1. TL Karavasilis. University Press. 2019
- Design of steel structures (with examples). I Vayias, I Ermopoulos, G Ioannidis. 2013.
- Steel structures – Analysis and Design. I Vayias. 2003.

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	CIV_5310	**SEMESTER**	5th
COURSE TITLE	SOIL MECHANICS I		

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 and Tutorials	4	6
Laboratory exercises	2	
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. It is however recommended that students have a working knowledge of Strength of Materials and Fluid Mechanics
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek. Teaching may be however performed in English in case foreign students attend the course.
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1655/

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*

At the end of this course the students should be able to:
1. Know the properties and mechanical behavior of soils.
2. Know the standard lab procedures for determining soil properties.
3. Understand the fundamental principle of effective stresses in soils.
4. Understand and quantify state-of-stress and stress-strain behavior in soils.
5. Compute discharge, settlement and shear strength

At the end of the course the student will have further developed the following skills/competences:
1. Ability to describe the natural state of soils and classify them within a standard system.
2. Ability to compute stresses in a soil mass and apply the effective stress principle.
3. Ability to quantify soil permeability.
4. Ability to compute total and time-rate of settlement.
5. Ability to compute shear strength of soils.
6. Ability to apply standard lab procedures and process the relevant data.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

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

3. SYLLABUS

1. **Introduction**
   Soil formation, mineralogy and basic characteristics.
2. **Natural state of soils**

Phase diagram, gradation, plasticity, classification.

3. **Stresses in soils**
   Geostatic conditions, theory of elasticity, external loads, deformation.
4. **Water in soils**
   Types of water, effective stresses, geostatic and flow conditions, Darcy law, permeability.
5. **Consolidation**
   Theory of consolidation, primary and secondary consolidation, total settlement, time-rate of settlement.
6. **Shear strength**
   Stress-strain relations and shear strength of soils, failure criteria, behavior of saturated soils in drained and undrained conditions.
7. **Compaction**
   Density-moisture relationship, compaction energy, methods for soil compaction

4. TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face to Face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Use of web based e-class platform</td></tr>
<tr><td>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></td><td><table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>26</td></tr>
<tr><td>Tutorials</td><td>26</td></tr>
<tr><td>Laboratory Practice</td><td>26</td></tr>
<tr><td>Technical Reports on Laboratory Tests</td><td>26</td></tr>
<tr><td>Hours for private study</td><td>46</td></tr>
<tr><td>Course total</td><td><i>150</i></td></tr>
</table></td></tr>
</table>

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.*	1. Written exams which include problem solving (80%) 2. Evaluation of Laboratory Tests Technical Reports (20%)

5. ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
- Related academic journals:

- GRAHAM BARNES, Soil Mechanics: Principles and Practice, Palgrave Macmillan, 2010
- “Principles of Geotechnical Engineering”, B.M. Das, PWS Engineering, 1985
- “An Introduction to Geotechnical Engineering”, R.D Holtz and W.D. Kovacs, Prentice Hall, 1981

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	CIV_5415A	**SEMESTER**	5th
COURSE TITLE	HYDRAULICS		

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 and laboratory work	4 (lect.) 2 (lab.)	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*	Mandatory – Civil Engineering
PREREQUISITE COURSES:	There are no prerequisites. The student must have adequate knowledge of Fluid Mechanics
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek. English for Erasmus students
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
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*

By the end of the course, the student will:

1. Know the basic types of flow in closed conduits and open channels (laminar and turbulent flow).
2. Be able to analyse flow problems in closed conduits taking into consideration friction losses, local losses as well as pumps.
3. Know the types of flow (subcritical, critical, supercritical) related to the analysis of problems in open channels.
4. Analyse open channel problems, both for uniform and gradually varied flow.
5. Determine free surface profiles in open channel flows.
6. Design contractions and expansions.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking

……

Others…

…….

By the end of the course, the student will have developed the following skills (general abilities):

1. Ability to analyse flow problems in closed conduits and to determine the type and characteristics of the pipe required (and the pump, if needed) using the general solution methodology as well as the energy and hydraulic grade lines.
2. Ability to analyse flow in open channels (discharge and free surface profiles) and to utilize the concepts of specific energy and specific momentum in order to check flow behaviour at local contractions, bed elevation changes, and at any flow control section. Also, ability to utilise hydraulic structures and to design contractions and expansions in subcritical and supercritical flow.

3. SYLLABUS

Basic fluid properties, elements of Fluid Mechanics, Laminar and Turbulent flow, boundary layer.

Flow in closed conduits: Continuity Energy and Momentum equations, transverse velocity distribution in laminar and turbulent flow, friction losses – Darcy Weisbach equation, local losses, pumps, energy and hydraulic grade lines, multiple pipe systems, water hammer, elements of design.

Open channel flow: definitions, pressure distribution, specific energy, types of flow, control sections, specific force (momentum), hydraulic jump, shear stress equation for steady state flow, uniform flow, normal depth, hydraulically optimum cross section, gradually varied flow, types of free surface profiles, computation of free surface profile, direct step method, standard step iteration method, flow-control structures, flow between two reservoirs, contractions and expansions for sub- and super-critical flow, roll waves.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Lectures and lab work.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Additional material uploaded to e-class Use of internet searches for special topics.

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 (4 contact hours per week x 13 weeks)	52
Lab work (2 contact hours per week x 13 weeks)	26
Final examination (3 contact hours)	3
Hours for study by the student, preparation for the Lab (study of techniques and theory) and writing of Lab reports	69
Total number of hours for the Course (25 hours of work-load per ECTS credit)	***150 hours (total student work-load)***

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.*	Final exam. Student performance in the Lab is also taken into consideration.

5. ATTACHED BIBLIOGRAPHY

- *Suggested bibliography:*

1. Akan A. O., "Open Channel Hydraulics," Elsevier, Amsterdam, 2006.
2. Chadwick A. and J. Morfett, "Hydraulics in Civil Engineering," ALLEN & UNWIN, London, 1986.
3. Chaudry M. H., "Open – Channel Flow," Second Edition, Springer, New York, 2008.
4. Chow V. T., "Open – Channel Hydraulics," McGraw – Hill, New York, 1959.
5. HEC – RAS (Hydrologic Engineering Center – River Analysis System), "Hydraulic Reference Manual", Version 4.1, U.S. Army Corps of Engineers, Davis, California, 2010.
6. Henderson F. M., "Open Channel Flow," Macmillan, New York, 1966.
7. Jain S. C., "Open – Channel Flow," Wiley, New York, 2001.
8. Shames I., "Mechanics of Fluids," Fourth Edition, McGraw – Hill, New York, 2003.
9. Streeter V. L. and E. B. Wylie, "Fluid Mechanics," 8th ed., McGraw – Hill, New York, 1985.
10. Wylie E. B. and V. L. Streeter, "Fluid Transients," Corrected ed., FEB Press, Ann Arbor, 1983.
11. White F. M., "Fluid Mechanics," 2nd Edition, McGraw – Hill, New York, 1986.

Greek

1. Δημητρακόπουλος Α., «Στοιχεία Υδραυλικής Κλειστών και Ανοικτών Αγωγών», Εκδόσεις GOTSIS, Πάτρα, 2018
2. Δημητρακόπουλος Α., «Στοιχεία Υπολογιστικής Υδραυλικής : Πανεπιστημιακές Παραδόσεις», Πανεπιστήμιο Πατρών, Πάτρα, 2015.

3. Λιακόπουλος Α., «Υδραυλική», 2η Έκδοση, Εκδόσεις Τζιόλα, Θεσσαλονίκη, 2014.
4. Νουτσόπουλος Γ., Γ. Χριστοδούλου και Τ. Παπαθανασιάδης, «Υδραυλική Ανοικτών Αγωγών», Fountas, Αθήνα, 2010.
5. Πρίνος Π., «Υδραυλική Κλειστών & Ανοικτών Αγωγών», Εκδόσεις Ζήτη, Θεσσαλονίκη, 2013.
6. Τερζίδης Γ. Α., «Εφαρμοσμένη Υδραυλική», Εκδόσεις Ζήτη, Θεσσαλονίκη, 1997.

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	CIV_5505A	**SEMESTER**	5th
COURSE TITLE	WATER TREATMENT		

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, Tutorials and Laboratory Exercises	7	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. The students must have basic knowledge of Chemistry, Physics and Applied Mathematics.
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1614/

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*

It is a basic course for the study and operation of water purification and disinfection units to meet the water needs of a population of settlements or cities.
The subject matter of the course aims at introducing students to the basic concepts of water purification, assessing the drinking water needs of a population, alternative water treatment and disinfection systems for water supply, and gaining experience in basic laboratory analyzes and purification processes.
Finally, the aim of the course is to acquire basic knowledge and skills so that qualified civil engineers can use them in their professional careers, either as consultants or constructors of water treatment plants, or as responsible to operate such units.
Upon successful completion of the course the student will be able to:

- Understand and use the physicochemical properties of water.

Understand the difference between infection and pollution.

- Assess the population's drinking water demands and designs water purification and disinfection systems.
- Recognizes the drinking water of good quality from its typical ingredients.
- Know basic processes and alternative water treatment technologies.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

- *Search for, analysis and synthesis of data and information, with the use of the necessary technology*
- Working independently
- Team work
- Project planning and management

3. SYLLABUS

1. Introduction, water supply, population prediction
2. Water quality and current provisions
3. Pumping and treatment of water (introduction, chemical precipitation, thrombosis, softening, mixing, precipitation, refining, chlorination - disinfection, control organic pollutants and other toxic substances, odor and taste control, wastewater from treatment plants)
4. Sewage treatment and disposal
5. Corrosion of distribution systems
6. Plant design
7. Laboratory exercise for water quality analysis and measurement.

4. TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>In the classroom</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Support Learning through the e-class platform</td></tr>
<tr><td>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></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>52</td></tr>
<tr><td>Tutorials for the consolidation of laboratory processes and the understanding of the design of the individual parts of a water treatment unit</td><td>6</td></tr>
<tr><td>Group Laboratory work in small groups of students (in pairs)</td><td>4</td></tr>
<tr><td>Educational visit / video view of water treatment units / Small individual practice work</td><td>6</td></tr>
<tr><td>Independent home work, elaboration and writing of Laboratory Exercises</td><td>20</td></tr>
<tr><td>Individual home work on tutorial exercises</td><td>20</td></tr>
</table>
</td></tr>
</table>

	Individual work at home of theoretical matter of the course	42
	Course total	***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 exam (100%) including: (a) Judgment questions on issues, natural water characteristics, water needs assessment or water purification systems and methodologies (b) Solving an exercise similar to a Laboratory Exercise and a problem related to the design of a part of a water purification unit or physicochemical process.	

5. ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Related academic journals:

Tsonis, SP, Water Purification, Papasotiriou Publisher, Athens, 2003, 450 pages. Book Code in Eudoxos: 9690 (in Greek).
Andreadakis A., Water Treatment, Basic Principles and Processes, Symmetry Publisher, Athens, 2008, 296 pages, Book Code in Eudoxos: 45236 (in Greek).

6th SEMESTER

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	CIV_6230A	**SEMESTER**	6th
COURSE TITLE	DESIGN OF REINFORCED CONCRETE LINEAR 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**
Lectures + laboratory work	4+2	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*	Field of Science
PREREQUISITE COURSES:	There are no prerequisite courses. Students must have at least a basic knowledge of the Engineering Mechanics/Statics and the Mechanics of Materials courses.
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1533/

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*

At the end of the course, the student will:

1. Know the technology and mechanical behaviour of concrete and steel materials,
2. Be aware of limit state design and the implementation of an appropriate combination of actions,
3. Be able to structurally design linear reinforced concrete elements based on the ultimate limit state in bending with normal forces,
4. Know how to apply the rules of constructional configuration and detailing of linear reinforced elements in accordance with relevant regulations and
5. Be able to structurally design linear reinforced concrete elements based on the ultimate limit state in shear.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

At the end of the course, the student will have developed the following skills:

1. An ability to demonstrate knowledge and understanding of the features and mechanical behaviour of the materials of reinforced concrete, concrete and steel,
2. An ability to understand the design situation and the design actions in the presence or not of earthquakes for different limit state designs,
3. An ability to structurally design columns and beams based on the ultimate limit state in bending with normal forces,
4. An ability to apply the rules of constructional configuration and detailing of linear reinforced elements and
5. An ability to structurally design linear reinforced concrete elements based on the ultimate limit state in shear.

3. SYLLABUS

1. Materials
Concrete technology, mechanical behaviour of concrete and reinforcing steel.

2. The basis of design
Extreme situations, combinations of actions and the determination of action effects.

3. Design based on the ultimate limit state in bending with normal forces
The basis of structural design in bending, design of rectangular cross sections in uniaxial bending with normal forces, interaction between moment and axial load for rectangular sections with symmetrical reinforcement in uniaxial bending, rectangular cross sections in biaxial bending with normal force, bending cross sections of the form T or Γ (flanged beams).

4. Constructional configuration rules and detailing of linear elements
Minimum anchorage lengths for reinforcement and minimum concrete cover, constructional configuration rules and the design of detailing for beams and columns.

5. Structurally designing linear elements based on the ultimate limit state in shear
Elements without shear reinforcement, tensile elements with shear reinforcement, behaviour of linear elements in shear under monotonic loading and/or cyclic loading, code regulations for structural design in shear, special cases of shear stress: indirect supports, suspended loads and connections of flanges and webs in flanged beams.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Blackboard lectures and/or PowerPoint presentations supplemented with handouts, tutorials, independent problem solving by individual students and in situ site visits.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of Information and Communication Technologies (ICTs) (e.g. PowerPoint) in teaching. The lectures' course content of each chapter are uploaded to the internet in the form of a series of PowerPoint files, from where students can freely download them using a password which is provided at the beginning of the course.
TEACHING METHODS *The manner and methods of teaching are described in detail.*	

Activity	*Semester workload*
Lectures	52
In-class exercises	15

<table>
<tr><td rowspan="6"><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></td><td>Laboratory exercises and written exam on the laboratory exercises</td><td>20</td></tr>
<tr><td>Final exam</td><td>3</td></tr>
<tr><td>Hours for student private study</td><td>62</td></tr>
<tr><td><i>Total number of hours for the Course
(25 hours of work-load per ECTS credit)</i></td><td><i>150 hours</i></td></tr>
<tr><td></td><td></td></tr>
<tr><td colspan="2"></td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<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></td><td colspan="2">Student evaluation is based on:

1. Final (written) exam (75%)
2. Laboratory exercises and examination (25%)</td></tr>
</table>

5. ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

1. “Reinforced Concrete - Part I”, M.N. Fardis, University of Patras Publications, 2015. (in Greek)
2. Reinforced Concrete Structures, R. Park and T. Pauley, John Wiley and Sons, 1995.
3. Concrete Structures Euro Design Handbook, Ernst & Sohn, 2004.
4. Comite Europeen de Normalisation, *European Standard EN 1992* Eurocode2:“Design of Concrete Structures”.

5. Comite Europeen de Normalisation, *European Standard EN 1998:2005 Eurocode 8: Design of Structures for Earthquake Resistance*, Part I General Rules, Seismic Actions and Rules for Buildings, 2005,
6. “Design of Reinforced Concrete Linear Elements – Examples” S. E. Dritsos, University of Patras Publications, 2018. (in Greek)
7. Laboratory guide, Structures Laboratory, Patras, 2018

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF COURSE	UNDERGRADUATE		
COURSE CODE	CIV_7236	**SEMESTER**	6th
COURSE TITLE	DESIGN OF STEEL STRUCTURES		

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, seminars and laboratory work	4 (lect.)	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, specialised general knowledge, skills development*	Field of Science
PREREQUISITE COURSES:	None. The students should possess fundamental knowledge in Mechanics of Materials.
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek. Offered also in English in the form of a coursework and independent meetings in the office of the instructor.
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1773/

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 goal of the course is to teach the theoretical background and the actual design guidelines of EN1998-1-8 for the design of steel connections and joints. In addition, the course aims to clarify all the available methods of analysis for the design of steel structures. It covers the design of bolted and welded connections, connections of braces to gusset plates, secondary-to-main beam connections, end plate beam-column joints, splices, and column base connections. It describes all the available methods of analysis for the design of steel structures and offers a theoretical treatment of P-Delta effects and geometric nonlinearities.

After successful completion of the course, the student will be able to:

- Design simple bolted connections
- Design simple welded connections
- Design brace-to-gusset plate connections
- Design secondary-to-main beam connections
- Design column bases
- Design beam-to-column end plate connections
- Design splices
- Choose among the available methods of analysis for the design of steel structures
- Distinguish P-delta and P-Delta effects and have an overall understanding of geometric nonlinearities

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

By the end of this course the student will have developed the following general abilities (from the list above):

- Criticism and self-criticism
- Project planning and management

Production of free, creative and inductive thinking

3. SYLLABUS

- EN1993-1-8
- Simple bolted connections
- Simple welded connections
- Brace-to-gusset plate connections

- Secondary-to-main beam connections
- Column bases
- Beam-to-column end plate connections
- Splices
- P-δ and P-Δ effects
- Geometrical nonlinearity in structural analysis

4. TEACHING AND LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Lectures
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	E-class teaching platform
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*	See table below
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*	Final written examination. Minimum passing grade: 5.

Activity	*Semester workload*
Lectures (4 contact hours per week x 13 weeks)	52
Hours for self-study of the student	73
Total number of hours for the Course (25 hours of work-load per ECTS credit)	***125 hours (total student work-load)***

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.*	

5. ATTACHED BIBLIOGRAPHY

- Design of steel connections and joints to EN1993-1-8. TL Karavasilis. University Press. 2019
- Design of steel structures (with examples). I Vayias, I Ermopoulos, G Ioannidis. 2013.
- Steel structures – Analysis and Design. I Vayias. 2003.

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	CIV_6315	**SEMESTER**	6th
COURSE TITLE	SOIL MECHANICS II		

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 and Tutorials	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, specialised general knowledge, skills development*	Specialised General Knowledge
PREREQUISITE COURSES:	There are no prerequisite courses. It is however recommended that students have a good understanding of the content of the course Soil Mechanics I
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek. Teaching may be however performed in English in case foreign students attend the course.
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1656/

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*

At the end of this course the students should be able to:
1. Know the use of flow nets to solve ground-water flow problems.
2. Know the methods for computing soil bearing capacity.
3. Know the basic theories for computing earth pressures on retaining structures.
4. Know the most common methods for slope stability analysis.

At the end of the course the student will have further developed the following skills/competences:
1. Ability to draw a flow net and compute discharge, pore water pressure and seepage forces.
2. Ability to compute soil bearing capacity.
3. Ability to determine active and passive earth pressures on retaining structures.
4. Ability to compute safety factors for earth slopes.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

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

3. SYLLABUS

1. **Groundwater flow**
   Flow nets, anisotropic soils, discharge, pore water pressure, seepage forces.
2. **Bearing capacity**
   Theories and computation methods, factors influencing bearing capacity.
3. **Earth pressures**

	Active and passive conditions, methods to compute and factors influencing earth pressures. 4. **Slope stability** Methods of analysis, homogeneous and layered soils, effect of groundwater flow, the friction circle method, methods of slices., compaction energy, methods for soil compaction

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to Face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of web based e-class platform
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 — 26 Tutorials — 26 Team work Project — 26 Hours for private study — 47 Course total — ***125***
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*	• Written exams which include problem solving (80%) • Evaluation of Team work Project (20%)

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.*	

5. ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
- Related academic journals:

- GRAHAM BARNES, Soil Mechanics: Principles and Practice, Palgrave Macmillan, 2010
- “Principles of Geotechnical Engineering”, B.M. Das, PWS Engineering, 1985
- “An Introduction to Geotechnical Engineering”, R.D Holtz and W.D. Kovacs, Prentice Hall, 1981

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF COURSE	UNDERGRADUATE		
COURSE CODE	CIV_6420	**SEMESTER**	6th
COURSE TITLE	ENGINEERING HYDROLOGY		

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, seminars, application examples	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, specialised general knowledge, skills development*	General background
PREREQUISITE COURSES:	There are no prerequisite courses.
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek.
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1856/

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 completion of the course, the students will have acquired the necessary knowledge and skills for understanding hydrological processes and quantifying hydrological variables, with particular emphasis on the hydrologic design of flood control structures and water management projects. The students will be able to:
- Describe the main components of the hydrological cycle.
- Understand and apply the necessary tools to quantify hydrological variables.
- Estimate critical components of the hydrological cycle (rainfall, evapotranspiration, streamflow)
- Interpret, construct and route flood hydrographs.
- Apply statistical and probabilistic methods to estimate and assess hydrologic risk.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Project planning and management
- Working independently
- Decision making

3. SYLLABUS

1) <u>Basic principles:</u> hydrological cycle, hydrologic variables and units of measurement, spatial and temporal scales in hydrology, hydrologic budget.
2) <u>Evaporation - evapotranspiration:</u> Estimation of evaporation, physical mechanisms of evapotranspiration, measurement of actual evapotranspiration, actual evapotranspiration estimation methods, potential evapotranspiration estimation methods.
3) <u>Precipitation:</u> physical mechanisms of precipitation formation, precipitation measurement, precipitation time series infilling methods, rainfall gradient, surface integration of point precipitation.
4) <u>Hydrologic abstractions:</u> Interception, surface or depression storage, infiltration, hydrologic abstractions estimation methods.
5) <u>Runoff and streamflow:</u> runoff components, streamflow hydrographs, discharge measurements, estimation of stage – discharge relationships,

storm hydrograph characteristic elements, estimation of basin concentration times, baseflow separation techniques, excess rainfall and direct runoff estimation, unit hydrograph (UH) and its use for direct runoff estimation, synthetic UHs, hydrologic routing.

6) Statistical hydrology: probability distributions, rainfall frequency analysis for hydrologic design, intensity - duration - frequency (IDF) estimation methods, design storm estimation, Areal Reduction Factor (ARF), design storm hyetograms.
7) Application Examples
8) Example application on the use of HEC-HMS software.

4. TEACHING AND LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face-to-face class lectures and problem solving</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Distribution of academic material through e-class.
Free software for hydrologic simulations.</td></tr>
<tr><td>TEACHING METHODS
<i>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</i></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures/Problem Solving</td><td>52</td></tr>
<tr><td>Independent study of the student</td><td>73</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td><i>Total number of hours for the Course
(25 hours of work-load per ECTS credit)</i></td><td><i>125 hours
(total student work-load)</i></td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure
Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-</i></td><td>Final Examination</td></tr>
</table>

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.*	

5. ATTACHED BIBLIOGRAPHY

1. Sakkas, I.G. (2004) Engineering Hydrology, Vol. 1, Surface hydrology, Aivazi publications, Thessaloniki, Greece.
2. Tsakiris, G. (1995) Water Resources: I Engineering Hydrology, Symmetria, Athens Greece.
3. Papamichael, D.M. (2004) Engineering Hydrology of Surface Waters, Pachoudi publications, Thessaloniki, Greece.
4. Koutsoyiannis, D. and Th. Xanthopoulos (1999) Engineering Hydrology, 3rd Edition, 418 p., doi:10.13140/RG.2.1.4856.0888, National Technical University of Athens, Greece.
5. Baltas, E. and M. Mimikou (2018) Engineering Hydrology, 6th Edition, 420 p., Papasotiriou & SIA, ISBN: 9789604911257.
6. Mimikou, M. (2006) Water Resources Technology, 3rd Edition, 612 p., Papasotiriou & SIA, ISBN: 9789607530790.
7. Chow, V.T., D.R. Maidment and L.W. Mays (1988) Applied Hydrology, McGraw-Hill, New York, 572 pp., ISBN 0-07-010810-2
8. Mays, L.W. (2001) Water Resources Engineering, Wiley, ISBN 9780471297833.
9. Maidment, D.R. (1993) Handbook of Hydrology, McGraw-Hill, ISBN: 978-0070397323.
10. Ponce, V.M. (2014) Engineering Hydrology, Principles and Practices, Online Edition, http://ponce.sdsu.edu/openchannel/index.html.
11. Singh, V.P. (1992) Elementary Hydrology, 1st edition, Pearson, 992 pages, ISBN: 978-0132493840.

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	CIV_6510A	**SEMESTER**	6th
COURSE TITLE	WASTEWATER TREATMENT		

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 and Laboratory	4/2(+1:Field work)	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*	Scientific Area
PREREQUISITE COURSES:	Environmental Chemistry, Water Treatment
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1561/

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 course is an introductory lesson to wastewater treatment processes and management.
The subject matter of the course aims at the introduction of students to the wastewater quality characteristics and to processes applied in wastewater treatment. The aim of the course is to provide a comprehensive understanding of the methods required for sewage treatment and to realize the importance of sewage treatment in environmental protection, and the evolution of sewage treatment and management in a distinct scientific field / profession.

At the end of this course the student should be able to:
- Present the main wastewater characteristics, and the methods for their determination.
- Know the steps for preliminary and primary wastewater treatment.
- Know the basic principles of the microbial metabolism applied in wastewater treatment processes.
- Know the methods for the biological wastewater treatment for organic and nutrient removal.
- Know the methods for the sludge treatment and disposal.
- Assess the methods for the wastewater disinfection.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

- Independent work
- Teamwork
- Design and project management
- Working in an interdisciplinary environment
- Protection of the environment

3. SYLLABUS

1. Introduction to wastewater treatment.
2. Wastewater flowrates, characteristics and impacts of sewage and wastewater, and disposal regulations.
3. Principles of applied microbiology and microbial metabolism.
4. Preliminary treatment (screens and communitors, grit removal, flow equalization) and primary treatment (sedimentation, physico-chemical treatment).
5. Biological wastewater treatment (activated sludge, trickling filters, rotating biological contactors).
6. Natural wastewater treatment (stabilization ponds, constructed wetlands).
7. Advanced treatment (removal of nitrogen, phosphorus and organic compounds).
8. Anaerobic wastewater treatment.
9. Sludge treatment and disposal.
10. Wastewater disinfection.
11. Onsite wastewater disposal.
12. Sewers corrosion

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Classroom
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Specialized software for simulation of sewage treatment processes. Support Learning through the e-class e-class platform.
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	52
Laboratory exercises	15
Laboratory assignments for individual or small groups of students	25
Team work in a case study	14
Field work, small individual exercises	13
Independent study	31
Course total	***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 exam (80%) consisting of: - Multiple choice questions - Problems solving - Comparative evaluation of theory II. Laboratory (20%) consisting of: - Written work - Written examination

5. ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- S.P.Tsonis (2004). Wastewater Treatment. Papasotiriou, Athens (in Greek).
- Metcalf and Eddy Inc., Burton, F., Stensel, D., Tchobanoglous G., Tsuchihashi, R. (2013). Wastewater Engineering: Treatment and Resource Recovery, 5th ed. McGraw-Hill, New York, NY.
- Henze, M., van Loosdrecht, M.C.M., Ekama, G.A. and Brdjanovic, D. (2008). Biological Wastewater Treatment: Principles, Modelling and Design. IWA Publishing, Cambridge University Press.
- Rittmann, B.E. and McCarty, P.L. (2001). Environmental Biotechnology: Principles and Applications. Mc-Graw-Hill Companies, Inc.

- Related academic journals:

Water Research, Journal of Environmental Engineering-ASCE, Water Environment Research

COURSE OUTLINE

1.GENERAL

SCHOOL	ENGINEERING		
DEPARTMENT	CIVIL ENGINEERING		
ΕΠΙΠΕΔΟ ΣΠΟΥΔΩΝ	UNDERGRADUATE		
COURSE CODE	CIV_6610	**SEMESTER**	6th
COURSE TITLE	TECHNICAL TERMINOLOGY IN ENGLISH LANGUAGE		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
	3	3

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	CORE CURRICULUM-FOREIGN LANGUAGE REQUIREMENT
PREREQUISITE COURSES:	NONE
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	TEACHING LANGUAGE: 20% IN GREEK, 80% IN ENGLISH ASSESSMENT LANGUAGE: 100% IN ENGLISH
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO
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

- Upon successful completion of the course, the students will have developed knowledge, abilities and skills so as to:

- Use the English language in their oral and written communication.

- Enrich their vocabulary and grammar with terminology of their science, along with the terminology of correlated professions, such as architecture and finance.

- Know the basic terminology in oral and written form, so as to use it when they communicate for the needs of their profession.

- Read manuals and scientific texts and articles, as well as to perform their e-communication, using the appropriate vocabulary.
- Decode basic forms of communication (oral and written), which are needed in their field

General Competences

TTaking 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 Adapting to new situations Decision-making Working independently Team work Working in an international environment Working in an interdisciplinary Project planning and management Respect for difference and multiculturalism Respect for the natural environment Showing social, professional and ethical responsibility and sensitivity to gender issues Criticism and self-criticism Production of free, creative and inductive thinking …… Course Outlines, Undergraduate Program, Dept. of Civil Engineering, University of Patras, 01/09/2024 42 environment Production of new research ideas Others…

3.SYLLABUS

Students will be introduced in the basic use of English language in the Civil Engineering science, through videos, exercises and texts.

The basic terminology is also included, as well as its implementation in the four language skills:

- Speaking (English for Civil Engineering)
- Listening (English for Civil Engineering)
- Reading (English for Civil Engineering)
- Writing (English for Civil Engineering)

A booklet of notes and exercises will be distributed to the students, and the learning methodology will include personal and group projects.

4. TEACHING and LEARNING METHODOLOGY ASSESSMENT

<table>
<tr><td>**DELIVERY**
Face-to-face, Distance learning, etc.</td><td>THREE CONSECUTIVE CONTACT/IN-CLASS HOURS PER WEEK</td></tr>
<tr><td>***USE OF INFORMATION AND COMMUNICATIONS*** *TECHNOLOGY Use of ICT in teaching, laboratory education, communication with student*</td><td>1. E-CLASS FOR: GENERAL COURSE RELATED ANNOUNCEMENTS AND COURSE MATERIAL
2. STUDENT ACCESS TO INSTRUCTOR’S EMAIL FOR EMERGENCY COMMUNICATION.
3. 3. IN-CLASS ACCESS OF ON-LINE COURSE RELATED WEB MATERIAL, E.G. TED TALKS</td></tr>
<tr><td>***TEACHING METHODS T****he manner and methods of teaching are described in detail. Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, Teaching Method Semester Workload PRESENTATION BY INSTRUCTOR 30% STUDENT IN-CLASS PARTICIPATION; READING 50% Course Outlines, Undergraduate Program, Dept. of Civil Engineering, University of Patras, 01/09/2024 43 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>*Teaching Method*</th><th>*Semester Workload*</th><th></th></tr>
<tr><td>INTERACTIVE PRESENTATION BY INSTRUCTOR / IN-CLASS PRACTICE</td><td>20%</td><td></td></tr>
<tr><td>CLASS ATTENDANCE</td><td>10%</td><td></td></tr>
<tr><td>MINI PROJECTS</td><td>20%</td><td></td></tr>
<tr><td>PRESENTATIONS/FINAL ASSIGNMENT</td><td>50%</td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>***Total number of hours for the Course***</td><td>***100% (75ECTS)***</td><td></td></tr>
</table>
</td></tr>
<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>-LANGUAGE OF ASSESSMENT: ENGLISH
50% OF THE FINAL GRADE COMES FROM A FINAL ASSIGNMENT/PRESENTATION / 50% COMES FROM A WRITTEN EXAM
-ALTERNATIVELY FOR STUDENTS WHO WILL NOT SUBMIT A FINAL ASSIGNMENT, THE FINAL GRADE WILL COME FROM A WRITTEN EXAM 100%
-CLASS ATTENDANCE AND PARTICIPATION IN IN-CLASS MINI PROJECTS PLAYS AN IMPORTANT ROLE IN THE FINAL GRADE</td></tr>
</table>

5. SUGGESTED BIBLIOGRAPHY

1. Malivitsi, Z. (2025) *Foundations in English for Architects, Civil Engineers, Surveyors, and Urban Planners.* Athanasiou-Altintzi Pubs.

2. Stamison-Atmatzidi, M. (2010). *Effective for Civil Engineering.* Klidarithmos Pubs.

3. Zafiri, M. (2024). *English for the students of urban planning and regional development.* Disigma Pubs.

7th SEMESTER

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	CIV_8223A	**SEMESTER**	7th
COURSE TITLE	STRUCTURAL DYNAMICS		
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 + laboratory work		4+0	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*	Field of Science		
PREREQUISITE COURSES:	1. Engineering Mechanics: Statics 2. Engineering Mechanics: Dynamics & Vibrations 3. Applied mathematics II 4. Numerical Methods 5. Mechanics of Materials 6. Basic Structural Analysis 7. Matrix Methods of Linear Structural Analysis 8. Structural Analysis Using Computers. These prerequisites have not been formally established by the Department.		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No		
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1527/		

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*

By the end of the course students should have mastered the course content described below and, in particular, the following points:

1. The students should be able to setup the equations of motion for simple or complex mechanical models of structures.
2. The students must be able to proceed to solve analytically (wherever this is feasible) or numerically the equations of motion and thus compute the response of the structural models.
3. The students must have acquired a basic understanding of the concept of response spectrum and its usefulness in evaluating the response of MDOF systems, in particular for seismic excitation.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

After course completion the student should be capable:

1. To model structures for dynamic analyses, selecting appropriate dynamic DOFs.
2. To simplify complex problems in order to develop simplified, yet accurate enough, solutions.
3. To solve analytically or numerically small size problems.

3. SYLLABUS

1. Formulation of the equation of motion for viscously damped SDOF systems for (a) externally applied loads and (b) support excitation (*e.g.* earthquake problem).
2. Free vibrations of viscously damped SDOF systems; effects of damping: underdamped, critically damped and overdamped systems.
3. Free vibrations of SDOF systems with COULOMB friction.
4. Forced vibration response of viscously damped SDOF systems to harmonic loading; analytic solution. Applications: (a) measurement of damping of structures; (b) vibration isolation; (c) vibration measurement instruments.
5. Response of SDOF systems to periodic loadings.
6. Energy dissipated by damping: viscous damping; equivalent viscous damping; rate independent damping; complex stiffness.
7. Forced vibration response of SDOF systems to pulse type loadings; analytic solutions. Introduction of the concept of shock spectrum.
8. Forced vibration response of SDOF systems to general type of loading: DUHAMEL's (convolution) integral.
9. Numerical evaluation of the dynamic response of a SDOF system; time-stepping methods.
10. Response & design spectra for seismic excitation.
11. Discrete parameter MDOF systems: Formulation of the equations of motion [reduction of (static) Degrees of Freedom (DOF); static & dynamic condensation]; system matrices [mass, stiffness, and damping matrices, influence vector (for support excitation problems)].
12. MDOF systems: Free vibrations of undamped MDOF systems: the generalized eigenvalue problem: natural frequencies and natural modes of vibration. Fundamental properties of the eigenvalues and eigenvectors. Methods for obtaining estimates of natural frequencies (*e.g*. RAYLEIGH quotient). Free vibrations of MDOF systems with classical damping (RAYLEIGH damping & extended RAYLEIGH damping).

    MDOF systems: Forced vibrations. Modal response analysis; modal contributions (modal contribution factor; dynamic response factor).

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Lectures are accompanied by tutorials (where example problems are solved in class). Lecture notes are accompanied by suggested problems as outlined in the course syllabus. The instructor is available for answering questions.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of Information and Communication Technologies (ICTs) (e.g. PowerPoint) in teaching. The lectures' course content of each chapter are uploaded to the internet in the form of a series of PowerPoint files, from where students can freely download them using a password which is provided at the beginning of the course.
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*	See table below
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*	Grading is based on a 3-hour final written exam.

Activity	*Semester workload*
Lectures	52
Interactive teaching	9
Writing report	28
Hours for private study of the student	61
Total number of hours for the Course (25 hours of work-load per ECTS credit)	***150 hours (total student work-load)***

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.*	

5. ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Related academic journals:

DYNAMICS OF STRUCTURES: Theory and applications to earthquake engineering. By A. CHOPRA, 3rd Edition, PRENTICE HALL.

Handouts provided by the instructor.

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF COURSE	UNDERGRADUATE		
COURSE CODE	CIV_7231A	**SEMESTER**	7th
COURSE TITLE	DESIGN OF PLANAR REINFORCED CONCRETE 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**
Lectures, seminars / in-class examples	4 (lect.)	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*	Field of Science (reinforced concrete structures) and Skills Development (design of concrete structures)
PREREQUISITE COURSES:	Typically, there are not prerequisite courses. However, successful completion of the course “Design of linear reinforced concrete elements” is necessary.
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek.
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1500/

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 the course, the student will be able to:

1. Apply the design rules for bar anchorages and lap splices
2. Design structures for the ultimate state of failure due to torsion
3. Present the basic cases of slab configuration and design slabs for the ultimate state of failure due to flexure
4. Recognize the particular structural features of shear walls and design shear walls for flexure and shear.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

At the end of the course the students will have further developed the following competences.

1. Ability to demonstrate knowledge and understanding of the mechanism of bar anchoraging and bar lap-splicing
2. Capacity to design reinforced concrete elements at the ultimate limit state of torsion
3. Ability to design slabs for flexure
4. Ability to apply capacity design rules for shear walls at the ultimate limit state of flexure and shear.

3. SYLLABUS

1. Bond of concrete to steel.
2. Anchorage and lap-splicing of steel reinforcement.
3. Design of concrete elements at ultimate limit state for torsion.
4. Slabs: one-way slabs, two-way slabs, analysis, design and detailing.
5. Slab design for punching.
6. Plane elements: deep beams, corbels, joints
7. Shear Walls: design and detailing for seismic actions

4. TEACHING AND LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Lectures (in class, with) and seminars
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Course website (e-class)
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*	see table below
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*	1. Midterm exam – design problem solving (20%) 2. Final exam –design problem solving (80%)

Activity	*Semester workload*
Lectures (4 hours per week x 13 weeks)	52
Seminars (1 conduct hour per week x 13 weeks) - solving representative problems	15
Midterm exam	3
Hours for private study of the student	77
Final examination (3 conduct hours)	3
Total number of hours for the Course	***150***

where they are accessible to students.	

5. RECOMMENDED LITERATURE

“Design of Reinforced Concrete – Part II”, M. Fardis, Univ. of Patras, 2018.

“Seismic Design, Assessment and Retrofitting of reinforced concrete buildings”, M. Fardis, Springer, 2009.

COURSE OUTLINE

1. GENERAL

<table>
<tr><td>SCHOOL</td><td colspan="3">ENGINEERING</td></tr>
<tr><td>ACADEMIC UNIT</td><td colspan="3">CIVIL ENGINEERING</td></tr>
<tr><td>LEVEL OF STUDIES</td><td colspan="3">UNDERGRADUATE</td></tr>
<tr><td>COURSE CODE</td><td>CIV_7320A</td><td>SEMESTER</td><td>7th</td></tr>
<tr><td>COURSE TITLE</td><td colspan="3">FOUNDATION ENGINEERING</td></tr>
<tr><td colspan="2">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></td><td>WEEKLY TEACHING HOURS</td><td>CREDITS</td></tr>
<tr><td colspan="2">Lectures and Tutorials</td><td>4</td><td>6</td></tr>
<tr><td colspan="2"></td><td></td><td></td></tr>
<tr><td colspan="2"></td><td></td><td></td></tr>
<tr><td colspan="2"><i>Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).</i></td><td></td><td></td></tr>
<tr><td>COURSE TYPE
<i>general background, special background, specialised general knowledge, skills development</i></td><td colspan="3">Specialised General Knowledge</td></tr>
<tr><td>PREREQUISITE COURSES:</td><td colspan="3">There are no prerequisite courses. It is however recommended that students have a good understanding of the content of the course Soil Mechanics I & II</td></tr>
<tr><td>LANGUAGE OF INSTRUCTION and EXAMINATIONS:</td><td colspan="3">Greek. Teaching may be however performed in English in case foreign students attend the course.</td></tr>
<tr><td>IS THE COURSE OFFERED TO ERASMUS STUDENTS</td><td colspan="3">No</td></tr>
<tr><td>COURSE WEBSITE (URL)</td><td colspan="3">https://eclass.upatras.gr/courses/CIV1659/</td></tr>
</table>

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*

At the end of this course the students should be able to understand:

1. (a) The tasks that must be accomplished by the foundation in order to achieve the proper functioning of a structure, and (b) the differentiation between shallow and deep foundations
2. The limit states of ultimate failure and serviceability of foundations
3. The need for a rational estimation of the expected settlement of a foundation under the applied loading
4. The need for a rational estimation of the ultimate load capacity of a foundation
5. The differentiation of behavior between non-cohesive and cohesive soils with regard to the development of settlements and the ultimate load capacity
6. (a) The purpose and the types of earth retaining structures (b) the methods for estimation of earth pressures and (c) the critical role played by the displacement of structure

At the end of the course the student will have further developed the ability to:

1. Plan the appropriate geotechnical investigation for a project including in-situ testing
2. Estimate the ultimate bearing capacity of shallow and deep foundations, for different types of ground conditions, taking into consideration the available codes
3. Estimate the expected settlement of a foundation and compare it to the allowable values provided in the code(s)
4. Analyze and design a foundation based on both criteria of ultimate bearing capacity and allowable settlement
5. Analyze and design on earth retaining structure, including reinforced concrete walls and steel sheet pile walls

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking

……

Others…

…….

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

3. SYLLABUS

1. Introduction
2. Geotechnical Investigation and In-situ Testing
3. Bearing Capacity of Shallow Foundations
4. Settlement of Shallow Foundations
5. Earth Retaining Structures
6. Bearing Capacity and Settlement of Deep Foundations

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to Face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of web based e-class platform
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*	see table below
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure*	1. Written exams which include problem solving (70%) 2. Evaluation of Team work Project (30%)

Activity	*Semester workload*
Lectures	26
Tutorials	26
Team work Project	52
Hours for private study	46
Course total	***150***

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.*	

5. ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
- Related academic journals:

- Donald P. Coduto, William A. Kitch, Man-chu Ronald Yeung, Foundation Design: Principles and Practices, Prentice Hall PTR, Jan 12, 2015
- Salgado, R. (2008), "The Engineering of Foundations", Mc Graw-Hill Companies, Inc., 882p

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	CIV_0480A	**SEMESTER**	7th
COURSE TITLE	HARBOUR WORKS ANALYSIS AND DESIGN		

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 knowledge
PREREQUISITE COURSES:	None
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1562/

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*

Desired learning outcomes:
1. Basic principles of wave mechanics and coastal hydraulics.
2. Design guidelines of port facilities layout.
3. Failure modes and design principles of harbour works.
4. Design of breakwaters, quays and pylons.

Specific knowledge and competences:
1. Knowledge and understanding of essential facts, concepts, principles and theories relating to the action of wind waves in the coastal zone.
2. Application of such knowledge in analysis of wind data and computation of "design wave".
3. Application of methodologies in the design of breakwaters, quays and pylons.
4. Synthesis and application of knowledge to the preliminary design of a harbour project.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

- Working independently
- Team work
- Project planning and management
- Respect for the natural environment

3. SYLLABUS

1. Legal framework of Greek ports.
2. Port site selection.
3. Coastal hydraulics: gravity waves, surf zone, wind-generated waves.
4. Design ship and port layout.

5. Operation and failure modes of harbour structures.
6. Rubble-mound breakwaters.
7. Vertical-wall and composite breakwaters.
8. Wharves.
9. Cylindrical pylons.
10. ~~Dredging.~~
11. ~~Port environmental management.~~

4. TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face-to-face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Support of the learning process using the e-class platform</td></tr>
<tr><td>TEACHING METHODS
<i>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</i></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>52</td></tr>
<tr><td>Team project. Preliminary Design of Harbour Works</td><td>50</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Study</td><td>48</td></tr>
<tr><td>Course total</td><td><i>150</i></td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure

Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem</i></td><td>I. Final exam which includes design problems (75%).

II. Collaborative project on the preliminary design of harbor works (technical report and brief oral examination) by students working in teams of 5-6 (25%).</td></tr>
</table>

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.*	

5. ATTACHED BIBLIOGRAPHY

- *Suggested bibliography:*

Coastal Engineering Manual. Engineer Manual 1110–2-1100, U.S. Army Corps of Engineers, Washington, D.C., 2002.

- *Related academic journals:*

1. Coastal Engineering
2. Journal of Waterways, Port, Coastal and Ocean Engineering
3. Ocean Engineering

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	CIV_7610A	**SEMESTER**	7th
COURSE TITLE	ROAD DESIGN AND CONSTRUCTION		

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, skills development
PREREQUISITE COURSES:	Basic knowledge of traffic engineering, geometry, materials
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1769/

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*

By the end of this course, the student will be able to:

- Assess a roadway horizontal alignment and determine its geometric properties.
- Assess an optimal roadway vertical alignment.
- Estimate the earthwork quantities and determine appropriate movement strategies. .
- Identify pavement types, their properties, materials, and construction processes.
- Design flexible pavements.
- Assess the level of road safety of a given infrastructure
- Apply construction methods for retaining walls and other concrete 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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

By the end of this course, the student will have developed the following general abilities (from the list above):

- Adapting to new situations
- Decision-making
- Working independently
- Working in an international environment
- Working in an interdisciplinary environment
- Project planning and management
- Respect for the natural environment

- Criticism and self-criticism

3. SYLLABUS

1. Introduction to roadway design
2. Road classification and standards, road capacity, vehicle speeds and kinematics, road geometric characteristics
3. Roadway horizontal and vertical alignment, cross-section design
4. Stopping and passing sight distance analysis
5. Grading operations, excavation and embankment, earthwork calculations, Bruckner diagram
6. Road safety analysis
7. Flexible pavement design
8. Pavement materials, properties, composition, and testing.

4. TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td colspan="2">Face-to-face lectures</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td colspan="2">PowerPoint presentations as part of the lectures, systematic use of eclass platform for course announcements and material handling, etc.</td></tr>
<tr><td rowspan="8">TEACHING METHODS
<i>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.</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></td><td>Activity</td><td>Semester workload</td></tr>
<tr><td>Lectures</td><td>52</td></tr>
<tr><td>Study and analysis of bibliography</td><td>48</td></tr>
<tr><td>Exercises</td><td>50</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td><i>Total number of hours for the course (25 hours of work-load per ECTS credit)</i></td><td><i>150</i></td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i></td><td colspan="2">Language of evaluation: Greek

Methods of evaluation:</td></tr>
</table>

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.*	Final exam (100%) or (alternatively) Exercises (10-30%) and final-term exam (90-70%). Evaluation criteria and updates can be found here: https://eclass.upatras.gr/courses/CIV1769/

5. ATTACHED BIBLIOGRAPHY

- *Suggested bibliography:*

- A. Apostoleris, "Highway Engineering: Theory and Practice", Athens 2015 (in Greek)
- A. Mouratides, "Highway Engineering: Highway Construction", University Studio Press, 2005 (in Greek)

- *Related academic journals:*

- ASCE Journal of Transportation Engineering
- Journal of Pavement Engineering
- ASCE Journal of Infrastructure Systems
- Computer-Aided Civil and Infrastructure Engineering

8th SEMESTER

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	CIV_7222A	**SEMESTER**	8th
COURSE TITLE	STRUCTURAL ANALYSIS WITH THE FINITE ELEMENT METHOD		

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 and laboratory	4(lect) 2(lab)	7
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 knowledge & skills development
PREREQUISITE COURSES:	Typical, there are no prerequisite courses. However, students should possess basic knowledge in the fields of: strength of materials, structural analysis, matrix operations
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1685/

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 conclusion of this course, the students should be able to:

1. Perform efficient structural (stress) analysis of complex structures using appropriate numerical models.
2. Use commercially available software for static and dynamic analysis of structures.
3. Develop simple routines for the development of stiffness, mass and damping matrices of several finite element types.
4. Assess the accuracy of analyses performed with the Finite Element Method.

Other competences:
1. Identify appropriate model for a given structural system.
2. Assess the important structural characteristics for efficient modeling.
3. Efficient simulation of complicated/skewed geometries.
4. Handle efficiently any type of loads including seismic actions.
5. Interpret outputs of commercial software.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

Analysis and synthesis of data and information, with the use of the necessary technology
Working independently

3. SYLLABUS

1. Virtual work principles
2. The concept of discretization, stiffness matrix, nodal forces and nodal displacements
3. Development of stiffness matrices for simple structures: truss, beam, 2-D frame elements. Solution of examples of such structures.
4. 3-D frame and grid elements. Solution of examples.
5. Plane stress and plane strain. Constant and linear strain triangle, 4-node rectangular element. Comparisons of various available elements. Numerical efficiency and convergence of solution. Solution of examples.
6. Axisymmetric elements. Solution of examples.
7. 3-D "brick" elements.
8. Practical considerations of modeling. Interpretation of results.
9. Static and dynamic analysis of structures.
10. Static and dynamic analysis of structures with computers. FEM programs for structural analysis (e.g. ANSYS, SAP, ETABS, etc).

4. TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face-to-face (Lectures, Laboratory exercises)
Presentations in class (blackboard or Powerpoint)
Solution of problems in class
Presentations and hand-on applications at computer laboratory
Short (weekly) projects to be performed at computer laboratory using commercial software</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Yes</td></tr>
<tr><td>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,</i></td><td><table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>52 hours</td></tr>
<tr><td>Study and analysis of bibliography</td><td>65 hours</td></tr>
<tr><td>Laboratory</td><td>26 hours</td></tr>
<tr><td>Laboratory study – reports</td><td>29 hours</td></tr>
<tr><td>Examination</td><td>3 hours</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
</table></td></tr>
</table>

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*	Course total **175 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.*	Final written exams (90%), Computer projects - laboratory reports (10%) Minimum passing grade: 5

5. ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

1. «Ανάλυση Φορέων με τη Μέθοδο των Πεπερασμένων Στοιχείων» Μ. Παπαδρακάκης, Εκδόσεις Παπασωτηρίου, Αθήνα.
2. “Concepts and Applications of Finite Element Analysis” R.D. Cook, D.S. Malkus, M.E.Plesha, John Wiley & Sons, New York.
3. “Finite Element Structural Analysis” T.Y. Yang, Prentice-Hall Inc., Englewood Cliffs, New Jersey.

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	CIV_8435A	**SEMESTER**	8th
COURSE TITLE	DESIGN OF WATER DISTRIBUTION, SEWAGE AND RAINWATER DRAINAGE NETWORKS		

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*	Special Background
PREREQUISITE COURSES:	There are no prerequisite courses. The student is expected to have adequate knowledge of Engineering Hydraulics.
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1593/

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 student familiarizes with basic concepts for the design of water distribution, sewage and rainwater drainage networks in urban and suburban areas (i.e. urban water projects). This is done through the analysis and understanding of applicable regulations and concepts, as well as detailed examples and practical applications.

By the end of the course, the student has the necessary knowledge and skills to design and size the individual components of water distribution, sewage and rainwater drainage networks in urban and suburban areas.

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
Project planning and management
Working independently
Decision making

3. SYLLABUS

Introduction to urban water projects (i.e. water distribution, sewage and rainwater drainage networks), historical references. Drinking water quality parameters. Calculation of water demand: water uses, estimation of design population, seasonal and diurnal variation of water demand, water losses, design flows for the delivering and distribution parts of the network. Spatial allocation, sizing and design of drinking water tanks and pressure-adjusting wells. Sizing of water distribution pipes, design of pumping stations, special network devices, methods for hydraulic calculations. Spatial allocation of water demand based on the spatial distribution of population, regular and emergency scenarios of network operation, introduction to computational tools. Design of sewage and rainwater drainage networks: composition of domestic wastewater, sewage networks, combined sewage and rainwater drainage networks, parasitic inflows, estimation of wastewater and rainwater discharges for hydraulic design, hydraulic concepts and approximations for the design and sizing of sewage and rainwater collectors. Calculation methodologies, restrictions on flow characteristics, design of transitional regions. Sewer technology, visiting manholes, sediment deposition, ventilation of wastewater collectors, quantification of hydrogen sulphide production, sewer protection against corrosion.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face class lectures and problem solving recitation sessions
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Free software for the hydraulic simulation and design of pressurized water distribution networks. Free software (for academic use only) for the design of wastewater and rainwater drainage networks. Distribution of academic material through e-class.
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*	see table below
STUDENT PERFORMANCE EVALUATION	Final written examination: - multiple choice questionnaires

Activity	*Semester workload*
Class lectures and problem solving recitation sessions.	52
Independent study	98
Course total	***150***

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.*	- problem solving

5. ATTACHED BIBLIOGRAPHY

- *Suggested bibliography:*
- *Related academic journals:*

1. Langousis A. and N. Fourniotis (2020) *Elements of Engineering Design of Water Distribution and Sewerage Networks*, 704 pages, GOTSIS publications, Greece, ISBN: 978-960-9427-89-0 (in Greek).
2. Aftias, M. (1992) *Water Distribution*, National Technical University of Athens, Athens, Greece (in Greek).
3. Koutsoyiannis, D. (2011) *Design of Urban Sewerage Networks*, National Technical University of Athens, Athens, Greece (in Greek).
4. Emmanouil, S. and A. Langousis (2017) UPStream: Automated Hydraulic Design of Pressurized Water Distribution Networks, *SoftwareX*, **6**, 248-254, https://doi.org/10.1016/j.softx.2017.09.001.

COURSE OUTLINE

1. GENERAL

SCHOOL	School of Engineering		
ACADEMIC UNIT	Department of Civil Engineering		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	CIV_5716A	**SEMESTER**	8th
COURSE TITLE	CONSTRUCTION PROJECT MANAGEMENT		

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 and laboratory work	6	7
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, skills development
PREREQUISITE COURSES:	There are no prerequisite courses
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1529/

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*

By the end of this course, the student will be able to:

- Apply methods for economic evaluation of investment plans.
- Evaluate proposals for optimal utilization and replacement of project machinery.
- Evaluate the economic feasibility of projects and optimize their characteristics.
- Analyze, describe and graphically present the project organizational structure.
- Estimate the duration and cost of project activities.
- Perform project scheduling, resource allocation and cost management analyses.
- Perform risk management analysis.
- Incorporate optimization methods in project management decision making.
- Apply building information modelling and project management software.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

By the end of this course, the student will have developed the following general abilities (from the list above):

- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Decision making
- Working independently
- Team-work
- Project planning and management
- Production of free, creative and inductive thinking

3. SYLLABUS

i. Introduction to construction project management
ii. Methods for economic evaluation of investment plans and projects
iii. Machinery replacement analysis, economic life of assets
iv. Economic analysis of public projects, cost-benefit analysis, feasibility studies
v. Accounting and depreciation, income tax considerations, effect of inflation, sensitivity analysis of economic proposals
vi. Project initiation, planning and organization, work breakdown structure (WBS)
vii. Project estimating: resource selection, activity duration and cost estimation
viii. Project scheduling, resource allocation and financial management
ix. Project tracking and control
x. Risk management in construction projects
xi. Optimization methods and applications in construction project management
xii. Information and communication technologies in construction, project management software, Building Information Modeling software in the project management field

In the course lab, students use BIM software and create in a PC, under the direct guidance of the instructor, a model of a building and perform the following specific analyses and designs as part of the class project:

- Architectural model of the structure
- Construction details, integration of elements for structural analysis
- Mechanical, electrical and plumping elements
- Building placement in the terrain
- Realistic 3d representation of the building and its surroundings, virtual navigation in and out of building at different phases of its development and level of detail, clash detection
- Quantity take off and cost estimation (project budget)
- Project scheduling
- Building energy analysis
- Sustainability analysis
- Fire evacuation path design
- Model export for 3D printing

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Lectures and laboratory work face to face
USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES *Use of ICT in teaching,*	PowerPoint presentations as part of the lectures, laboratory education in project management software (Ms-Excel financial functions, Ms-Project, Building Information Modeling -BIM software), systematic use of eclass platform for

<table>
<tr><td><i>laboratory education, communication with students</i></td><td>course announcements and material handling, student team forming, etc.</td></tr>
<tr><td>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></td><td>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures</td><td>52</td></tr>
<tr><td>Laboratory practice</td><td>26</td></tr>
<tr><td>Study and analysis of bibliography</td><td>40</td></tr>
<tr><td>Project</td><td>45</td></tr>
<tr><td>Essay writing</td><td>12</td></tr>
<tr><td></td><td></td></tr>
<tr><td><i>Total number of hours for the course (25 hours of work-load per ECTS credit)</i></td><td><i>175</i></td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<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></td><td>Language of evaluation: Greek

Methods of evaluation:
Course exam: 80%
Class project with BIM:20%
The course exam may be in the form of the final written exam (100%) or, alternatively by a mid-term exam (50%) and a final-term exam (50%).
Homework assignments are additionally taken into account.

Evaluation criteria are accessible to students in:
https://eclass.upatras.gr/courses/CIV1529/</td></tr>
</table>

5. ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- A. Shtub, J. Bard and S. Globerson , “ Project Management: Processes, Methodologies, and Economics”, 2nd Edition, Pearson, 2005
- R. Burke, “ Project Management - Planning & Control Techniques”, 5th Edition, Wiley, 2013

- Related academic journals:

- ASCE Journal of Construction Engineering and Management
- ASCE Journal of Management in Engineering
- Automation in Construction
- Construction Management and Economics
- Information Technology in Construction (ITcon)
- International Journal of Project Management

8th SEMESTER - TRACK CORE COURSES

The Core Course of each Track is selected from the following list according to the student's track.

1st Track: "Structural Engineering"

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF COURSE	UNDERGRADUATE		
COURSE CODE	CIV_8232A	**SEMESTER**	8th or 10th
COURSE TITLE	DESIGN OF REINFORCED CONCRETE STRUCTURES		

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	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, specialised general knowledge, skills development*	Specialised general knowledge
PREREQUISITE COURSES:	Typically, there are not prerequisite courses, but students should, essentially, possess good knowledge of the courses "Design of reinforced concrete linear elements" and "Design of reinforced concrete plane elements"
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek.
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1534/

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*

At the end of the course, students will have knowledge of:

- design principles for foundation elements and staircases,
- serviceability limit states,
- principles of seismic design according to modern codes and Eurocode 8.

At the end of the course, students will have developed the following competencies:

- ability to design and detail foundation elements and staircases,
- ability to calculate and verify deformations,
- ability to apply the principles of seismic design.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

- Search for, analysis and synthesis of data and information, with the use of the necessary technology.
- Decision-making.
- Working independently.
- Project planning and management

3.SYLLABUS

Course content:

i. Design of foundations: dimensioning and detailing of shallow foundations and foundation elements.
ii. Staircases: design and detailing, influence on the seismic response of the structure.
iii. Calculation and verification of deformations.
iv. Principles of seismic design: capacity design and ductility.
v. Seismic design of reinforced concrete structures according to Eurocode 8.

4.TEACHING AND LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Lectures, seminars in-class.</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Use of ICT in teaching (eg. powerpoint presentations, photos etc)
Support of learning process through e-class platform</td></tr>
<tr><td>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></td><td><table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures (4 conduct hours per week x 13 weeks)</td><td>52</td></tr>
<tr><td>Self-study and optional individual written work (two or three home-works)</td><td>73</td></tr>
<tr><td><i>Total number of hours for the Course (25 hours of work-load per ECTS credit)</i></td><td><i>125 hours</i></td></tr>
</table></td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<i>Language of evaluation, methods of evaluation, summative or conclusive,</i></td><td>The written final exam is in Greek and includes problem solving.
The final grade is calculated according to the following:
A. Student who did not deliver the optional home-works:
- Written final exam (100%)</td></tr>
</table>

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.*	B. Student who delivered at least one home-work (out of two or three): - Written final exam (80%) - Individual written home-works (20%) The final grade in case B is the maximum between the final exam and the grade calculated according to the above percentages. Home-works are valid only for the exam that follows the semester in which they were written.

5.ATTACHED BIBLIOGRAPHY

M.N. Fardis, “Design of reinforced concrete” (in Greek)”. 3rd Edition, University of Patras Publishing House 2003: Vol. I, Vol. II, Vol. III.

M.N. Fardis, “Design of earthquake resistant concrete structures (in Greek)”, Hellenic Open University 2003, ISBN 960-538-351-9

M.N. Fardis, E. Carvalho, A. Elnashai, E. Faccioli, P. Pinto and A. Plumier, “Designers’ Guide to EN 1998-1 and EN 1998-5: Eurocode 8: Design of structures for earthquake resistance. General rules, seismic actions, design rules for buildings, foundations and retaining structures”. Thomas Telford Publishers 2005, ISBN 07277-3348-6 (translated to Greek by Kleidarithmos, S.A., 2011, ISBN: 978-960-461-452-3)

M.N. Fardis, “Seismic design, assessment and retrofitting of concrete buildings (based on EN-Eurocode 8)”. Springer 2009, ISBN 978-1-4020-9841-3

M.N. Fardis, G. Tsionis, “Application of EN-Eurocode 8 Part 1 for the seismic design of multistorey concrete buildings”. University of Patras Publishing House 2011, ISBN 978-960-89691-2-4 (also available in Greek, ISBN 978-960-89691-3-1)

2nd Track: “Geotechnical Engineering – Infrastructure Works”

COURSE OUTLINE

1. GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	CIV_8355A	**SEMESTER**	8o, 10o
COURSE TITLE	GEOTECHNICAL EARTHQUAKE ENGINEERING		

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 and Tutorials	3	5
Field work	1	
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. It is expected, however, that students have a solid background in Soil Mechanics
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek/English
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1871/

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, students will be able to:
1. *Recognise the main geotechnical seismic hazards and to assess their consequences to the built and natural environment.*
2. *Evaluate the seismic response of soil layers based on closed form solutions and on their implementation in wave propagation software.*
3. *Assess the liquefaction potential based on simplified methodologies.*
4. *Evaluate the seismic response of slopes, retaining walls and piles.*

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

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

3.SYLLABUS

1. **INTRODUCTION**
   Overview of the main geotechnical seismic hazards (e.g., liquefaction, seismically triggered landslides) and of their implications for the built and natural environment. The dominant role of soil layer and topography amplification in historic seismic events (e.g. Kobe 1995, Chi-Chi 1999, Christchurch 2011).
2. **ELEMENTS OF ENGINEERING SEISMOLOGY AND DYNAMIC RESPONSE OF SIMPLE SYSTEMS**
   Elastic rebound theory. Seismic faults (types of faults, main features, dimensions, active and non-active faults). Location of seismic sources and

magnitude of earthquakes. Response of a single degree of freedom system to base excitation. Elastic response spectra.

3. **WAVE PROPAGATION**
   Wave propagation in one-direction, longitudinal and shear body waves, reflection and refraction of waves. Wave propagation in a homogeneous elastic half-space, in a layered half-space, surface waves (Rayleigh and Love), wave propagation in porous media, influence of the water table.
4. **SOIL BEHAVIOUR UNDER DYNAMIC LOADING**
   Overview of the fundamental dynamic soil properties and their measurement in the laboratory (bender elements, resonant column, cyclic triaxial). Dynamic soil response for a wide range of strains.
5. **SOIL LIQUEFACTION**
   Liquefaction phenomenon (cyclic mobility and flow liquefaction) through laboratory tests. Consequences of liquefaction on the built and natural environment. Evaluation of liquefaction potential through empirical methodologies (SPT and CPT based). Mitigation measures against liquefaction.
6. **SITE RESPONSE ANALYSIS**
   Soil layer amplification. Close-form solutions for 1D wave propagation in visco-elastic soil. Numerical methods. Equivalent linear and simple nonlinear constitutive models. 2D and 3D wave propagation and effect of topography on wave propagation.
7. **DESIGN OF GEOTECHNICAL STRUCTURES UNDER SEISMIC LOADING**
   Slope stability and retaining walls under seismic loading. Selection of appropriate seismic coefficient and factor of safety for pseudo-static analysis. Seismic design of piles.

4. TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face to Face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Use of web based e-class platform</td></tr>
<tr><td>TEACHING METHODS
<i>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.</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></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>26</td></tr>
<tr><td>Tutorials</td><td>13</td></tr>
<tr><td>Team work Project</td><td>39</td></tr>
<tr><td>Hours for private study</td><td>42</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td><i>125</i></td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<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></td><td>1. Assessment of assignments (30%)
2. Assessment of semester project (70%)</td></tr>
</table>

Specifically-defined evaluation criteria are given, and if and where they are accessible to students.	

5. ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
- Related academic journals:

1. Course notes (digital form)
2. Αθανασόπουλος, Γ. (2001) «Μαθήματα Δυναμικής του Εδάφους», Εκδόσεις Πανεπιστημίου Πατρών
3. Κ. Πιτιλάκης (2010), «Γεωτεχνική Σεισμική Μηχανική», Εκδόσεις Ζήτη
4. Kramer, S L, Geotechnical Earthquake Engineering. Prentice-Hall, 1996
5. Ishihara, R, Soil Behaviour in Earthquake Geotechnics, Clarendon Press, Oxford 1995
6. Semblat, J. F. and Pecker, a. (2009), "Waves and Vibrations in Soils: Earthquakes, Traffic, Shocks, Cosntruction Works" IUSS Press, 2009
7. Idriss, IM; Boulanger, Ross W; Soil liquefaction during earthquakes, Earthquake Engineering Research Institute, MNO-12, 2008

3^{rd} Track: “Hydraulic Engineering – Environmental Engineering”

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	CIV_9560A	**SEMESTER**	8th or 10th
COURSE TITLE	ENVIRONMENTAL IMPACT ASSESSMENT STUDIES OF TECHNICAL WORKS		

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 and Tutorials	3	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, specialised general knowledge, skills development*	Specialised general knowledge
PREREQUISITE COURSES:	There are no prerequisite courses. The students must have basic knowledge of Chemistry.
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1872/

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*

It is obligatory course of the 8th semester of the 3rd Track “Hydraulic Engineering – Environmental Engineering”, as well as an obligatory course under selection of the 3rd and 4th Track “Systems of Sustainable Transportation and Project Management”.

The subject matter of the course aims at informing students about the methods they can use to identify, assess and address the potential environmental impacts or risks coming from the civil engineering projects and activities, as well as the relevant legislation.

Upon successful completion of the course the student will be able to:

- assess possible environmental impacts on projects and activities under study
- classify environmental impacts and hazard of projects and activities
- Evaluate the impacts and propose appropriate measures to address environmental impacts and restore the environment
- Organize environmental impact assessment studies
- Supervise the implementation of environmental impact studies during construction as well as of environmental and remediation measures.

Finally, the aim of the course is to acquire basic knowledge and skills so that the qualified engineers can use them in their professional careers, either as consultants or as contractors or responsible operators of projects and activities.

In particular, at the end of this course, the student will further develop the following skills:

- Ability to understand the basic concepts and mechanisms related to the environmental impact assessment of projects and activities
- Ability to apply methodologies for assessing and evaluating environmental impacts on a variety of practical problems and studies, such as site selection of civil works (industries, ports, airports), improving traffic and transportation, road positioning, disposing of solid waste etc.
- Ability to study, lifelong learning and continuing professional development
- Ability to conduct environmental impact assessment studies, as well as interdisciplinary cooperation.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism

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

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

3. SYLLABUS

1. Introduction

Concepts and Definitions, Environment and civil works, Impacts, state of the art, Significance of Environmental Impact, Legislation

2. Forecasting and Environmental Impact Assessment

Methodology and application of techniques, Risk forecasting and assessment, Accident impact assessment

3. Addressing Environmental Impacts and Hazards

Methodology for evaluating alternatives, Environmental restoration, Hazard reduction, Risk prevention systems

4. Monitoring of Environmental Impacts

Methodology, Quantitative and qualitative monitoring

5. Conduction of Environmental Impact Assessment Studies

Methodology for organizing the conduction of studies and follow up the process of the general study

6. Legislation and Process for Approval of Environmental Impact Assessment Studies

National and Community Legislation, Public Information and Participation, Environmental Terms, Approval Authority, Remedies.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	In the classroom
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Support Learning through the e-class platform

TEACHING METHODS
The manner and methods of teaching are described in detail.

Activity	***Semester workload***
Lectures	39
Tutorial exercises to consolidate concepts	6

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*	and understand the implementation of methods for identifying, assessing and addressing environmental impacts	
	Tutorial work in small groups of students	6
	Educational visit / Small individual exercises	6
	Independent home work, elaboration and writing of individual topics	25
	Organized presentation of all topics	3
	Individual work at home of theoretical matter of the course	40
	Course total	***125***
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 exam (90%) including: (a) Responding to questions and solving an exercise on the identification, evaluation and address of potential environmental impacts due to the construction and / or operation of a particular project or activity. (b) During the lecture, two assignments for each interested student are given. Rate 5% per exercise upon successful completion and good presentation of them.	

5. ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Related academic journals:

1. "Environmental Impact Assessment Studies of Technical Works", P.C. Yannopoulos, Patras, 2015, p. 128. (Notes in Greek).
2. "Environment - Environmental Impact Assessment Studies", Vavizos G.C., Mertzanis A., 2nd edition, Papasotiriou Publications, Athens, 2003, p. 344. Book Code in Eudoxos: 68406906 (in Greek).

4th Track: “Sustainable Transportation and Project Management Systems”

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF COURSE	UNDERGRADUATE		
COURSE CODE	CIV_8665A	**SEMESTER**	8th or 10th
COURSE TITLE	TRANSPORTATION SYSTEMS ANALYSIS AND DESIGN I		

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, seminars and laboratory work	3	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, specialised general knowledge, skills development*	Field of Science
PREREQUISITE COURSES:	Knowledge in Applied Mathematics and Statistics is necessary.
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek. Teaching may be performed in English if foreign students attend the course.
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
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

6. *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*

7. *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
8. *Guidelines for writing Learning Outcomes*

By the end of this course the student will be able to:
1. Know the most important components of transportation systems analysis
2. Apply the principles of transportation theory to identify the most appropriate demand functions in transportation systems
3. Apply the principles of demand-supply equilibrium to identify the basic equilibrium states of transportation demand
4. Know and apply the 4-step transportation model.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

By the end of this course the student will have developed the following skills (general abilities):
1. Ability to demonstrate knowledge and understanding of essential facts, concepts, principles and theories relative to analytical transportation systems.
2. Ability to apply such knowledge and understanding to the solution of qualitative and quantitative problems of an unfamiliar nature.
3. Ability to adopt and apply relevant methodology to the solution of unfamiliar problems in transport, traffic and road analysis.
4. Ability to apply skills for continuing professional development.
5. Ability to interact with others in researching, analysing, and reporting on multidisciplinary professional problems.

Generally, by the end of this course the student will have developed the following general abilities:
Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adaptation to new situations
Decision making
Independent work
Group work
Promotion of free, creative and inductive thinking
Work analysis

Work design and management

3. SYLLABUS

Introduction to transportation systems analysis. Components of transportation systems analysis. Transportation demand. Elements of demand-supply equilibrium. Methodologies to collect and analyse transportation data. Transport demand generation. Transport demand distribution. Mode choice. Traffic assignment.

4. TEACHING AND LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	In class. Lecture, problem-solving seminar. Face-to-face. Collaborative problem research and analysis in groups of 5-8.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	- Specialised software for statistical analysis of transportation systems' data - Learning support through electronic platform e-class
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*	see table below
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires,*	Final exam or alternatively + Two written tests* (50% of total grade) + Final project report (50%) All tests and project must be passed. Passing grade for each is 50 out of 100. Grade scaling is used.

Activity	***Semester workload***
Lectures	34
Practical exercises that focus on the application of methods and the analysis of case studies in small groups	17
Group project on case study. Group project on systems analysis.	34
Educational visit/ individual work exercises	10
Independent study	30
Total number of hours for the Course (25 hours of work-load per ECTS credit)	***125***

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.*	

5. ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

Greek bibliography:

Γιαννόπουλος, Γ. (2005). Σχεδιασμός των μεταφορών. Εκδόσεις Επίκεντρο Α.Ε., ISBN: 978-960-88681-0-6.

Ματσούκης, Ε. (2008). Σχεδιασμός των Μεταφορών και Στοιχεία Σιδηροδρομικής. Εκδόσεις Συμμετρία.

Σταθόπουλος, Α., Καρλαύτης, Μ. (2008). Σχεδιασμός Μεταφορικών Συστημάτων. Εκδόσεις Παπασωτηρίου, ISBN 9789607182050.

Φραντζεσκάκης, Ι., Γκόλιας Ι., Πιτσιάβα-Λατινοπούλου, Μ. (2009). Κυκλοφοριακή Τεχνική, Εκδόσεις Παπασωτηρίου, ISBN: 978-960-7182-42-5.

Foreign bibliography:

Ben-Akiva, M., Lerman, S. (1985). Discrete Choice Models. MIT Press.

de Smith, M. J. (2014). *Statistical Analysis Handbook: A comprehensive handbook of statistical concepts, techniques and software tools*. The Winchelsea Press, Winchelsea, U.K. http://www.statsref.com/StatsRefSample.pdf

Manheim, M. (1979). Fundamentals of Transportation Systems Analysis. Cambridge MIT Press.

Meyer, M., Miller, E. (2000). Urban Transportation Planning. New York, NY: McGraw-Hill, 2000. ISBN: 9780072423327.

Ortuzar, J.D., Willumsen, L.G. (2011). Modelling Transport. 4th edition. London: Wiley.

Richardson, A., Ampt, E., Meyburg, A. (1995). Survey Methods for Transport Planning, Eucalyptus Press.

Stopher, P., Mayburg, A. (1975). Urban Transportation and Planning, Lexington.

Sussman, J.M. (2000). Introduction to Transportation Systems, Artech House.

- Related academic journals:

Transport Policy, Transportation Research Part A, B, C, D, E, Transportation Research Procedia, Transportation Planning and Technology, Journal of Transport Geography, International Journal of Sustainable Transportation.

8th SEMESTER - 1st TRACK ELECTIVE COURSES

Students of the 1st Track select one (1) elective course from the following list.

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF COURSE	UNDERGRADUATE		
COURSE CODE	CIV_9269A	**SEMESTER**	8th or 10th
COURSE TITLE	COMPOSITE STRUCTURES		

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	3	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, specialised general knowledge, skills development*	Field of Science
PREREQUISITE COURSES:	Good knowledge obtained in the introductory courses on the design of steel and reinforced concrete structures
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1503/

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

9. Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education

Area

10. *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
11. *Guidelines for writing Learning Outcomes*

By the end of this course the student will:

- Know the basic principles for the design of steel – concrete composite structures.
- Know the mechanics of the shear connection.
- Understand the mechanical behavior of steel - concrete composite elements: simply supported and continuous composite beams and slabs; columns under biaxial bending and axial load; connections.
- Know the basics of seismic design of steel – concrete composite structures.
- Understand the mechanical behaviour of steel – concrete composite members and systems in the field of strengthening and seismic retrofitting.
- Understand the mechanical behaviour of timber – concrete composite beams and slabs.
- Know the basic principles of the composite action between concrete and fiber-reinforced polymer composite materials.

By the end of this course the student will have developed the ability to:

- Know the basic principles for the design of steel – concrete composite structures.
- Calculate the strength, stiffness and slip of shear connections.
- Verify the ultimate and the serviceability limit state of simply supported and continuous steel – concrete composite beams and slabs.
- Verify the ultimate limit state of steel – concrete composite columns.
- Understand the behaviour of steel – concrete composite connections in terms of strength and stiffness, as well as to perform the relevant calculations.
- Verify the seismic design of steel-concrete composite structures.
- Explain the behavior of concrete members strengthened with steel elements along the lines of steel – concrete composite action.
- Calculate the strength and stiffness of timber – concrete composite beams and slabs.
- Understand basic principles of the composite action between concrete and fiber-reinforced polymer composite materials.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…

environment …….   *Production of new research ideas*
• Search, analysis and synthesis of data and information, as well as using the necessary technologies   • Autonomous (Independent) work

3. SYLLABUS

Steel-concrete composite structures: introduction, materials, basis of design, full and partial shear connection, simply supported and continuous beams and slabs, composite columns, composite connections, introduction to seismic design. Steel-concrete composite members in the field of strengthening and seismic retrofitting. Introduction to timber - concrete composites and hybrid structures made of fiber-reinforced polymers in combination with concrete.

4. TEACHING AND LEARNING METHODS - EVALUATION

<table>
<tr><td>COURSE TYPE
<i>general background, special background, specialised general knowledge, skills development</i></td><td>Lectures in the classroom</td></tr>
<tr><td>PREREQUISITE COURSES:</td><td>Use of simple computer software for problem sets, interaction with students through the electronic platform e-class</td></tr>
<tr><td>LANGUAGE OF INSTRUCTION and EXAMINATIONS:</td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>39</td></tr>
<tr><td>Self-study and work on the problem sets</td><td>86</td></tr>
<tr><td><i>Total number of hours for the Course
(25 hours of work-load per ECTS credit)</i></td><td><i>125</i></td></tr>
</table>
</td></tr>
<tr><td>IS THE COURSE OFFERED TO ERASMUS STUDENTS</td><td>IV. Final written examination (75%) on problem solving
V. Problem sets (25%)</td></tr>
<tr><td>COURSE WEBSITE (URL)</td><td>VI. https://eclass.upatras.gr/courses/CIV1503/</td></tr>
</table>

5. ATTACHED BIBLIOGRAPHY

Triantafillou, Ath., Composite Structures, GOTSIS Publishers, 2016.

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	CIV_9255A	**SEMESTER**	8th or 10th
COURSE TITLE	EARTHQUAKE ENGINEERING AND EARTHQUAKE RESISTANT STRUCTURES		

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 + laboratory work	3+0	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, specialised general knowledge, skills development*	Field of Science
PREREQUISITE COURSES:	1. Design of steel structures 2. Design of reinforced concrete structures 3. Structural dynamics These prerequisites have not been formally established by the Department.
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1519/

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* *12. Description of the level of learning outcomes for each qualifications cycle,*

according to the Qualifications Framework of the European Higher Education Area

13. Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B

14. Guidelines for writing Learning Outcomes

By the end of the course should have mastered the course content described below and, in particular, the following points:

1. The concept and analytical usefulness of response spectra, which lead to design spectra.
2. The elastic and inelastic earthquake response of building structures and the factors affecting it.
3. The principles of earthquake resistant design so that the student will be able to employ them in design.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

After course completion the student should be capable:

1. To understand and correlate the seismic response of a structure with the characteristics of the earthquake excitation.
2. To understand the provisions of a modern Earthquake Resistant Design Code (*e.g.* EC8), to know their origin and justification and to apply this code for earthquake resistant design of structures (mainly buildings).

3. SYLLABUS

1. Introduction

2. Elastic Response Spectra
3. Inelastic Response Spectra
4. Earthquake Response of MDOF Systems: Formulation of the Equations of Motion (Review)
5. Earthquake Analysis of Linear Systems
6. Response Spectrum Analysis
7. Earthquake Response of Linearly Elastic Buildings
8. Earthquake Response of Inelastic Buildings
9. Earthquake Analysis of Torsionally Coupled Buildings
10. Soil-Structure Interaction
11. Building Codes

Wherever possible, the lectures are interjected by relevant information originating from the discipline of Engineering Seismology. Also, new protective systems (such as base isolation) are mentioned

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Lectures are accompanied by suggested problems as outlined in the course syllabus. The instructor is available for answering questions.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of Information and Communication Technologies (ICTs) (e.g. PowerPoint) in teaching. The lectures' course content of each chapter are uploaded to the internet in the form of a series of PowerPoint files, from where students can freely download them using a password which is provided at the beginning of the course.
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.*	see table below

Activity	*Semester workload*
Lectures	39
Hours for private study of the student	86
Total number of hours for the Course (25 hours of work-load per ECTS credit)	***125 hours (total student work-load)***

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	
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.*	Grading is based on a 3-hour final written exam.

5. ATTACHED BIBLIOGRAPHY

DYNAMICS OF STRUCTURES: Theory and applications to earthquake engineering. By A. CHOPRA, 3rd Edition, PRENTICE HALL.

Handouts provided by the instructor.

Selected relevant articles from the published scientific literature.

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	CIV_8268A	**SEMESTER**	8th or 10th
COURSE TITLE	DESIGN AND REPAIR OF MASONRY STRUCTURES		

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**
	3	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, specialised general knowledge, skills development*	Elective course, skills development
PREREQUISITE COURSES:	Structural materials, Mechanic of Materials
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	no
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1521/

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 scope of the course is the comprehension of :

a) The materials and the types of structural masonry and their effect to the mechanical properties of masonry
b) The specifications for the design of new structures of plain, confined and reinforced masonry according to Eurocodes
c) The design principles for new masonry structures in seismic areas
d) The verification of unreinforced and reinforced masonry walls under compressive and lateral loads
e) The verification of masonry buildings under seismic loads
f) The pathology of masonry structures, focused on the seismic vulnerability
g) The knowledge of available repair and strengthening techniques as well as criteria for the selection of strengthening measures based on technical and social data
h) The proper selection for the repairing and strengthening of damaged or vulnerable buildings

After completed this course the student will be able to:

a) calculate the mechanical properties of an existing or new masonry
b) choose the proper materials for structural masonry in seismic areas
c) estimate the vulnerability of existing masonry buildings frequent found in Greece
d) design a building according to the specifications of Eurocodes 6 and 8
e) execute a complete seismic verification of an existing masonry building
f) give an explanation of any damage of a masonry structure
g) choose the proper repairing or strengthening measure for the retrofitting of an existing masonry building

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

- Decision making
- Working independently
- Project Planning

3. SYLLABUS

- **Masonry types**
  Types and grouping of masonry units. Types of mortars and specifications
- **Mechanical properties of Masonry**
  Compressive, flexural and shear strength. Modulus of Elasticity. Walls under compressive and/ or later loads.
- **Structural elements of buildings**
  Types of floors and sills. Types, function, failure and strengthening measures of arches, vaults and domes
- **Types and vulnerability of existing buildings frequent found in Greece**
  Classification of building stock and relation between structural type and vulnerability
- **Plain, Confined and Reinforced masonry.**
  Specifications according to EN 1996 and EN 1998
- **Design of masonry according to Eurocode 6**
  Unreinforced and reinforced masonry walls under compressive or/and in-plane or out-of-plane loading
- **Analysis methods and seismic behavior of masonry buildings**
  The available methods for the analysis of masonry structures are examined and their ability to predict the seismic behavior of existing structures is verified by comparing the results with the developed seismic damage.
- **Damage of masonry structures**
  Damage generated of structural faults as well as of soil effects. Seismic vulnerability of masonry structures
- **Strengthening techniques**
  Fields of application and execution of techniques like repointing, grouting, and sprayed concrete. Structural details for the construction of horizontal diaphragms and insertion of tendons.
- **Repairs and Strengthening of existing masonry structures**
  Details on the selection and execution of the proper repairing or retrofitting works depending on the type of damage and masonry type
- **Effectiveness and cost of strengthening measures**
  Effectiveness criterion, effectiveness and relation with the cost of retrofitting measures

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	**Use of e-class platform**	
TEACHING METHODS	***Activity***	***Semester workload***
	Lectures	39

<table>
<tr><td><i>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</i></td><td>
<table>
<tr><td>project</td><td>51</td></tr>
<tr><td>Study</td><td>35</td></tr>
<tr><td>Course total</td><td><i>125</i></td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>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.</i></td><td>Term project</td></tr>
</table>

5. ATTACHED BIBLIOGRAPHY

Masonry Structures by F. Karantoni, ed. Papasotiriou Any text book on structural masonry

8th SEMESTER – 2nd TRACK ELECTIVE

COURSES

Students of the 2nd Track select one (1) elective course from the following list.

COURSE OUTLINE

1.GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	CIV-9371A	**SEMESTER**	8ο ή 10 ο
COURSE TITLE	GEOTECHNICAL SITE EXPLORATION METHODS		

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	2	5
Laboratory Exercises	2	
Field Work	1	
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. It is anticipated, however, that students should have background of Soil Mechanics
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek. Teaching may be however performed in English in case foreign students attend the course.
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1731/

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

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

At the end of this course the students will be able to:

1. Know the composition of a geotechnical investigation report.
2. Know methods of drilling and sampling.
3. Know the basic laboratory soil mechanics tests.
4. Know the most frequently performed field tests.
5. Know methods for field instrumentation and monitoring.

At the end of the course the student will have further developed the following skills/ competences:

1. Ability to perform the basic soil mechanics laboratory tests.
2. Ability to participate in the planning and execution of a geotechnical investigation program, including in-situ tests.
3. Ability to participate in the planning, execution and interpretation of field instrumentation and monitoring program.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

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

3.SYLLABUS

1. **Geotechnical investigation**
   Steps, drilling methods, sampling, in-situ tests.

2. **Laboratory soil mechanics tests**
   Gradation, Atterberg limits, permeability, compaction, consolidation, shear strength
3. **Field instrumentation and monitoring**
   Methods and instruments for monitoring the behavior of soils and geotechnical construction

4.TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face to Face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Use of web based e-class platform</td></tr>
<tr><td>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></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>26</td></tr>
<tr><td>Laboratory Practice</td><td>26</td></tr>
<tr><td>Technical Reports</td><td>33</td></tr>
<tr><td>Field work</td><td>10</td></tr>
<tr><td>Hours for private study</td><td>30</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td><i>125</i></td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires,</i></td><td>1. Written exams which include problem solving (50%)
2. Evaluation of Laboratory Tests Technical Reports (50%)</td></tr>
</table>

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.*	

5.ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
- Related academic journals:

- Roy E. Hunt, Geotechnical Investigation Methods: A Field Guide for Geotechnical Engineers, CRC Press, Oct 31, 2006
- John Dunnicliff, Gordon E. Green, Geotechnical Instrumentation for Monitoring Field Performance, John Wiley & Sons, Sep 24, 1993
- “Engineering Properties of Soils and their Measurement”, J.E.Bowles, McGraw-Hill Book Co., 1978

COURSE OUTLINE

1 GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	CIV_8371A	**SEMESTER**	$8^{ο}$ or $10^{ο}$
COURSE TITLE	SELECTED TOPICS IN FOUNDATION ENGINEERING		

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 and Tutorials	3	5
Field Work	1	
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. It is expected, however, that students have a solid background in Soil Mechanics
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek.
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1858

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

18. *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
19. *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for*

Lifelong Learning and Appendix B

20. Guidelines for writing Learning Outcomes

Upon successful completion of this course, students will be able to design:

21. *Bored piles.*
22. *Flexible retaining walls.*
23. *Anchors for flexible retaining structures and soil slopes.*
24. *Retaining walls of reinforced soil using geotextiles.*

Upon successful completion of this course, students will have further developed the following skills:

1. *Competence in the use of in-situ soil tests data for the design of piles.*
2. *Competence in the use of specialised software for geotechnical analysis.*
3. *Competence in presenting their work and writing scientific and technical reports.*

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

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

3. SYLLABUS

1. **INTRODUCTION**
   Revision of basic concepts of Soil Mechanics which are required as theoretical background to support the syllabus of this course, e.g., calculation of soil stresses and lateral earth pressures, shear soil strength etc.
2. **BORE PILES DESIGN**

Presentation of construction methods. Calculation of axial bearing capacity and settlements of bored piles; estimation of the load-settlement response, using a) DIN 4014 and b) Data derived from in-situ load tests on a bored pile.

3. **FLEXIBLE RETAINING STRUCTURES DESIGN**
   Presentation of construction methods. Calculation of lateral earth pressures for the following cases of flexible retaining walls: a) Without anchors (cantilever walls) b) With single head anchor (fixed base & free base types) and c) With multiple anchors.
4. **ANCHORS DESIGN**
   Presentation of construction methods. Design methodology of anchors considering: anchor pullout, wedge failure, global slope stability failure and composite failure.
5. **DESIGN OF REINFORCED SOIL RETAINING WALLS USING GEOTEXTILES**
   Presentation of construction methods. Design methodology of the aforementioned retaining walls by Koerner and by Ingold, considering internal and total wall stability failures.

4. TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face to Face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Use of web based e-class platform</td></tr>
<tr><td>TEACHING METHODS
<i>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</i></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>26</td></tr>
<tr><td>Tutorials</td><td>13</td></tr>
<tr><td>Field work</td><td>10</td></tr>
<tr><td>Team work Project</td><td>34</td></tr>
<tr><td>Hours for private study</td><td>42</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td><i>125</i></td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>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</i></td><td>3. Assessment of individual assignments during the course term (40%)
4. Assessment of team project (60%)</td></tr>
</table>

Specifically-defined evaluation criteria are given, and if and where they are accessible to students.	

5. ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
- Related academic journals:

8. Course notes (digital form)
9. Braja M. Das, ”Principles of Foundation Engineering”, PWS Publishing, ITP, 1998
10. Budhu, M. (2010). *Soil mechanics and foundations* (No. Ed. 3). John Wiley & Sons.
11. Koerner R. M., “Designing with Geosynthetics - 6th Edition Vol. 1&2”, Xlibris, 2012

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF COURSE	UNDERGRADUATE		
COURSE CODE	CIV_8356A	**SEMESTER**	8th
COURSE TITLE	GEODESY		

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	2	5
Laboratory	2	
Field work	1	
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 knowledge
PREREQUISITE COURSES:	CIV_3803 /INTRODUCTION TO GEODESY or similar.
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1750/

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 design and construction of modern engineering projects and the study and management of natural hazards (fires, floods, etc.) require detailed characterization of the spatio-temporal evolution of geophysical phenomena (e.g., topography, land use, urban/forestry zones, etc.) using geodetic instruments (e.g., robotic total stations, laser scanners) and remote sensing observations. The course aims to familiarize students with basic concepts of Geodesy and Geoinformatics in the ever-evolving field of Civil Engineering, making use of new technologies and combining field measurements with remote sensing data for modern applications. Upon successful completion of the course the student will be able to:

(1) Organize and perform field work involving the use of modern Geodetic instruments.
(2) Process geospatial data with Geographic Information Systems (GIS).
(3) Combine field measurements with large databases to characterize geophysical phenomena at various spatio-temporal scales.
(4) Analyse and visualize spatio-temporal data using advanced Geostatistical methods and specialized software (e.g., AutoCAD, R/Rstudio, QGIS).
(5) Present the results of the coursework in a technical report.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Adapting to new situations
- Decision-making
- Working independently
- Team work
- Project planning and management
- Criticism and self-criticism
- Production of free, creative and inductive thinking

3.SYLLABUS

(1) Introduction to Geostatistics and methods of time series analysis of Geodetic observations.
(2) Basic Principles of Geodetic Surveying and Satellite Geodesy.
(3) Geographic Information Systems (GIS), analysis and visualization of spatio-temporal data using specialized software (QGIS).
(4) Cadastre and geospatial data management.
(5) Planning and conducting field measurements, processing and synthesis of measurements and evaluation of results.

4.TEACHING AND LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>(1) Lectures with visual and multimedia material and interactive communication with the students (questions and tests).
(2) Laboratory exercises (design, measurements, processing, presentation of results in the form of a technical report).
(3) Short comprehension exercises.
(4) Integrated field project.</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Support for the learning process through the e-class platform and various scientific and teaching resources available online.</td></tr>
<tr><td>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></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Interactive lectures</td><td>30</td></tr>
<tr><td>Field training and technical reports</td><td>60</td></tr>
<tr><td>Individual exercises</td><td>25</td></tr>
<tr><td>Integrated field project</td><td>10</td></tr>
<tr><td><i>Total number of hours for the Course (25 hours of work-load per ECTS credit)</i></td><td><i>125 hours (total student work-load)</i></td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i></td><td>Grading through a generalized weighted average that evaluates the student's performance in each component of the course (comprehension exercises, laboratory</td></tr>
</table>

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.*	exercises, technical reports, oral presentation/exam etc.).

5. ATTACHED BIBLIOGRAPHY

Notes on the e-class platform
Books selected through the EYDOXOS system (in alphabetical order):
Γεωδαισία ΙΙ: Τοπογραφικές Αποτυπώσεις -Χαράξεις
Σαββαΐδης Π., Υφαντής Ι, Δούκας Ι.
ISBN: 978-618-5105-93-8, Κωδικός Ευδόξου: **50662654**

8th SEMESTER – 3rd TRACK ELECTIVE COURSES

Students of the 3rd Track select one (1) elective course from the following list.

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	CIV_8460A	**SEMESTER**	8th or 10th
COURSE TITLE	COMPUTATIONAL HYDRAULICS		
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 and laboratory work	3	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, specialised general knowledge, skills development*	Specialised knowledge		
PREREQUISITE COURSES:	There are not prerequisites. The student must have adequate knowledge of Fluid Mechanics, Hydraulics and Hydrology.		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes		
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1513/		

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

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

By the end of the course, the student will be able to solve Hydraulic Engineering problems employing computational (numerical) methods in cases where:

1. The governing equations are algebraic but cannot be solved analytically (e.g. normal and critical depth in open channel flow).
2. The governing equations are ordinary differential equations (e.g. gradually varied flow in open channels, hydrologic routing through reservoirs, contaminant transport in well mixed systems).
3. The governing equations are partial differential equations (e.g. contaminant advection and diffusion – dispersion, flow through porous media, transient flow in open channels and closed conduits).
4. There is a need for special numerical technics (e.g. time series analysis for hydraulic or hydrologic data).

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

By the end of the course, the student will have developed the following skills:

1. Ability to analyze Hydraulic Engineering problems and determine governing equations.
2. Ability to determine / identify the suitable computational / numerical methodology for the solution of the problem and write the appropriate computer code.

3. SYLLABUS

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Additional material uploaded to e-class Use of internet searches for special topics.
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*	see table below
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*	Final exam 30% and projects 70%

Activity	***Semester workload***
Lectures (3 contact hours per week x 13 weeks)	39
Final examination (3 contact hours)	3
Hours for study by the student, preparation project assignments and writing of technical reports	83
Total number of hours for the Course (25 hours of work-load per ECTS credit)	***125 hours (total student work-load)***

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.*	

5. ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

1. Chadwick A. and J. Morfett, "Hydraulics in Civil Engineering," ALLEN & UNWIN, London, 1986.
2. Chaudry M. H., "Open – Channel Flow," Second Edition, Springer, New York, 2008.
3. Henderson F. M., "Open Channel Flow," Macmillan, New York, 1966.
4. Jain S. C., "Open – Channel Flow," Wiley, New York, 2001.
5. Vreugdenhil, C.B., Computational hydraulics: An introduction, Springer – Verlag, Berlin, 1989.
6. Wylie E. B. and V. L. Streeter, "Fluid Transients," Corrected ed., FEB Press, Ann Arbor, 1983.
7. White F. M., "Fluid Mechanics," 2nd Edition, McGraw – Hill, New York, 1986.

Greek

1. Δημητρακόπουλος Α., «Στοιχεία Υπολογιστικής Υδραυλικής : Πανεπιστημιακές Παραδόσεις,» Πανεπιστήμιο Πατρών, Πάτρα, 2015.
2. Λιακόπουλος Α., «Υδραυλική», 2η Έκδοση, Εκδόσεις Τζιόλα, Θεσαλλονίκη, 2014.
3. Νουτσόπουλος Γ., Γ. Χριστοδούλου και Τ. Παπαθανασιάδης, «Υδραυλική Ανοικτών Αγωγών», Fountas, Αθήνα, 2010.
4. Πρίνος Π., «Υδραυλική Κλειστών & Ανοικτών Αγωγών», Εκδόσεις Ζήτη, Θεσσαλονίκη, 2013.
5. Τερζίδης Γ. Α., «Εφαρμοσμένη Υδραυλική», Εκδόσεις Ζήτη, Θεσσαλονίκη, 1997.

- Related academic journals:

1. Journal of Hydraulic Engineering
2. Computers and Fluids
3. International Journal for Numerical Methods in Fluids

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	CIV_8461A	**SEMESTER**	8th or 10th
COURSE TITLE	HYDRAULICS OF ENERGY INFRASTRUCTURE		

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	3	5
Field work	1	
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 knowledge
PREREQUISITE COURSES:	There are no prerequisites. The student must have adequate knowledge of Fluid Mechanics, Hydraulics and Structural Engineering.
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
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*

Intended Learning Outcomes:

1. Familiarization with the basic types of hydraulic and marine structures for energy production and the principles of energy generation.

2. Fundamental principles of hydraulic design for these structures.

3. Knowledge and understanding of the processes related to the hydraulic design of energy production structures, such as fossil fuel power plants, dams, offshore/floating wind turbines, and tidal/wave energy devices.

4. Ability to use design tools (equations/models) for structural dimensioning.

5. Synthesis of the above and application in the preparation of a preliminary hydraulic design study.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

By the end of the course, the student will have developed the following skills:

1. Work independently
2. Team working
3. Design of infrastructure
4. Working in an interdisciplinary environment
5. Respect for the natural environment

3. SYLLABUS

1. Basic types of hydraulic and marine structures for energy infrastructure

2. Key economic aspects of each type and national/international trends

3. Fundamental principles of hydraulic design for cooling systems

4. Fundamental principles of hydraulic design for offshore wind turbines

5. Basic principles of wave energy generation and examples of hydraulic design for specific devices

6. Basic principles of tidal energy generation and examples of hydraulic design for specific installations

4. TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face-to-face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Additional material uploaded to e-class
Use of internet searches for special topics.</td></tr>
<tr><td>TEACHING METHODS
<i>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.</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></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures (3 contact hours per week x 13 weeks)</td><td>39</td></tr>
<tr><td>Preparation project assignment and writing of technical report</td><td>30</td></tr>
<tr><td>Hours for study by the student</td><td>56</td></tr>
<tr><td><i>Total number of hours for the Course (25 hours of work-load per ECTS credit)</i></td><td><i>125 hours (total student work-load)</i></td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i></td><td>I. Literature review on the feasibility of energy infrastructure</td></tr>
</table>

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.*	II. Comprehensive preliminary hydraulic design study for an energy infrastructure project (delivery of a group technical report) III. Development of an empirical or numerical model for calculating hydrodynamic loads on a marine renewable energy device IV. Written examination at the instructor's discretion, if the above are not satisfactorily covered V. Assessment criteria will be announced annually on eClass

5. ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

1. Multon, Bernard. Marine renewable energy handbook. John Wiley & Sons, 2013..
2. Zobaa, A.F. and Bansal, R.C. eds., 2011. Handbook of renewable energy technology. World Scientific.
3. DNV GL RP C-205 (2010) - ENVIRONMENTAL CONDITIONS AND ENVIRONMENTAL LOADS
4. Goda, Y., 2010. Random seas and design of maritime structures (Vol. 33). World Scientific Publishing Company.
5. Willi H. Hager, Anton J. Schleiss, Robert M. Boes Michael Pfister. Hydraulic Engineering of Dams. CRC Press
6. Pawitan, K.A., Dimakopoulos, A.S., Vicinanza, D., Allsop, W. and Bruce, T., 2019. A loading model for an OWC caisson based upon large-scale measurements. Coastal Engineering, 145, pp.1-20.

Greek

1. Τσόγκας, Χ.Ε. and Τσόγκα, Ε.Χ., 2000. Υδροδυναμικά έργα φράγματα.

- Related academic journals:

1. Renewable Energy
2. Journal of Fluids and structures
3. Ocean Engineering

COURCE OUTLINE

1. GENERAL

SCHOOL	ENGINEERIC		
DEPERTMENT	CIVIL ENGINEERING		
LEVEL	GRADUATE		
COURCE CODE	CIV_0560	**SEMESTER**	8th and 10th
ΤΙΤΛΟΣ ΜΑΘΗΜΑΤΟΣ	SOLID WASTE MANAGEMENT		

INDEPENDED 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 TEACHNIG HOURS**	**CREDIDS**
Lectures/exercises and Field Exercises	3+1	5

COURCE TYPE *general background, special background, specialised general knowledge, skills development*	Special background
PREREQUISITE COURCES:	None .
TEACHING and EXAMINATION LANGUAGE:	Greek
IS THE COURCE OFFERED TO ERASMUS STUDENTS	NO
COURCE WEBSTITE (URL)	https://eclass.upatras.gr/courses/CIV1874/

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*
Elective course of the 8th and 10th semesters of the 3rd Direction "Hydraulic Engineering - Environmental Engineering". The course aims include the understanding of the solid waste management system

throughout the stages of generation to the final disposal, which includes methods of processing, sorting, recycling and utilization. Upon successful completion of the course, the student will be able to understand the problems related to solid waste management, having a comprehensive knowledge of the entire system and will be able to provide solutions and proposals for upgrading existing or designing new solid waste management systems.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking

Search, analyze and synthesize data and information using the necessary technologies
- Individual Assignments
- Group Assignments

3. SYLLABUS

1. Solid waste concepts, definitions and legislation

Basic definitions, terminology. National and Community legislation. Solid waste categories. Subsystems

2. Production and composition of solid waste

Qualitative and quantitative characteristics. Sampling methods.

3. Collection, storage, transport and transshipment systems

Temporary storage systems. Bins, garbage trucks. Source separation. Upload. Calculation of transport costs

4. Mechanical processing

Separation methods, shredding, compactors. Recyclable material sorting centers

5. Thermal processing methods

Combustion, pyrolysis, gasification. Energy recovery.

6. Biological processing methods

Composting, anaerobic digestion, bi-drying.

7. Sites for Final Disposal of Solid Waste and Residues

Landfills (sanitary landfill sites of waste/ sanitary landfill sites of residues). Management of methane emissions and leachates.

8. Life Cycle Analysis and Environmental Impact

Data inventory and recording, data normalization, Impact assessment. Carbon and water footprint. Circular economy.

9. **Management of special and toxic solid waste**

Medical and hospital waste. Industrial and hazardous waste.

4. TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>In the classroom</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Support Learning through the e-class platform</td></tr>
<tr><td>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></td><td>
<table>
<tr><th><i>Δραστηριότητα</i></th><th><i>Φόρτος Εργασίας Εξαμήνου</i></th></tr>
<tr><td>Lectures</td><td>29</td></tr>
<tr><td>Exercises</td><td>10</td></tr>
<tr><td>Individual and group assignments</td><td>41</td></tr>
<tr><td>Individual homework</td><td>45</td></tr>
<tr><td><i>Course Total (25 h/credit)</i></td><td><i>125</i></td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<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</i></td><td>I. Written final Exam (70%) including:
- Multiple choice questions
- Problem solving
- Comparative evaluation of theory elements

II. Assignments (30%)</td></tr>
</table>

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.*	

5. SUGGESTED BIBLIOGRAPHY

- Suggested bibliography:

- Related academic journals:

1. Solid Waste Management and Engineering, D. Komilis (Giola Publications, 2023, ISBN: 978-618-221-023-9, BOOK CODE IN EYDOXOS: 122075545) (in Greek)
2. SOLID WASTE MANAGEMENT, A. Koungoulos, C. Emannouil (Giola Publications, 2021, ISBN: 978-960-418-869-7, BOOK CODE IN EYDOXOS: 94688996) (in Greek)
3. Solid Waste Management Manual, 2018, Tchobanoglous G. and Kreith, Giola Publications, ISBN: 978-960-418-285-5, BOOK CODE IN EYDOXOS: 77106824
4. Tutator ’s notes – e-class notes

COURSE OUTLINE

1.GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	CIV_8555A	**SEMESTER**	8th & 10TH
COURSE TITLE	AIR POLLUTION		

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 and Tutorials	3	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, specialised general knowledge, skills development*	Specialised general knowledge
PREREQUISITE COURSES:	There are no prerequisite courses. The students must have basic knowledge of Chemistry and Applied Mathematics.
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1619/

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*

It is an obligatory course under selection of both the 3rd direction "Hydraulic Engineering - Environmental Engineering" and 4th direction "Systems of Sustainable Transportation and Project Management" for the study of atmospheric pollution, diffusion-dispersion of pollutants and applied anti-pollution technologies.

The subject matter of the course aims at informing students about the basic properties of the atmosphere, the characteristics of air pollutants, the application of the Gauss model for predicting air pollution and the most usual anti-pollution technologies applied.

Upon successful completion of the course the student will be able to:

- Know general elements of air pollution as well as acid rain, stratospheric ozone depletion and greenhouse phenomena
- Know the atmospheric pollutants, their properties and their impact on humans and the environment, also taking into account the effect of meteorological parameters on the dispersion of pollutants
- Evaluates ambient air quality based on current quality standards
- Simulates the dispersion of air pollutants with Gauss-type models for emissions of point, linear and surface sources
- Apply the appropriate anti-pollution technology and propose an appropriate short or long-term abatement strategy for emission control and address air pollution by aerosol and gaseous pollutants.

Finally, the aim of the course is to acquire basic knowledge and skills so that qualified engineers can use them in their professional careers, either as consultants or as contractors / manufacturers of anti-pollution systems. In particular, at the end of this course the student will further develop the following skills:

- Ability to demonstrate knowledge and understanding of the essential physicochemical properties, concepts and mechanisms associated with atmospheric pollution
- Ability to apply this knowledge and understanding in the description, simulation and solution of unusual atmospheric pollution problems
- Ability to adopt and apply methods of anti-pollution technology to a variety of practical problems and studies, such as optimizing the siting of activities (industries, ports, airports), traffic and transport regulation, road positioning, etc.
- Ability to study, lifelong learning and continuing professional development
- Ability to use this knowledge to develop environmental impact assessment studies, as well as interdisciplinary cooperation on problems and studies of interscientific nature.

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	*Project planning and management*

data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

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

3.SYLLABUS

1. Introduction. Definitions, Components of atmospheric pollution (source categories, pollutants, atmosphere, dispersion - processes, recipients), Historical review
2. General Pollution Elements. Categories, Units of Measurement, Sources, Major and global impacts of air pollution (acid rain, dispersion of radioactive substances, Ozone layer damage, Greenhouse effect), International measurement bodies
3. Pollutant Properties and Impacts.
Particulate pollutants, Carbon monoxide, Sulfur oxides, Hydrocarbons, Nitrogen oxides, Secondary air pollutants and nitrogen monoxide, Photochemical oxidants
4. Air quality. General elements, Air quality criteria and standards, Emission standards
5. Meteorology and Pollution. Meteorological data (heat and atmospheric stability, barometric pressure, wind, absolute and relative humidity), Effects of meteorological parameters on the dispersion of pollutants, Periodicity and long-term evolution of air pollution
6. Transport and Diffusion of Pollutants. Basic concepts, Maximum mixing height, Simulation of dispersion of atmospheric pollutants (emission of pollutants from point, linear and surface sources, contribution of point, linear or area sources)
7. Anti-pollution Technology. Physical mechanisms, Chimneys design, Control of source pollution (devices for particulate pollutants, devices for gas pollutants)
8. Air Pollution Abatement Strategy. General Elements, Selection of an optimal strategy for long-term control of air pollution
9. Measurements and Analysis of Air Quality. General principles and Sampling, Air sampling devices, particulate sampling devices, site selection methods and sampling time, Methods for air quality determination, Standard methods for determining the air quality, monitoring network and teletransport of results.

4.TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>In the classroom</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Support Learning through the e-class platform</td></tr>
<tr><td>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></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>39</td></tr>
<tr><td>Tutorial exercises for the consolidation of the concepts and understanding the implementation of the Gauss model and the design of anti-pollution devices</td><td>6</td></tr>
<tr><td>Team work tutoring</td><td>6</td></tr>
<tr><td>Training Visit - Demonstration of Station of Air Pollutants Measurement / Individual Exercise Works</td><td>3</td></tr>
<tr><td>Independent home work of exercises</td><td>30</td></tr>
<tr><td>Individual work at home of theoretical matter of the course</td><td>41</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td><i>Course total</i></td><td><i>125</i></td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires,</i></td><td>Written final exam (100%) including:
Part A’ – Theory 33% (judgment questions)
Part B’ – Problems 67% (two problems must be solved applying the Gauss model or/and designing anti-pollution systems).</td></tr>
</table>

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.*	

5.ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Related academic journals:

3. "Air Pollution", P.C. Yannopoulos, Patras, 2018, p. 200. (Notes in Greek).
4. "Air Pollution : Effects, Control and Alternative Technologies", I.B. Gentekakis, 2nd edition, Cleidarithmos Publications, Athens, 2010, p. 784. Book Code in Eudoxos: 9642 (in Greek).
5. “Air Pollution with Meteorology Elements”, M. Lazaridis, 2nd edition, Tziola Publications, Athens, 2010, p. 640. Book Code in Eudoxos: 18548841.

8th SEMESTER – 4th TRACK ELECTIVE COURSES

Students of the 4th Track select one (1) elective course from the following list.

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	CIV_0683A	**SEMESTER**	8th or 10th
COURSE TITLE	CONSTRUCTION PROJECT ORGANIZATION AND MANAGEMENT		

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	3	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, specialised general knowledge, skills development*	Specialised general knowledge, skills development
PREREQUISITE COURSES:	There are no prerequisite courses
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1528/

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

28. *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
29. *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning*

and Appendix B

30. *Guidelines for writing Learning Outcomes*

By the end of this course, the student will be able to:

- Select proper location and determine efficient layout of construction worksite.
- Organize the required facilities, machinery, and project team.
- Determine and evaluate work safety measures.
- Organize construction work and project progress tracking.
- Address quality assurance and environmental impact issues.
- Apply information and communication technologies (ICT) in managing construction projects.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

By the end of this course, the student will have developed the following general abilities (from the list above):

- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Decision making
- Project planning and management
- Production of free, creative and inductive thinking

3. SYLLABUS

- i. Introduction to construction and construction site organization and management
- ii. Construction site location selection and layout planning, facility selection and configuration
- iii. Machinery and equipment selection and management
- iv. Organizational structure of project team, human resource management
- v. Material and procurement management, construction warehouse organization, inventory analysis
- vi. Quality assurance and management in construction
- vii. Construction safety and health
- viii. Protection and restoration of the construction site environment
- ix. Construction law principles
- x. Risk management in construction
- xi. Information and communication technologies in construction
- xii. Lean construction principles

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Lectures face to face
USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES *Use of ICT in teaching, laboratory education, communication with students*	PowerPoint presentations as part of the lectures, seminars in construction organization and control software (ACE ERP eCM), systematic use of eclass platform for course announcements and material handling, etc.
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-*	see table below

Activity	Semester workload
Lectures	39
Study and analysis of bibliography	40
Project	32
Essay writing	14
Total number of hours for the course (25 hours of work-load per ECTS credit)	***125***

directed study according to the principles of the ECTS	
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 Methods of evaluation: Final exam (60%) or (alternatively) Mid-term exam (30%) and final-term exam (30%). Homework assignments (40%). Evaluation criteria are accessible to students in: https://eclass.upatras.gr/courses/CIV1528/

5. ATTACHED BIBLIOGRAPHY

- *Suggested bibliography:*

- A. Kastrinakis, “Construction Management of Civil Engineering Projects”, Papasotiriou Editions, 2002 (in Greek)

- *Related academic journals:*

- ASCE Journal of Construction Engineering and Management
- ASCE Journal of Infrastructure Systems
- Automation in Construction
- Information Technology in Construction (ITcon)
- Computer-Aided Civil and Infrastructure Engineering

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF COURSE	UNDERGRADUATE		
COURSE CODE	CIV_8658A	**SEMESTER OF STUDIES**	8th or 10th
COURSE TITLE	SMART CITIES, INFRASTRUCTURE AND TRANSPORTATION SYSTEMS		

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, seminars and laboratory work	3	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, specialised general knowledge, skills development*	Field of Science
PREREQUISITE COURSES:	Course in transportation/energy analysis or infrastructures/buildings or concurrent
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek. Teaching may be performed in English if foreign students attend the course
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
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

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

33. Guidelines for writing Learning Outcomes

By the end of this course the student will be able to:

- Know general elements of intelligent transportation systems or energy systems or infrastructure
- Apply the principles of smart cities to the design of transportation systems or energy systems or infrastructure
- Apply the methods of smart cities to data collection and estimation
- Evaluate smart cities systems with respect to dynamic performance functions

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

By the end of this course the student will have developed the following skills (general abilities):

- Ability to demonstrate knowledge and understanding of essential facts, concepts, principles and theories relative to the design of innovative smart cities systems.
- Ability to apply such knowledge and understanding to the description, simulation and solution of qualitative and quantitative problems of an unfamiliar nature.
- Ability to adapt and apply relevant methodology to the solution of unfamiliar problems in intelligent transport, energy and infrastructure, risk assessment and effectiveness of innovative smart cities systems.
- Ability to apply skills for continuing professional development.
- Ability to use the above knowledge in synthetic studies and in interacting with others in creating innovative solutions of complex problems and in multidisciplinary professional studies.

Generally, by the end of this course the student will have developed the following general abilities:

Collecting and integrating facts and information, and using the appropriate technologies
Adaptation to new situations
Decision making
Independent work

Group work
Promotion of free, creative, inductive and innovative thinking
Work design and management

3. SYLLABUS

Introduction to the sustainable city concept. Introduction to the smart city concept. Road map. Phases of development. Assessment indices. Key performance indicators. Examples of systems in smart cities. Intelligent systems algorithms and methods for smart cities.

4. TEACHING AND LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>In class. Lecture, problem-solving seminar.
Face-to-face. Collaborative problem research and solution in groups of 5-8.</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>- Specialised software for smart cities systems design such as intelligent transportation systems, energy systems and infrastructure.
- Learning support through electronic platform e-class</td></tr>
<tr><td>TEACHING METHODS
<i>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.</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></td><td>
<table>
<tr><th><i>Δραστηριότητα</i></th><th><i>Φόρτος Εργασίας Εξαμήνου</i></th></tr>
<tr><td>Lectures</td><td>35</td></tr>
<tr><td>Practical exercises that focus on the application of methods and the analysis of case studies in small groups</td><td>10</td></tr>
<tr><td>Group project on case study.
Group project on systems design.</td><td>35</td></tr>
<tr><td>Educational visit/ individual work exercises</td><td>10</td></tr>
<tr><td>Independent study</td><td>35</td></tr>
<tr><td><i>Total number of hours for the Course (25 hours of work-load per ECTS credit)</i></td><td><i>125</i></td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<i>Language of evaluation, methods of evaluation,</i></td><td>+ Three written tests (47.5% of total grade)
+ Final project report (47.5%)
+ Class participation (5%)
All tests and project must be passed. Passing grade for each is 60 out of 100. Grade scaling is used.</td></tr>
</table>

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.*	

5. ATTACHED BIBLIOGRAPHY

Stephanedes, Y.J. (2004). Intelligent Transportation Systems. Chapter 86, The Engineering Handbook, 2nd Edition, Ed. R. C. Dorf. CRC Press, Boca Raton, Florida.

Cocchia, A. (2014) “Smart and Digital City: A Systematic Literature Review” *Smart city* (2014): 13–43.

-Realated academic journals:

Transportation Research Journal, Pergamon.

COURSE OUTLINE

1.GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	CIV_8659A	**SEMESTER**	8th and 10th
COURSE TITLE	OPTIMIZATION METHODS AND APPLICATIONS		

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	3	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, specialised general knowledge, skills development*	Specialised general knowledge, skills development
PREREQUISITE COURSES:	There are no prerequisite courses
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
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*

Upon successful completion of the course, the student will be able to:

- Design and develop mathematical and computational optimization models for a variety of applications in the fields of civil engineering, transportation, project and operations management, and operations research.
- Implement the optimization models in software to produce results.
- Apply and comparatively evaluate alternative algorithms and optimization tools in reference to the problem at hand.
- Develop a solution framework to support decisions for the problem under consideration.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

Upon successful completion of the course, the student will have developed the following general abilities (from the list above):

- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Decision making
- Working independently
- Team work
- Project planning and management
- Production of free, creative and inductive thinking

3.SYLLABUS

1. Principles of mathematical programming and operations research
2. Linear & integer programming, Simplex method.
3. Multi-objective, multi-criteria optimization
4. Meta-heuristic optimization methods - evolutionary algorithms.
5. Analytic hierarchy process.
6. Assignment applications.
7. Routing applications.
8. Resource allocation applications.
9. Development and implementation of optimization software.
10. Laboratory exercise.

4.TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Lectures face to face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Presentations (power point) as part of the lectures, seminars-training in the use of software, software development and laboratory exercises, systematic use of the eclass platform for information and distribution of material to students, etc.</td></tr>
<tr><td>TEACHING METHODS
<i>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</i></td><td><table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures</td><td>39</td></tr>
<tr><td>Study and analysis of bibliography</td><td>40</td></tr>
<tr><td>Project</td><td>32</td></tr>
<tr><td>Essay writing</td><td>14</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td><i>Total number of hours for the course (25 hours of work-load per ECTS credit)</i></td><td><i>125</i></td></tr>
</table></td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i></td><td>Language of evaluation: Greek

Methods of evaluation:
1) Final exam (60%) or (alternatively)</td></tr>
</table>

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.*	Mid-term exam (30%) and final-term exam (30%). 2) Homework assignments (40%). Evaluation criteria are accessible to students in the eclass platform:

5.ATTACHED BIBLIOGRAPHY

- *Suggested bibliography:*

- M. Karlaftis, N. Lagaros, "Operational Research and Optimization for Engineers", Symmetria Publications, 2010 (in Greek).
- P. Ypsilantis, "Operational Research", Propompos Publications, 2015 (in Greek).

- *Related academic journals:*

- Engineering Optimization
- Applied Soft Computing
- Applied Intelligence
- Advances in Engineering Software
- Construction Engineering and Management
- Computing in Civil Engineering

9th SEMESTER - 1st TRACK ELECTIVE COURSES

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	CIV_9263A	**SEMESTER**	9th
COURSE TITLE	REPAIR AND STRENGTHENING OF REINFORCED CONCRETE STRUCTURES		

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 + laboratory work	3+0	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, specialised general knowledge, skills development*	Field of Science
PREREQUISITE COURSES:	There are no prerequisite courses. Students must have at least a basic knowledge of the Engineering Mechanics-Statics, Mechanics of Materials, and Reinforced Concrete courses
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1894/

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*

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

At the end of the course, the student will:

1. Recognize the pathology of structures and the damage in reinforced concrete structural members.
2. Know the basic methods for non-destructive and laboratory testing of materials and structural members.
3. Know and select appropriate strategies and methods for structural interventions.
4. Know the technologies and materials for structural interventions.
5. Know the methods of modeling and analysis for existing structures.
6. Design retrofitted structural members according to different intervention methods.
7. Know the basic principles for the combined energy/seismic retrofitting of existing buildings.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment

Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……

Search for, analysis and synthesis of data and information, with the use of the necessary technology, Decision-making , Working independently, Teamwork, Project planning and management, Respect for the natural environment, Production of free, creative and inductive thinking.

3. SYLLABUS

1. Pathology of Existing Structures
Introduction, structural deficiencies and damage in reinforced concrete structures.

2. Structural Assessment
General, knowledge levels, material properties, partial safety factors on resistance models. In-situ and laboratory testing.

3. Structural Intervention Technologies and Materials
Introduction, structural intervention technologies and materials, selection criteria.

4. Basis for Structural Assessment and for the Design of the Retrofitting
Performance requirements, compliance criteria, verification rules.

5. Modeling and Structural Analysis
General, modeling, review of methods for analysis.

6. Verification of Limit States and Resistance Models for Structural Interventions
General for the verification of limit states, resistance models for assessment, verification of limit states at member level, resistance models for retrofitting.

7. Energy and Combined Energy/Seismic Retrofitting of Existing Buildings
Energy retrofitting, combined energy/seismic retrofitting, analysis of methods for combined retrofitting.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of the electronic platform e-class. Powerpoint presentations. Use of specialized software (Seismobuild) for the assessment and redesign of existing reinforced concrete buildings.
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.*	see table below

Activity	***Semester workload***
Lectures	39
Team Project	36
Homework assignments (individual)	15
Self-study	36
Total number of hours for the Course (25 hours of work-load per ECTS credit)	***125 hours (total student work-load)***

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	
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.*	Homework assignments (20%). Team project (20%). Final written exam (60%).

5. ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

1. Triantafillou, T. C. (2025), "Retrofitting of Existing Reinforced Concrete Structures", University of Patras Class Notes (in Greek).
2. Greek Retrofitting Code of Structural Interventions, 3rd Edition, 2022.
3. FprEN 1998-3 (2025) "*Eurocode 8 – Design of Structures for Earthquake Resistance – Part 3: Assessment and Retrofitting of Buildings and Bridges".* CEN/TC250.
4. *fib* Bulletin 103 (2022), "Guide for Strengthening of Concrete Structures", International Federation for Structural Concrete.
5. Dritsos, S. E. (2025) "Repair and Strengthening of Reinforced Concrete Structures", University of Patras Class Notes (in Greek).

- Related academic journals:

COURSE OUTLINE

1.GENERAL

SCHOOL	ENGINEERING		
DEPARTMENT	CIVIL ENGINEERING		
LEVEL OF COURSE	UNDERGRADUATE		
COURSE CODE	CIV_8262A	**SEMESTER OF STUDIES**	9th
COURSE TITLE	PRESTRESSED CONCRETE		
INDEPENDENT TEACHING ACTIVITIES *σε περίπτωση που οι πιστωτικές μονάδες απονέμονται σε διακριτά μέρη του μαθήματος π.χ. Διαλέξεις, Εργαστηριακές Ασκήσεις κ.λπ. Αν οι πιστωτικές μονάδες απονέμονται ενιαία για το σύνολο του μαθήματος αναγράψτε τις εβδομαδιαίες ώρες διδασκαλίας και το σύνολο των πιστωτικών μονάδων*		**TEACHING HOURS PER WEEK**	**ECTS CREDITS**
Lectures		3	5
Προσθέστε σειρές αν χρειαστεί. Η οργάνωση διδασκαλίας και οι διδακτικές μέθοδοι που χρησιμοποιούνται περιγράφονται αναλυτικά στο 4.			
COURSE TYPE *Υποβάθρου , Γενικών Γνώσεων, Επιστημονικής Περιοχής, Ανάπτυξης Δεξιοτήτων*	Field of Science		
PREREQUISITE COURSES:	NO -working knowledge of Mechanics of materials, Structural analysis and Design of reinforced concrete structures, suffice.		
TEACHING AND ASSESSMENT LANGUAGE:	Greek		
THE COURSE IS OFFERED TO ERASMUS STUDENTS	NO		
COURSE WEBPAGE (URL)	https://eclass.upatras.gr/courses/ CIV1508/		

2.LEARNING OUTCOMES

Leraning outcomes

Περιγράφονται τα μαθησιακά αποτελέσματα του μαθήματος οι συγκεκριμένες γνώσεις, δεξιότητες και ικανότητες καταλλήλου επιπέδου που θα αποκτήσουν οι φοιτητές μετά την επιτυχή ολοκλήρωση του μαθήματος.

Συμβουλευτείτε το Παράρτημα Α (ξεχωριστό αρχείο στο e-mail)

- *Περιγραφή του Επιπέδου των Μαθησιακών Αποτελεσμάτων για κάθε ένα κύκλο σπουδών σύμφωνα με Πλαίσιο Προσόντων του Ευρωπαϊκού Χώρου Ανώτατης Εκπαίδευσης*
- *Περιγραφικοί Δείκτες Επιπέδων 6, 7 & 8 του Ευρωπαϊκού Πλαισίου Προσόντων*

Διά Βίου Μάθησης
και Παράρτημα Β
- *Περιληπτικός Οδηγός συγγραφής Μαθησιακών Αποτελεσμάτων*

By the end of this course the student will have knowledge of:

1. the role and objectives of pre- and post-tensioning
2. the materials and requirements for the selection of the post-tensioning system
3. the methods for calculating action effects, defining the tendon profile and determining pre-tension losses
4. the calculation of internal actions in isostatic and indeterminate prestressed structures
5. the methodology of design of prestressed structures in the ultimate limit states of flexure and shear
6. the implementation of the serviceability limit states and the implementation of the relevant Code provisions

General Abilities

Λαμβάνοντας υπόψη τις γενικές ικανότητες που πρέπει να έχει αποκτήσει ο πτυχιούχος (όπως αυτές αναγράφονται στο Παράρτημα Διπλώματος και παρατίθενται ακολούθως) σε ποια / ποιες από αυτές αποσκοπεί το μάθημα;.

Αναζήτηση, ανάλυση και σύνθεση δεδομένων και πληροφοριών, με τη χρήση και των απαραίτητων τεχνολογιών
Προσαρμογή σε νέες καταστάσεις
Λήψη αποφάσεων
Αυτόνομη εργασία
Ομαδική εργασία
Εργασία σε διεθνές περιβάλλον
Εργασία σε διεπιστημονικό περιβάλλον
Παράγωγή νέων ερευνητικών ιδεών
Σχεδιασμός και διαχείριση έργων
Σεβασμός στη διαφορετικότητα και στην πολυπολιτισμικότητα
Σεβασμός στο φυσικό περιβάλλον
Επίδειξη κοινωνικής, επαγγελματικής και ηθικής υπευθυνότητας και ευαισθησίας σε θέματα φύλου
Άσκηση κριτικής και αυτοκριτικής
Προαγωγή της ελεύθερης, δημιουργικής και επαγωγικής σκέψης

By the end of this course the student will, furthermore, have developed the following skills (general abilities):

5. Ability to demonstrate knowledge and understanding of the basic behaviour of prestressed structures, the design principles for the tendon profile and determination of prestress losses
6. Determine the action effects for prestressed concrete structures
7. Capacity to design prestressed concrete elements at the ultimate limit state for flexure, shear and torsion
8. Ability to check prestressed concrete elements for compliance to the serviceability limit states
9. Use the serviceability limits for the preliminary design of prestressed concrete structures

3. SYLLABUS

1. Introduction, basic concepts of pre- and post-tensioning,
2. The materials (high-strength concrete and prestressed steels,
3. Implementation of pre-stressing, pre-stressing systems,
4. Analysis of statically indeterminate prestressed concrete structures,

5. Posttensioning force reduction (friction losses) and pretensioning losses (instantaneous and time-dependent),
6. Dimensioning of prestressed concrete structures at the ultimate limit states,
7. Synthesis of prestressed concrete structures, geometric properties of cross section and tendon profile and determination of pre-tensioning force,
8. Calculation and detailing of tendon anchorage.
9. Examples and applications.

4.TEACHING AND LEARNING METHODS - ASSESSMENT

TEACHING METHOD *Πρόσωπο με πρόσωπο, Εξ αποστάσεως εκπαίδευση κ.λπ.*	Lectures
USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES *Χρήση Τ.Π.Ε. στη Διδασκαλία, στην Εργαστηριακή Εκπαίδευση, στην Επικοινωνία με τους φοιτητές*	The lectures content of the course are uploaded open-access on the e-learning platform (e-class)
TEACHING ORGANIZATION *Περιγράφονται αναλυτικά ο τρόπος και μέθοδοι διδασκαλίας.* *Διαλέξεις, Σεμινάρια, Εργαστηριακή Άσκηση, Άσκηση Πεδίου, Μελέτη & ανάλυση βιβλιογραφίας, Φροντιστήριο, Πρακτική (Τοποθέτηση), Κλινική Άσκηση, Καλλιτεχνικό Εργαστήριο, Διαδραστική διδασκαλία, Εκπαιδευτικές επισκέψεις, Εκπόνηση μελέτης (project), Συγγραφή εργασίας / εργασιών, Καλλιτεχνική δημιουργία, κ.λπ.* *Αναγράφονται οι ώρες μελέτης του φοιτητή για κάθε μαθησιακή δραστηριότητα καθώς και οι ώρες μη καθοδηγούμενης μελέτης ώστε ο συνολικός φόρτος εργασίας σε επίπεδο εξαμήνου να αντιστοιχεί στα standards του ECTS*	see table below
STUDENT ASSESSEMNT *Περιγραφή της διαδικασίας αξιολόγησης*	Final exam

Δραστηριότητα	***Φόρτος Εργασίας Εξαμήνου***
Lectures	60
Homeworks	35
Final examination	3
Hours for private study of the students	52
Total number of hours for the Course (25 hours of work-load per ECTS credit)	*150 hours*

Γλώσσα Αξιολόγησης, Μέθοδοι αξιολόγησης, Διαμορφωτική ή Συμπερασματική, Δοκιμασία Πολλαπλής Επιλογής, Ερωτήσεις Σύντομης Απάντησης, Ερωτήσεις Ανάπτυξης Δοκιμίων, Επίλυση Προβλημάτων, Γραπτή Εργασία, Έκθεση / Αναφορά, Προφορική Εξέταση, Δημόσια Παρουσίαση, Εργαστηριακή Εργασία, Κλινική Εξέταση Ασθενούς, Καλλιτεχνική Ερμηνεία, Άλλη / Άλλες *Αναφέρονται ρητά προσδιορισμένα κριτήρια αξιολόγησης και εάν και που είναι προσβάσιμα από τους φοιτητές;*	

5.RECOMMENDED LITERATURE

5. M.N. Fardis, “Prestressed concrete (in Greek)”. 3rd Edition, University of Patras Publishing House 2001
6. Lin, T.Y., and Burns, N. "Prestressed Concrete Structures", John Wiley and Sons, New York, N.Y., 1981.
7. Nilson, A. "Design of Prestressed Concrete", John Wiley & Sons, New York, N.Y., 1978.
8. CEN EN 1992-1-1: "Eurocode No.2. Design of Concrete Structures - Part 1: General Rules and Rules for Buildings", 2004

COURSE OUTLINE

1. GENERAL

<table>
<tr><td>SCHOOL</td><td colspan="4">POLYTECHNIC</td></tr>
<tr><td>DEPARTMENT</td><td colspan="4">CIVIL ENGINEERING</td></tr>
<tr><td>LEVEL OF COURSE</td><td colspan="4">UNDERGRADUATE</td></tr>
<tr><td>COURSE CODE</td><td>CIV_9264A</td><td>SEMESTER OF STUDIES</td><td colspan="2">9o</td></tr>
<tr><td>COURSE TITLE</td><td colspan="4">FIRE ENGINEERING AND FIRE PROTECTION</td></tr>
<tr><td colspan="3">INDEPENDENT TEACHING ACTIVITIES
<i>σε περίπτωση που οι πιστωτικές μονάδες απονέμονται σε διακριτά μέρη του μαθήματος π.χ. Διαλέξεις, Εργαστηριακές Ασκήσεις κ.λπ. Αν οι πιστωτικές μονάδες απονέμονται ενιαία για το σύνολο του μαθήματος αναγράψτε τις εβδομαδιαίες ώρες διδασκαλίας και το σύνολο των πιστωτικών μονάδων</i></td><td>TEACHING HOURS PER WEEK</td><td>ECTS CREDITS</td></tr>
<tr><td colspan="3"></td><td>3</td><td>5</td></tr>
<tr><td colspan="3"><i>Προσθέστε σειρές αν χρειαστεί. Η οργάνωση διδασκαλίας και οι διδακτικές μέθοδοι που χρησιμοποιούνται περιγράφονται αναλυτικά στο 4.</i></td><td></td><td></td></tr>
<tr><td>COURSE TYPE
<i>Υποβάθρου , Γενικών Γνώσεων, Επιστημονικής Περιοχής, Ανάπτυξης Δεξιοτήτων</i></td><td colspan="4">Scientific area</td></tr>
<tr><td>PREREQUISITE COURSES:</td><td colspan="4">Building construction</td></tr>
<tr><td>TEACHING AND ASSESSMENT LANGUAGE:</td><td colspan="4">Greek (Lectures, exams)
English (exams only)</td></tr>
<tr><td>THE COURSE IS OFFERED TO ERASMUS STUDENTS</td><td colspan="4">Yes (in english)</td></tr>
<tr><td>COURSE WEBPAGE (URL)</td><td colspan="4"></td></tr>
</table>

2. LEARNING OUTCOMES

Leraning outcomes

Περιγράφονται τα μαθησιακά αποτελέσματα του μαθήματος οι συγκεκριμένες γνώσεις, δεξιότητες και ικανότητες καταλλήλου επιπέδου που θα αποκτήσουν οι φοιτητές μετά την επιτυχή ολοκλήρωση του μαθήματος.

Συμβουλευτείτε το Παράρτημα Α (ξεχωριστό αρχείο στο e-mail)

- *Περιγραφή του Επιπέδου των Μαθησιακών Αποτελεσμάτων για κάθε ένα κύκλο σπουδών σύμφωνα με Πλαίσιο Προσόντων του Ευρωπαϊκού Χώρου Ανώτατης Εκπαίδευσης*

- *Περιγραφικοί Δείκτες Επιπέδων 6, 7 & 8 του Ευρωπαϊκού Πλαισίου Προσόντων Διά Βίου Μάθησης*

και Παράρτημα Β

- *Περιληπτικός Οδηγός συγγραφής Μαθησιακών Αποτελεσμάτων*

The course covers the scientific domain of fire engineering and fire protection. The course objective is to introduce the students to the design principles of fire protection of buildings and infrastructures. The basic principles of the behaviour of structures under fire conditions and the structural fire design of structural members and systems. Passive and active fire protection systems design are considered including the growth and spread of fire, compartmentation, fire resistance of structural elements and systems etc with attention to classification (products, materials and systems). The course distinguishes in prescriptive design and performance based design with focus on understanding the philosophy of design based on codes and empirical and scientific evidence.

After completion of the course the student will be able to:

- Understand the basics of fire engineering and fire protection
- Understand the impact of fires on structures
- To be familiar with Eurocode structural fire parts
- To be familiar with the European and internation standards for selection and classification of materials and systems
- To distinguish between passive and active fire protection design
- To understand the design philosophy that is covered by the Greek fire code and other international standards
- To get familiar with and use the Greek fire code for normal buildings

General Abilities

Λαμβάνοντας υπόψη τις γενικές ικανότητες που πρέπει να έχει αποκτήσει ο πτυχιούχος (όπως αυτές αναγράφονται στο Παράρτημα Διπλώματος και παρατίθενται ακολούθως) σε ποια / ποιες από αυτές αποσκοπεί το μάθημα;.

Αναζήτηση, ανάλυση και σύνθεση δεδομένων και πληροφοριών, με τη χρήση και των απαραίτητων τεχνολογιών
Προσαρμογή σε νέες καταστάσεις
Λήψη αποφάσεων
Αυτόνομη εργασία
Ομαδική εργασία
Εργασία σε διεθνές περιβάλλον
Εργασία σε διεπιστημονικό περιβάλλον
Παράγωγή νέων ερευνητικών ιδεών
Σχεδιασμός και διαχείριση έργων
Σεβασμός στη διαφορετικότητα και στην πολυπολιτισμικότητα
Σεβασμός στο φυσικό περιβάλλον
Επίδειξη κοινωνικής, επαγγελματικής και ηθικής υπευθυνότητας και ευαισθησίας σε θέματα φύλου
Άσκηση κριτικής και αυτοκριτικής
Προαγωγή της ελεύθερης, δημιουργικής και επαγωγικής σκέψης

Επιλέξτε από τα προηγούμενα

3. COURSE CONTENT

1. *Safety of structures against fire and performance criteria*
2. *Fire dynamics - Fire growth and spread of fire*
3. *The ISO834 fire*

4. *Material properties (concrete, steel, wood, masonry)*
5. *Impact of fires on structures (spalling, thermal strains and stresses)*
6. *Design of steel and concrete structural members against fire based on the Eurocodes*
7. *Passive fire protection systems design (means of escape, smoke ventilation, fire resistance, facades)*
8. *Active fire protection systems design (detection systems, alarm systems, suppression systems)*
9. Reaction to fire and fire resistance classification systems

4. TEACHING AND LEARNING METHODS - ASSESSMENT

<table>
<tr><td>TEACHING METHOD
<i>Πρόσωπο με πρόσωπο, Εξ αποστάσεως εκπαίδευση κ.λπ.</i></td><td>Lectures in the classroom, support via power point slides</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES
<i>Χρήση Τ.Π.Ε. στη Διδασκαλία, στην Εργαστηριακή Εκπαίδευση, στην Επικοινωνία με τους φοιτητές</i></td><td>Learning support via the e-class platform.</td></tr>
<tr><td>TEACHING ORGANIZATION
<i>Περιγράφονται αναλυτικά ο τρόπος και μέθοδοι διδασκαλίας.
Διαλέξεις, Σεμινάρια, Εργαστηριακή Άσκηση, Άσκηση Πεδίου, Μελέτη & ανάλυση βιβλιογραφίας, Φροντιστήριο, Πρακτική (Τοποθέτηση), Κλινική Άσκηση, Καλλιτεχνικό Εργαστήριο, Διαδραστική διδασκαλία, Εκπαιδευτικές επισκέψεις, Εκπόνηση μελέτης (project), Συγγραφή εργασίας / εργασιών, Καλλιτεχνική δημιουργία, κ.λπ.

Αναγράφονται οι ώρες μελέτης του φοιτητή για κάθε μαθησιακή δραστηριότητα καθώς και οι ώρες μη καθοδηγούμενης μελέτης ώστε ο συνολικός φόρτος εργασίας σε επίπεδο εξαμήνου να αντιστοιχεί στα standards του ECTS</i></td><td>
<table>
<tr><th><i>Δραστηριότητα</i></th><th><i>Φόρτος Εργασίας Εξαμήνου</i></th></tr>
<tr><td>Lectures</td><td>50</td></tr>
<tr><td>Team coursework (5 students)</td><td>35</td></tr>
<tr><td>Coursework correction and student support</td><td>15</td></tr>
<tr><td><i>Total number of hours for the Course
(25 hours of work-load per ECTS credit)</i></td><td><i>100</i></td></tr>
</table>
</td></tr>
<tr><td>STUDENT ASSESSEMNT</td><td>1. Written exams (70%) including:</td></tr>
</table>

Περιγραφή της διαδικασίας αξιολόγησης *Γλώσσα Αξιολόγησης, Μέθοδοι αξιολόγησης, Διαμορφωτική ή Συμπερασματική, Δοκιμασία Πολλαπλής Επιλογής, Ερωτήσεις Σύντομης Απάντησης, Ερωτήσεις Ανάπτυξης Δοκιμίων, Επίλυση Προβλημάτων, Γραπτή Εργασία, Έκθεση / Αναφορά, Προφορική Εξέταση, Δημόσια Παρουσίαση, Εργαστηριακή Εργασία, Κλινική Εξέταση Ασθενούς, Καλλιτεχνική Ερμηνεία, Άλλη / Άλλες* *Αναφέρονται ρητά προσδιορισμένα κριτήρια αξιολόγησης και εάν και που είναι προσβάσιμα από τους φοιτητές;*	- multiple choice questions, theory questions - fire safety design problems and their solution 2. Coursework (30%)

5. RECOMMENDED LITERATURE

EN1991-1-2
EN1992-1-2
EN1993-1-2
EN1994-1-2
EN1995-1-2
EN1996-1-2
Drysdale, D. (2011). An introduction to fire dynamics. John wiley & sons.

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF COURSE	UNDERGRADUATE		
COURSE CODE	CIV_0276A	**SEMESTER OF STUDIES**	9th
COURSE TITLE	DESIGN OF ENERGY EFFICIENT BUILDINGS		

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, seminars	3	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, specialised general knowledge, skills development*	Scientific field: energy-based design of buildings
PREREQUISITE COURSES:	No prerequisite courses.
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1735/

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

1. *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
2. *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for*

Lifelong Learning and Appendix B
3. Guidelines for writing Learning Outcomes

By the end of this course the student will be able to:

1. Understand the thermal function of buildings and the importance of energy efficiency of buildings
2. Comprehend the available design tools and the relevant codes
3. Determine efficient buildings configuration in terms of energy parameters, use relevant software, make best use of available materials for the design of energy-efficient buildings
4. Select appropriate methods of intervention for increasing the energy efficiency of conventional, energy-deficient 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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

By the end of this course the student will, furthermore, have developed the following abilities:

1. Perform a basic design of energy-efficient buildings.
2. Work in an inter-disciplinary environment
3. Perform a*utonomous (Independent) work*
4. Participate in g*roup work*

3. SYLLABUS

1. Introduction to thermodynamics: heat treansfer, (thermal resistance, conductivity, etc.), Building thermal equilibrium – temperature bridges
2. The role of energy design: climatic parameters, the building-skin, thermal losses, solar radiation and building orientation, active/passive energy systems, European directive for the energy efficiency of buildings, modern methods for the thermal-response of buildings
3. Thermal comfort: calculation-design for thermal comfort

4. Cooling of buildings: conventional and bioclimatic methods, thermal insulation and passive systems for heating: materials, calculations. Passive measures for cooling.
5. Upgdrading the energy efficiency of existing buildings.

4. TEACHING AND LEARNING METHODS - ASSESSMENT

DELIVERY *Face-to-face, Distance learning, etc.*	Lectures, seminars
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of e-class platform
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*	see workload table below
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure*	Final exam (100%): solve problems in energy-design of buildings.

Activity	***Semester workload***
Lectures (3 hours per week)	39
Seminars (1 conduct hour per week x 13 Practical exercises in class – use of specialized software	15
Final examination (3 conduct hors for Synthetic Organic Chemistry)	3
Hours for private study of the student and preparation of home-works (3 per semester), for Synthetic Organic Chemistry, and reports, for the Laboratory, and preparation for the Laboratory (study of techniques and theory)	68
Total number of hours for the Course (25 hours of work-load per ECTS credit)	***125***

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.*	

5. ATTACHED BIBLIOGRAPHY

1. Papadopoulos, A. M. (2006) “Thermal comfort in buildings – New codes and thermal enhancement of buildings”, Thessaloniki.
2. Papadopoulos, M. and Axarli, K. (2015) “Energy-design and passive solar systems of buildings”, ISBN - 978-960-599-019-0.

COURSE OUTLINE

1. GENERAL

SCHOOL	POLYTECHNIC		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF STUDIES	GRADUATE		
COURSE CODE	CIV_0272A	**SEMESTER**	9th
COURSE TITLE	TIMBER STRUCTURES		

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**
	3	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, specialised general knowledge, skills development*	Elective course
PREREQUISITE COURSES:	Structural materials, Mechanic of Materials
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1540/

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 outcomes of the course is:

a. The knowledge of the principles of design according to EC5
b. The knowledge of mechanical properties of solid timber, glued laminated timber, LVL, and wood-based panels
c. The verification of timber beams, columns and joists according to EC5
d. The design of connections with metal fasteners
e. Specifications and verification of components and assemblies, i.e. glued beams and mechanically jointed and glued columns

After completed this course the student will be able to:

a) Design a timber building
b) Execute a complete verification of a timber structure under vertical and horizontal loading
c) Design and verify nailed, screwed, bolted and dowelled metal connections

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

- Decision making
- Working independently
- Project Planning

3. SYLLABUS

- Basics on wood structure
- Macro- and micro-structure of wood
- Actions and environmental influences
- Load-duration classes
- Service classes

- Mechanical properties of wood
- Solid timber
- Glued laminated timber
- Laminated veneer lumber (LVL)
- Wood-based panels
- Design
- Design of cross-sections under tension parallel and perpendicular to the grain, under compression parallel and perpendicular to the grain, under bending, under shear and torsion
- Cross-sections under combined bending and axial tension, under combined bending and axial compression
- Stability of members
- Design of cross-sections in members with varying cross-section or curved shape
- Connection with metal fasteners
- Timber-to-timber and panel-to-timber connections
- Steel-to-timber connections
- Nailed, bolted, doweled and screwed connections
- Components and Assemblies
- Glued thin-webbed beams, glued thin-flanged beams
- Mechanically jointed beams, mechanically jointed and glued columns
- Trusses with punched metal plate fasteners

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face lectures in the classroom
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	**Use of e-class platform**

COURSE OUTLINE

1. GENERAL

<table>
<tr><td>SCHOOL</td><td colspan="3">ENGINEERING</td></tr>
<tr><td>ACADEMIC UNIT</td><td colspan="3">CIVIL ENGINEERING</td></tr>
<tr><td>LEVEL OF COURSE</td><td colspan="3">UNDERGRADUATE</td></tr>
<tr><td>COURSE CODE</td><td>CIV_0268A</td><td>SEMESTER</td><td>9th</td></tr>
<tr><td>COURSE TITLE</td><td colspan="3">THEORY OF PLATES AND SHELLS</td></tr>
<tr><td colspan="2">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></td><td>WEEKLY TEACHING HOURS</td><td>CREDITS</td></tr>
<tr><td colspan="2">Lectures</td><td>3</td><td>5</td></tr>
<tr><td colspan="2"><i>Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).</i></td><td></td><td></td></tr>
<tr><td>COURSE TYPE
<i>general background, special background, specialised general knowledge, skills development</i></td><td colspan="3">Field of Science</td></tr>
<tr><td>PREREQUISITE COURSES:</td><td colspan="3"></td></tr>
<tr><td>LANGUAGE OF INSTRUCTION and EXAMINATIONS:</td><td colspan="3">Greek</td></tr>
<tr><td>IS THE COURSE OFFERED TO ERASMUS STUDENTS</td><td colspan="3">No</td></tr>
<tr><td>COURSE WEBSITE (URL)</td><td colspan="3">https://eclass.upatras.gr/courses/CIV1745/</td></tr>
</table>

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

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

This course will expose students to

1. Kirchhoff-Love theory for orthogonal plates
2. Membrane theory for cylindrical and spherical shells
3. The general membrane theory of shells
4. The bending theory of cylindrical and spherical shells

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…*
	…….

1. Ability to work autonomously
2. Ability to make decisions
3. Ability to work in groups
4. Design of structures

3. SYLLABUS

1. Introduction to the theory of plates and shells
2. Elasticity theory
3. Kirchhoff-Love equations for orthogonal plates
4. Analysis of orthogonal plates using Fourier method
5. Analysis of circular plates
6. Membrane theory of cylindrical and spherical shells
7. General membrane theory of shells
8. Bending theory of cylindrical and spherical shells

4. TEACHING AND LEARNING METHODS - EVLUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Lectures
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Learning supported through the e-class internet platform

<table>
<tr><td>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></td><td>

Activity	*Semester workload*
Lectures	39
Group project on case studies	31
Autonomous study	55
Total number of hours for the Course (25 hours of work-load per ECTS credit)	***125 hours (total student work-load)***

</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<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></td><td>I. Final exam (70%) includes:
- Multiple choice questions
- Short answer questions
- Problem solving
II. Group project (30%)</td></tr>
<tr><td></td><td></td></tr>
</table>

5. ATTACHED BIBLIOGRAPHY

9th SEMESTER - 2nd TRACK ELECTIVE COURSES

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF COURSE	UNDERGRADUATE		
COURSE CODE	CIV_8357A	**SEMESTER**	9th
COURSE TITLE	GEOLOGY OF TECHNICAL WORKS AND ROCK MECHANICS		
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, Laboratory Work		2(L), 2(LW)	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Field of Science (Geology) and Skills Development (Technical Works and Environment)		
PREREQUISITE COURSES:	There are not any prerequisite courses. It is however recommended that students should have at least a basic knowledge in Engineering Geology		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek. Teaching may be performed in English in case that foreign students attend the course		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No		
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/GEO349/		

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

7. *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
8. *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for*

Lifelong Learning and Appendix B
Guidelines for writing Learning Outcomes

The course gives the theoretical and objective knowledge related to the identification and description of the engineering geological conditions that prevail on technical works design and it focuses in rock mechanics subjects. Emphasis is given to selecting and identifying the most "critical" engineering geological parameters that affect technical work construction and operation.
By the end of this course the student will possess cognitive and practical skills and the ability to:

9. Utilise the knowledge to assess the physical and mechanical parameters of rock formations (rock material and rock mass) through laboratory and on - site methodologies and simulations (use of appropriate methods, materials and instruments)
10. Apply the knowledge and creative thinking to solve problems and accomplish technical solutions in critical matters that may be encountered in the study and design of technical works (slope protection, tunnel supporting, dam grouting, etc.)

Also, the student in the working environment will possess the ability to respond:

- with competence in the interdisciplinarity that is required in technical works (study - construction)
- with responsibility and reliability in the case of autonomous employment

General Competances

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

6. Search for, analysis and synthesis of data and information, with the use of the necessary technology
7. Decision making
8. Adapting to new situations
9. Working independently

10. Working in an interdisciplinary environment
11. Project planning and management
12. Respect for the natural environment

3. SYLLABUS

1) Engineering behaviour of rock mass: rock mass classification systems RMR, Q and Geological Strength Index (GSI). Applications on the design and construction of tunnels, slopes and foundations.
2) Landslides: terminology and classification, causal and triggering factors, remedial measures
3) Design and construction of dams: classification of dams, design criteria, engineering geological requirements, dam and reservoir waterproofing, monitoring techniques.
4) Design and construction of tunnels: geological conditions during construction, rockmass deformation and failure mechanism, construction methods (NATM and TBM) and supporting techniques.
5) Laboratory testing in rocks (Rock Mechanics) according to ASTM, ISRM and E103-84 standards

4. TEACHING AND LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face to face and Distance learning</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>• Use of Information and Communication Technologies (ICTs) in teaching (zoom and power point).
• Electronic Delivery of Laboratory Exercises, individually to each student, in a weekly basis, with the use of e-class
• Support of the Learning Process and Dissemination of the Educational Material through the e-class platform</td></tr>
<tr><td>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-</i></td><td>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures (2 conduct hours per week x 13 weeks)</td><td>2×13=26</td></tr>
<tr><td>Laboratory work (2 conduct hours per week x 13 weeks) in (a) rocks (Rock Mechanics) and (b) in situ rockmass measurements for geotechnical design</td><td>2×13=26</td></tr>
<tr><td>Autonomous study</td><td>73</td></tr>
<tr><td>Total number of hours for the Course</td><td>125 hours</td></tr>
</table>
</td></tr>
</table>

directed study according to the principles of the ECTS	
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 (English for Erasmus students) I) Laboratory work evaluation (50%): (a) Each lab exercise is resolved and delivered the next week after its educational process. Afterwards it is corrected, marked and returned to the student. It is calculated the average mark of all lab exercises (b) Written examination on laboratory exercises. Final Lab Work Grade (50%) =(a)*20% + (b)*30% II) Final Written Course Exam (50%): Ten (10) questions of short answer related to lectures

ATTACHED BIBLIOGRAPHY

-Text Books 1) Γεωλογία Τεχνικών έργων (2007). Γ. Κούκης, Ν. Σαμπατακάκης Εκδόσεις Παπασωτηρίου, σελ. 575. 2) Engineering Geology. Principle and practice (2009). D.G. Price, Springer. 3) Engineering Geology (2007). F.G. Bell. Second edition. B.H. 4) Practical Rock Engineering. E. Hoek. https://www.rocscience.com/documents/hoek/corner/Practical-Rock-Engineering-Full-Text.pdf -Scientific International Journals: 1) Bulletin of Engineering Geology and the Environment. Springer 2) Engineering Geology. Elsevier. 3) Geotechnical and Geological Engineering.

COURSE OUTLINE

1.GENERAL

<table>
<tr><td>SCHOOL</td><td colspan="3">SCHOOL OF ENGINEERING</td></tr>
<tr><td>ACADEMIC UNIT</td><td colspan="3">DEPARTMENT OF CIVIL ENGINEERING</td></tr>
<tr><td>LEVEL OF STUDIES</td><td colspan="3">UNDERGRADUATE</td></tr>
<tr><td>COURSE CODE</td><td>CIV_9372A</td><td>SEMESTER</td><td>9ο</td></tr>
<tr><td>COURSE TITLE</td><td colspan="3">COMPUTATIONAL GEOTECHNICAL ENGINEERING</td></tr>
<tr><td colspan="2">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></td><td>WEEKLY TEACHING HOURS</td><td>CREDITS</td></tr>
<tr><td colspan="2">Lectures and Tutorials</td><td>3</td><td>5</td></tr>
<tr><td colspan="2"></td><td></td><td></td></tr>
<tr><td colspan="2"></td><td></td><td></td></tr>
<tr><td colspan="2"><i>Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).</i></td><td></td><td></td></tr>
<tr><td>COURSE TYPE
<i>general background, special background, specialised general knowledge, skills development</i></td><td colspan="3">Specialised General Knowledge</td></tr>
<tr><td>PREREQUISITE COURSES:</td><td colspan="3">There are no prerequisite courses. It is expected, however, that students have a solid background in Soil Mechanics</td></tr>
<tr><td>LANGUAGE OF INSTRUCTION and EXAMINATIONS:</td><td colspan="3">Greek.</td></tr>
<tr><td>IS THE COURSE OFFERED TO ERASMUS STUDENTS</td><td colspan="3">No</td></tr>
<tr><td>COURSE WEBSITE (URL)</td><td colspan="3">https://eclass.upatras.gr/courses/CIV1859</td></tr>
</table>

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

11. *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
12. *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for*

Lifelong Learning and Appendix B
13. Guidelines for writing Learning Outcomes

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

14. *Apply the limit equilibrium method in slope stability problems and in remediation of landslides*
15. *Appreciate the basic principles underpinning the application of the finite element method on geotechnical problems*
16. *Select, calibrate and use appropriate constitutive models for the simulation of soils' mechanical behaviour*
17. *Perform non-linear finite element analyses of geotechnical boundary value problems*

Upon successful completion of this course, students will have further developed the following skills:

1. *Competence in the use of specialised software of limit equilibrium and finite elements, such as PLAXIS LE and PLAXIS FE respectively.*

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

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

3.SYLLABUS

1. **INTRODUCTION**
   Applications of numerical methods (finite elements, finite difference, discrete elements, limit equilibrium, limit analysis) on geotechnical problems. Selected examples of application on complex geotechnical projects and back analyses of case studies involving failure.

2. **FUNDAMENTAL ASPECT OF MECHANICAL SOIL BEHAVIOUR AND SIMPLE CONSTITUTIVE MODELS**
   Linear and non-linear soil behaviour. Elastoplastic constitutive models (Mohr-Coulomb, Tresca, Hardening Soil).
3. **APPLICATION OF THE LIMIT EQUIBRIUM METHOD IN SLOPE STABILITY**
   Numerical application of the method of slices, Bishop's, Janbu's and Morgenstern-Price on slope stability. Demonstration and use of a limit equilibrium software (PLAXIS LE) on a landslide remediation with different stabilisation methods (e.g. berms, drainage, piles).
4. **APPLICATION OF THE FINITE ELEMENT METHOD IN GEOTECHNICAL APPLICATIONS**
   Fundamental aspects of spatial discretization and geometric approximation of geotechnical problems. Quadrilateral finite elements, linear elements, interface elements. Boundary conditions and initiation of a geostatic stress field.
5. **NUMERICAL MODELLING OF GEOTECHNICAL PROBLEMS**
   Examples of finite element application (PLAXIS FE) on a range of geotechnical problems : foundations, excavations, embankments, retaining walls, underground works.

4.TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to Face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of web based e-class platform
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*	see table below
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*	Assessment of individual assignments during the course term and semester project (100%)

Activity	***Semester workload***
Lectures	26
Tutorials	13
Team work Project	39
Hours for private study	42
Course total	***125***

Specifically-defined evaluation criteria are given, and if and where they are accessible to students.	

5.ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
- Related academic journals:

12. Course notes (digital form)
13. Υπολογιστική Γεωτεχνική: Αλληλεπίδραση Εδάφους--Κατασκευών, Εκδόσεις Κλειδάριθμος, ISBN-13: 9789604612017.
14. Potts, D. M., & Zdravković, L. (1999). Finite element analysis in geotechnical engineering: Theory. Thomas Telford. https://doi.org/10.1680/feaiget.27534
15. Potts, D. M., & Zdravković, L. (2001). Finite Element Analysis in Geotechnical Engineering: Application. Thomas Telford. https://doi.org/10.1680/feaigea.27831

COURSE OUTLINE

1.GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	CIV-9373A	**SEMESTER**	Ninth
COURSE TITLE	GROUND IMPROVEMENT AND REINFORCEMENT METHODS		

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	3	5
Laboratory Exercises		
Field Work	1	
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. It is anticipated, however, that students have background of Soil Mechanics
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek. Teaching may be however performed in English in case foreign students attend the course.
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1893/

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*

At the end of this course the students will be able to:

1. Identify the principles of ground improvement & reinforcement.
2. Apply the methods of soil improvement & reinforcement.
3. Understand the concepts of reinforced earth.
4. Identify the applications of geosynthetics in civil engineering projects.

At the end of the course the student will have further developed the following skills/ competences:

1. Ability to properly select a soil improvement method.
2. Ability to evaluate the properties of improved soils.
3. Ability to design reinforced earth applications.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Adapting to new situations
- Decision-making
- Project planning and management

3.SYLLABUS

1. **Basic Concepts**
   Need for soil improvement - reinforcement, categorization, suitability and applicability of soil improvement - reinforcement methods.
2. **Densification of coarse-grained soils**
   Vibration at the soil surface, dynamic compaction at the surface and at depth.
3. **Densification of fine-grained soils**
   Preloading, design of vertical wick drains – stone columns
4. **Reinforced earth**
   Type of reinforcement, design and applications.
5. **Grouting**
   Types of grouts, chemical grouts and methods of application.

4.TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face to Face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Use of web based e-class platform</td></tr>
<tr><td>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></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>52</td></tr>
<tr><td>Laboratory Practice</td><td></td></tr>
<tr><td>Weekly assignments</td><td>33</td></tr>
<tr><td>Field work</td><td>10</td></tr>
<tr><td>Hours for private study</td><td>30</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td><i>125</i></td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<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,</i></td><td>1. Written exams which include problem solving (50%)
2. Evaluation of weekly assignments (50%)</td></tr>
</table>

clinical examination of patient, art interpretation, other *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	

5.ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
- Related academic journals:

- Nicholson, Peter G. *Soil improvement and ground modification methods*. Butterworth-Heinemann, 2014.
- “Ground and soil improvement”, Kirsch, K., & Bell, A. (Eds.), CRC Press, 2012.
- “Ground Improvement Techniques”, Bujang B.K. Huat, Arun Prasad, Sina Kazemian, Vivi Anggraini, CRC Press, 2019

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF COURSE	UNDERGRADUATE		
COURSE CODE	CIV_9810A	**SEMESTER OF STUDIES**	9th
COURSE TITLE	GEODETIC APPLICATIONS		

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, seminars and laboratory work	3	4
Integrated field project	1	1
Total credits		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, specialised general knowledge, skills development*	Scientific Field
PREREQUISITE COURSES:	Basic knowledge of surveying/geodetic techniques (for example CIV_3803, CIV_8356A).
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1552/

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*

Successful completion of the course provides the following knowledge and skills:
(1) An in-depth understanding of the use of Geographic Information Systems (GIS) in Civil Engineering problems.
(2) Familiarization with Geostatistical methods for the analysis of spatio-temporal observations.
(3) Basic principles of Satellite Geodesy.
(4) Use of modern Geodetic instruments (e.g., laser scanners) in surveying and designing structures.
(5) Familiarization with digital techniques for processing and visualization of the topographic relief by extracting data from geospatial databases.
(6) Basic geodetic techniques for the study of geophysical phenomena and natural disasters (landslides, earthquakes, fires, floods, etc.) using ground and satellite observations.
(7) Geodetic techniques for the Structural Health Monitoring of infrastructures.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

- Search for, analysis and synthesis of data and information, with the use of the necessary technology.
- Adaptation to new conditions.
- Decision making.
- Working independently.
- Team work.
- Project planning and management.
- Criticism and self-criticism.
- Production of free, creative and inductive thinking.

3. SYLLABUS

The course has two components:
(1) Seminar-style presentations on specific topics in Geodesy and Geoinformatics with extensive references to geophysical processes at the national and international scales (e.g, interactive presentation of thematic modules using research publications and application of computational tools and specialized software, e.g., R/Rstudio, QGIS, Google Earth Engine) using examples with field measurements, satellite data and complementary spatio-temporal observations. These modules cover a wide range of geophysical phenomena that are of great interest to the ever-evolving field of Civil Engineering and aim to familiarise students with the analysis of spatio-temporal observations.
(2) Development of a semester project that will be presented during a special conference. The topic is based on experimental data, literature research, processing of existing data or development of algorithms. The student also derives knowledge from the gradual progress, presentation and evaluation of all topics.

4. TEACHING AND LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	(1) Seminar-style interactive lectures based on visual material. (2) Completion and presentation/review of the semester project. (3) Integrated field project.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Support for the learning process through the e-class platform and through references to specific educational and scientific websites.

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-

Activity	***Semester workload***
Lectures and interactive teaching	40
Semester project	75
Integrated field project	10
Total number of hours for the Course (25 hours of work-load per ECTS credit)	***125 hours***

directed study according to the principles of the ECTS	
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.*	Grading of active participation in the course (40%) and delivery of exercises and project (60%).

5. ATTACHED BIBLIOGRAPHY

Notes on the e-class platform
Books selected through the EYDOXOS system (in alphabetical order):
Γεωχωροπληροφορική Τοπογραφία
Χατζόπουλος Ι.
ISBN: 978-960-4186-53-2, Κωδικός Ευδόξου: 86054829
Τοπογραφία
Ghilani W.
ISBN: 978-960-3307-70-9, Κωδικός Ευδόξου: 59375461

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	CIV_9485A	**SEMESTER**	9th
COURSE TITLE	COASTAL HYDRAULICS		

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	3	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, specialised general knowledge, skills development*	Specialised knowledge
PREREQUISITE COURSES:	None
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1517/

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

18. *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*

19. *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
20. *Guidelines for writing Learning Outcomes*

Desired learning outcomes:

1. Basic principles of irregular wave action in the coastal zone including shoaling, breaking, setup, runup, refraction, diffraction, reflection and transmission.
2. Spectral analysis and prediction of irregular wind waves.
3. Basic principles of coastal currents and longshore sediment transport.

Specific knowledge and competences:

1. Knowledge and understanding of essential facts, concepts, principles and theories relating to the action of wind waves in the coastal zone.
2. Application of such knowledge in analysis of wind data and computation of wave data.
3. Computation of longshore sediment transport and assessment of coastal erosion potential.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

- Working independently
- Team work
- Project planning and management
- Respect for the natural environment

3. SYLLABUS

1. Wave energy, power and radiation stresses.
2. Wave setup and runup.

3. Irregular waves: spectra and coastal processes.
4. Wave-generated currents.
5. Coastal sediment transport.
6. Coastal morphodynamics.
7. Coastal protection works.
8. Numerical methodologies in coastal engineering.

4. TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face-to-face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Support of the learning process using the e-class platform</td></tr>
<tr><td>TEACHING METHODS
<i>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</i></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>39</td></tr>
<tr><td>Project on coastal sediment transport balance.</td><td>30</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Study</td><td>56</td></tr>
<tr><td>Course total</td><td><i>125</i></td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>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,</i></td><td>I. Final exam which includes environmental and design problems (75%).

II. Project on coastal sediment transport (technical report) (25%).</td></tr>
</table>

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.*	

5. ATTACHED BIBLIOGRAPHY

- *Suggested bibliography:*

Coastal Engineering Manual. Engineer Manual 1110–2-1100, U.S. Army Corps of Engineers, Washington, D.C., 2002.

- *Related academic journals:*

1. Coastal Engineering
2. Journal of Waterways, Port, Coastal and Ocean Engineering
3. Ocean Engineering
4. Journal of Coastal Research

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF COURSE	UNDERGRADUATE		
COURSE CODE	CIV_9470A	**SEMESTER**	9th
COURSE TITLE	GROUNDWATER		

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, seminars and laboratory work	3 (lect.)	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, specialised general knowledge, skills development*	Field of Science	
PREREQUISITE COURSES:	There are not prerequisite course.	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek	
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No	
COURSE WEBSITE (URL)	http://www.civil.upatras.gr/el/ProptixiakhEkpaideysh/Mathimata/EEtos/entry/179084a7-f2b0-4e4e-9423-21211f5f72ed/?PageNo=0	

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*

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

- Parameters characterizing storage capacity and conductivity of porous materials
- Types of aquifers
- Equation of one-dimensional and two-dimensional flow in porous media.
- Radially symmetric flow to wells
- Analytical and graphical solutions of flow equation.
- Finite difference method for the solution of the two-dimensional flow equation.
- Mechanisms of mass transport in porous media

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

- Independent working
- Analysis and synthesis of data

3. SYLLABUS

Groundwater in the hydrological cycle; Hydraulic properties of porous media (porosity, hydraulic conductivity); One-dimensional flow in confined, unconfined and leaky aquifers; Solution of the radially symmetric flow in different types of aquifers and pumping tests; Analysis of two-dimensional horizontal flow with analytical, graphical and numerical (finite difference) methods; Mechanisms of mass transport in porous media (advection, dispersion, sorption, decay); Analytical solution of the one-dimensional mass transport equation in porous media.

4. TEACHING AND LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Lectures/Problem Solving face to face.</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td></td></tr>
<tr><td>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></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures/Problem Solving</td><td>39</td></tr>
<tr><td>Private study of the student</td><td>86</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td><i>Total number of hours for the Course
(25 hours of work-load per ECTS credit)</i></td><td><i>125 hours (total student work-load)</i></td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>
<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</i></td><td>Final Examination</td></tr>
</table>

where they are accessible to students.	

5. ATTACHED BIBLIOGRAPHY

1. Kaleris, V., 2004. Material for the course “Groundwater”. Notes
2. Tolikas, D.K., 2006. Groundwater Hydraulics. Epikentron Editions, Thessaloniki.
3. Terzidis, G.A. & Karamouzis, D.N., 1985. Hydraulics of Groundwater. Zitis Editions, Thessaloniki.
4. Voudouris, K.S., 2015. Exploitation and management of groundwater, Tziolas Editions, Thessaloniki.

9th SEMESTER - 3rd TRACK ELECTIVE COURSES

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
DEPARTMENT	CIVIL ENGINEERING		
ACADEMIV UNIT	UNDERGRADUATE		
COURSE CODE	CIV_9480A	**SEMESTER**	9th
COURSE TITLE	LABORATORY TOPICS IN HYDRAULIC ENGINEERING		

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 and laboratory experiments	2 (lect.) 2 (lab.)	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, specialised general knowledge, skills development*	Field of Science
PREREQUISITE COURSES:	There are no formal prerequisites. Basic Fluid Mechanics and Hydraulics are, however, assumed.
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek.
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1551/

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

24. *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*

25. Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B

26. Guidelines for writing Learning Outcomes

Students are expected to develop the following skills:

1) Ability to perform simple experiments in Hydraulics
2) Ability to analyze experimental results and evaluate them through comparison with pertinent theories
3) Writing technical reports

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking

……

Others…

…….

Team work aiming at performing hydraulic engineering experiments
Team work aiming at writing technical reports
Independent personal work

3. SYLLABUS

- Recapitulation of selected topics from Fluid Mechanics and Hydraulics.
- Experiment No 1: Impact of jets on plates.
- Experiment No 2: Open-channel flow-meters: Sharp-crested weirs.
- Experiment No 3: Orifice in a reservoir: coefficient of discharge and velocity. Jet trajectory.
- Experiment No 4: Energy losses in closed conduits.
- Experiment No 5: Flow in open channels and force on a sluice gate.
- Experiment No 6: Closed-conduit flow meters: Venturi and orifice meters.
- Introduction to drag and lift.

4. TEACHING AND LEARNING METHODS – EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Blackboard lectures, supplemented with projection of video movies (Britannica, N.S.F. U.S.A.). Laboratory demonstrations. :Quantitative laboratory experiments.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching,*	Use of selected excerpts from video movies (Britannica, N.S.F. U.S.A.) is made. These excerpts which are analyzed during the lectures are made

laboratory education, communication with students	available to students in the course Web Use of e-class material.
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 (2 conduct hours per week x 13 weeks) — 26 laboratory experiment — 26 Writing of Laboratory Reports — 60 Hours for private study of the student — 13 ***Total number of hours for the Course (25 hours of work-load per ECTS credit)*** — ***125 hours (total student work-load)***
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.*	I. Detailed grading of Group Laboratory Reports for each experiment. These reports contain pertinent theory, description of laboratory equipment and techniques, and compilation and analysis of experimental results II. Personal oral examination.

5. ATTACHED BIBLIOGRAPHY

- Streeter, V.L., Wylie, E.B., Bedford, K.W., Fluid Mechanics, Fountas Books (in Greek).
- Liakopoulos, A. (2011) Fluid Mechanics, Tziolas Publications (in Greek).

- Prinos, P. (2014) Fluid Mechanics, Ziti Publications (in Greek).

COURSE OUTLINE

1. GENERAL

SCHOOL	POLYTECHNIC		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	CIV_7430A	**SEMESTER**	9th
COURSE TITLE	HYDRAULIC AND FLOOD CONTROL STRUCTURES		

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	3	5
Field work	1	
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*	Special Background
PREREQUISITE COURSES:	There are no prerequisite courses. The student is expected to have adequate knowledge of Engineering Hydraulics.
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1749/

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 student familiarizes with concepts and methods of engineering hydraulics, as applied for the design of hydraulic and flood control structures. Emphasis is given to the study of spatially varying open channel flow, by combining theoretical procedures with applicable regulations and concepts, on the basis of detailed examples and practical applications.

By the end of the course, the student has developed all necessary knowledge and skills to analyze some of the most interesting and challenging problems in hydraulic engineering and flood control, as well as the ability to participate in the analysis, design, and sizing of basic elements and structures used in a variety of hydraulic works and large scale flood control 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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking

……

Others…

…….

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Project planning and management
Working independently
Decision making

3. SYLLABUS

Introduction, classification of hydraulic structures. Flow measurement structures, broad and sharp crested weirs, lateral spillways, sluice gates, free overfall, dam spillways. Locating and controlling a hydraulic jump. Energy dissipation. Stilling basins. Design of transitions for sub-critical flow. Curves

and transitions in super-critical flow, oblique hydraulic jumps. Bridge abutments. Culverts. Junctions.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face class lectures and problem solving recitation sessions
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Free software for hydraulic calculations. Distribution of academic material through e-class.
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*	see table below
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*	Final written examination: problem solving

Activity	***Semester workload***
Class lectures and problem solving recitation sessions.	39
Independent study	86
Course total	***125***

Specifically-defined evaluation criteria are given, and if and where they are accessible to students.	

5. ATTACHED BIBLIOGRAPHY

- *Suggested bibliography:*

- *Related academic journals:*

1. Noutsopoulos, G., G. Christodoulou and T. Papathanasiadis (2007) *Open Channel Hydraulics*, Fountas, Athens, Greece, p. 325 (in Greek).
2. Chow, V.T. (1988) *Open Channel Hydraulics*, McGraw Hill, NY, p. 680.
3. Morris, H.M. (1972) *Applied Hydraulics in Engineering*, 2nd Edition, Ronald Press, N.Y., p. 629.
4. Novak, P., A.I.B. Moffat, C. Nalluri and R. Narayanan (2007) *Hydraulic Structures*, Taylor & Francis, NY, p. 700.
5. Roberson, J.A., J.J. Cassidy and M.H. Chaudhry (1998) *Hydraulic Engineering*, John Wiley & Sons, Inc., 2nd Edition, p. 653.

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE ELECTIVE		
COURSE CODE	CIV_9576A	**SEMESTER**	9th
COURSE TITLE	NATURAL WASTEWATER TREATMENT SYSTEMS		

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	3	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, specialised general knowledge, skills development*	Scientific Area
PREREQUISITE COURSES:	Wastewater Treatment
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1743/

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

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

29. Guidelines for writing Learning Outcomes

This course aims to provide students with a strong background in low-cost technologies for the treatment, disposal and reuse of wastewater in small population communities in peri-urban and rural areas.

At the end of this course the student should be able to:
- Understand the basic physicochemical and biological processes in natural treatment systems.
- Know the design principles of low-cost natural treatment systems (stabilization ponds; filters; constructed wetlands; land systems).
- Understand the advantages and disadvantages of the various systems.
- Have a comprehensive understanding and critical awareness of engineering topics related to the sustainable management of wastewater.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

- Independent work
- Teamwork
- Design and project management
- Working in an interdisciplinary environment
- Protection of the environment

3. SYLLABUS

1. Introduction.
2. Flow rate and wastewater characteristics.
3. Site selection.
4. Stabilization ponds overview, anaerobic ponds, anaerobic reactors, facultative ponds, maturation ponds, filters, constructed wetlands.
5. Land treatment systems.
6. Source separating systems.
7. Wastewater disposal and reuse.
8. Biomass valorization.

4. TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Classroom and Laboratory</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Support Learning through the e-class e-class platform.</td></tr>
<tr><td>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></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>35</td></tr>
<tr><td>Individual and team assignments</td><td>45</td></tr>
<tr><td>Independent study</td><td>45</td></tr>
<tr><td><i>Course total</i></td><td><i>125</i></td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<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</i></td><td>Written final exam (60%) consisting of:
- Multiple choice questions
- Problems solving
- Comparative evaluation of theory

II. Written assignments (40%)</td></tr>
</table>

where they are accessible to students.	

5. ATTACHED BIBLIOGRAPHY

-Suggested bibliography: - Crites, R.W., Middlebrooks, J. and Reed, S.W. (2006). Natural Wastewater Treatment Systems. Taylor & Francis Group, CRC Press, Boca Raton, FL. - Mara, D. (2003). Domestic Wastewater Treatment in Developing Countries. Earthscan, UK. - Parten, S.M. (2010). Planning and Installing Sustainable Onsite Wastewater Systems. McGraw-Hill Companies, USA. *-Related academic journals:* Ecological Engineering, Bioresource Technology, Journal of Water and Health, Journal of Environmental Engineering-ASCE, Water Environment Research

COURSE OUTLINE

1.GENERAL

SCHOOL	ENGINEERING		
DEPARTMENT	CIVIL ENGINEERING		
LEVEL OF COURSE	UNDERGRADUATE		
COURSE CODE	CIV_8558A	**SEMESTER OF STUDIES**	9th
COURSE TITLE	POLLUTION OF INLAND AND COASTAL WATERS		

INDEPENDENT TEACHING ACTIVITIES *σε περίπτωση που οι πιστωτικές μονάδες απονέμονται σε διακριτά μέρη του μαθήματος π.χ. Διαλέξεις, Εργαστηριακές Ασκήσεις κ.λπ. Αν οι πιστωτικές μονάδες απονέμονται ενιαία για το σύνολο του μαθήματος αναγράψτε τις εβδομαδιαίες ώρες διδασκαλίας και το σύνολο των πιστωτικών μονάδων*	**TEACHING HOURS PER WEEK**	**ECTS CREDITS**
Lectures/Laboratory/Field work Total	2/2/1 5	5
Προσθέστε σειρές αν χρειαστεί. Η οργάνωση διδασκαλίας και οι διδακτικές μέθοδοι που χρησιμοποιούνται περιγράφονται αναλυτικά στο 4.		

COURSE TYPE *Υποβάθρου , Γενικών Γνώσεων, Επιστημονικής Περιοχής, Ανάπτυξης Δεξιοτήτων*	Field of Science
PREREQUISITE COURSES:	Environmental chemistry
TEACHING AND ASSESSMENT LANGUAGE:	Greek. Teaching may be however performed in English in case foreign students attend the course.
THE COURSE IS OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBPAGE (URL)	https://eclass.upatras.gr/courses/CIV1746

2.LEARNING OUTCOMES

Leraning outcomes *Περιγράφονται τα μαθησιακά αποτελέσματα του μαθήματος οι συγκεκριμένες γνώσεις, δεξιότητες και ικανότητες καταλλήλου επιπέδου που θα αποκτήσουν οι*

φοιτητές μετά την επιτυχή ολοκλήρωση του μαθήματος.

Συμβουλευτείτε το Παράρτημα Α (ξεχωριστό αρχείο στο e-mail)

- *Περιγραφή του Επιπέδου των Μαθησιακών Αποτελεσμάτων για κάθε ένα κύκλο σπουδών σύμφωνα με Πλαίσιο Προσόντων του Ευρωπαϊκού Χώρου Ανώτατης Εκπαίδευσης*
- *Περιγραφικοί Δείκτες Επιπέδων 6, 7 & 8 του Ευρωπαϊκού Πλαισίου Προσόντων Διά Βίου Μάθησης*

και Παράρτημα Β

- *Περιληπτικός Οδηγός συγγραφής Μαθησιακών Αποτελεσμάτων*

This course introduces students to the quality of inland and coastal waters. The course will help students to know the most important environmental pollution problems, what measurements are necessary for specific environmental problems, organize sampling in water bodies, evaluate and interpret the experimental results, and implement experimental results for identification and localization problems and to propose technical solutions.

At the end of this course the student will be able to:

1. Explain the basic principles of water pollution
2. Analyze Process Chemistry in the Hydrosphere
3. Collect all the necessary information for biochemical processes in the hydrosphere
4. Explain the effects of pollutants on hydrosphere chemistry
5. Explain the effects of pollutants and their toxicity
6. Use physicochemical and physical treatment of pollutants
7. Explain the minimization and prevention of pollution
8. Take measures for the remediation of water bodies

General Abilities

Λαμβάνοντας υπόψη τις γενικές ικανότητες που πρέπει να έχει αποκτήσει ο πτυχιούχος (όπως αυτές αναγράφονται στο Παράρτημα Διπλώματος και παρατίθενται ακολούθως) σε ποια / ποιες από αυτές αποσκοπεί το μάθημα;.

Αναζήτηση, ανάλυση και σύνθεση δεδομένων και πληροφοριών, με τη χρήση και των απαραίτητων τεχνολογιών
Προσαρμογή σε νέες καταστάσεις
Λήψη αποφάσεων
Αυτόνομη εργασία
Ομαδική εργασία
Εργασία σε διεθνές περιβάλλον
Εργασία σε διεπιστημονικό περιβάλλον
Παράγωγή νέων ερευνητικών ιδεών
Σχεδιασμός και διαχείριση έργων
Σεβασμός στη διαφορετικότητα και στην πολυπολιτισμικότητα
Σεβασμός στο φυσικό περιβάλλον
Επίδειξη κοινωνικής, επαγγελματικής και ηθικής υπευθυνότητας και ευαισθησίας σε θέματα φύλου
Άσκηση κριτικής και αυτοκριτικής
Προαγωγή της ελεύθερης, δημιουργικής και επαγωγικής σκέψης

By the end of this course the student will, furthermore, have developed the following skills (general abilities):

10. Ability to exhibit knowledge and understanding of the essential facts, concepts, theories and applications which are related to Water Pollution.
11. Ability to apply this knowledge and understanding to the solution of problems related to Water Pollution of non-familiar nature.
12. Ability to adopt and apply methodology to the solution of non-familiar problems of Water Pollution.
13. Study skills needed for continuing professional development.
14. Ability to interact with others in environmental chemical or interdisciplinary problems.

Generally, by the end of this course the student will, furthermore, have develop the following general abilities (from the list above):
Searching, analysis and synthesis of facts and information, as well as using the necessary technologies
Adaptation to new situations
Decision making
Autonomous (Independent) work
Group work
Exercise of criticism and self-criticism
Promotion of free, creative and inductive thinking
Respect to natural environment
Work design and management

3.COURSE CONTENT

The contents of the course are as follows:

1. Physico-chemical characteristics of fresh and seawater
2. Life in the aquatic environment - The ecosystem
3. Forms and behaviors of the elements in the aquatic environment
4. Physical and chemical processes in water
5. The main bio-geochemical cycles
6. Chemical processes at environmental interfaces
7. Chemical water pollution
8. Simulation of physical and biochemical processes in aquatic ecosystems

4.TEACHING AND LEARNING METHODS - ASSESSMENT

TEACHING METHOD *Πρόσωπο με πρόσωπο, Εξ αποστάσεως εκπαίδευση κ.λπ.*	Lectures and seminars.
USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES *Χρήση Τ.Π.Ε. στη Διδασκαλία, στην Εργαστηριακή Εκπαίδευση, στην Επικοινωνία με τους φοιτητές*	Use of Information and Communication Technologies (ICTs) (e.g. powerpoint) in teaching. The lectures content of the course for each chapter are uploaded on the internet, in the form of a series of pdf files, where from the students can freely download them using a password which is provided to them at the beginning of the course.

<table>
<tr>
<td>TEACHING ORGANIZATION
<i>Περιγράφονται αναλυτικά ο τρόπος και μέθοδοι διδασκαλίας.</i>
<i>Διαλέξεις, Σεμινάρια, Εργαστηριακή Άσκηση, Άσκηση Πεδίου, Μελέτη & ανάλυση βιβλιογραφίας, Φροντιστήριο, Πρακτική (Τοποθέτηση), Κλινική Άσκηση, Καλλιτεχνικό Εργαστήριο, Διαδραστική διδασκαλία, Εκπαιδευτικές επισκέψεις, Εκπόνηση μελέτης (project), Συγγραφή εργασίας / εργασιών, Καλλιτεχνική δημιουργία, κ.λπ.</i>

<i>Αναγράφονται οι ώρες μελέτης του φοιτητή για κάθε μαθησιακή δραστηριότητα καθώς και οι ώρες μη καθοδηγούμενης μελέτης ώστε ο συνολικός φόρτος εργασίας σε επίπεδο εξαμήνου να αντιστοιχεί στα standards του ECTS</i></td>
<td>
<table>
<tr><th><i>Δραστηριότητα</i></th><th><i>Φόρτος Εργασίας Εξαμήνου</i></th></tr>
<tr><td>Lectures (3 conduct hours per week x 13 weeks)</td><td>39</td></tr>
<tr><td>Final examination (3 conduct hours)</td><td>3</td></tr>
<tr><td>Hours for private study of the student and preparation of home-works (3 per semester)</td><td>83</td></tr>
<tr><td><i>Total number of hours for the Course
(25 hours of work-load per ECTS credit)</i></td><td><i>125</i></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
</table>
</td>
</tr>
<tr>
<td>STUDENT ASSESSEMNT
<i>Περιγραφή της διαδικασίας αξιολόγησης</i>

<i>Γλώσσα Αξιολόγησης, Μέθοδοι αξιολόγησης, Διαμορφωτική ή Συμπερασματική, Δοκιμασία Πολλαπλής Επιλογής, Ερωτήσεις Σύντομης Απάντησης, Ερωτήσεις Ανάπτυξης Δοκιμίων, Επίλυση Προβλημάτων, Γραπτή Εργασία, Έκθεση / Αναφορά, Προφορική Εξέταση, Δημόσια Παρουσίαση, Εργαστηριακή Εργασία, Κλινική Εξέταση Ασθενούς, Καλλιτεχνική Ερμηνεία, Άλλη / Άλλες</i>

<i>Αναφέρονται ρητά προσδιορισμένα κριτήρια αξιολόγησης και εάν και που</i></td>
<td>1. Obligatory preparation of personal work by each student. After each lecture there is an exercise to be answered-solved to better understand the lecture. Students are required to solve and deliver the exercises to pass exams.

2. Written exam after the end of the semester - final grade.

Minimum level of examination: 5.</td>
</tr>
</table>

είναι προσβάσιμα από τους φοιτητές;	

5.RECOMMENDED LITERATURE

1. "Aqueous Chemistry", Nikolaidis N., Ziti Publications, ISBN: 960-431-957-4, 2005.

2. "Marine Environmental Hydraulics", I. Krestenitis, Greek Academic Textbooks and Assistants, ISBN: 978-960-603-253-0

3. "Chemical Oceanography", Dasenakis M., Greek Academic Texts and Assistants, ISBN: 978-960-603-234-9

4. PDF from ppt's lectures

5. 13 exercises from the lectures

6. Notes by the teacher in Greek.

COURSE OUTLINE

1.GENERAL

SCHOOL	POLYTECHNIC		
ACADEMIC UNIT	CIVIL ENGINNERING		
LEVEL OF STUDIES	Undergraduate Elective		
COURSE CODE	CIV-9562A	**SEMESTER**	**9th**
COURSE TITLE	Environmental Analysis		

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 and Laboratory	2+2	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, specialised general knowledge, skills development*	Scientific Area
PREREQUISITE COURSES:	Environmental Chemistry, Water Treatment, Wastewater Treatment, Probability-Statistics
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES (In English)
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1740/

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 course introduces students to how environmental measurements related to water and wastewater quality are conducted. The course will help students know which tests are appropriate for given environmental problems, organize sampling in water/wastewater treatment plants and water bodies, statistically interpret laboratory results, and apply laboratory results to problem identification, quantification, and environmental design and technical solutions.

At the end of this course the student should be able to:

- Perform common determinations related to water and wastewater quality.
- Know which parameters are appropriate for given environmental problems.
- Statistically analyze and interpret laboratory results.
- Apply the laboratory results to problems identification and assessment.
- Understand and use water and wastewater sampling procedures and sample preservation.
- Demonstrate the ability to write laboratory reports.
- Demonstrate the ability to work in groups.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

- Independent work
- Teamwork
- Working in an interdisciplinary environment
- Protection of the environment

3.SYLLABUS

13. Introduction and laboratory safety.
14. Types of pollutants.
15. Sampling design and samples handling.
16. Precision and accuracy of measurements.
17. Determination of pH, dissolved oxygen, electric conductivity and salinity.
18. Determination of chemical and biochemical oxygen demand.
19. Determination of nitrogen (ammonia, nitrate and Kjeldahl nitrogen) and

phosphorus.
20. Spectrophotometric methods of analysis.
21. Ion chromatography.
22. Atomic emission spectroscopy.

4.TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Classroom and Laboratory</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Support Learning through the e-class e-class platform. Statistics software programmes (SPSS, Minitab, R).</td></tr>
<tr><td>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></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>20</td></tr>
<tr><td>Laboratory exercises</td><td>40</td></tr>
<tr><td>Laboratory assignments</td><td>30</td></tr>
<tr><td>Independent study</td><td>35</td></tr>
<tr><td><i>Course total</i></td><td><i>125</i></td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<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></td><td>Written final exam (60%) consisting of:
- Multiple choice questions
- Problems solving
- Comparative evaluation of theory

II. Laboratory (40%) consisting of Laboratory experiments and assignments</td></tr>
</table>

Specifically-defined evaluation criteria are given, and if and where they are accessible to students.	

5.ATTACHED BIBLIOGRAPHY

- *Suggested bibliography:*
- *Related academic journals:*
- APHA, AWWA, WEF. 2012. Standard Methods for the Examination of Water and Wastewater, 22nd ed. American Public Health Association, Washington, DC.
- Sawyer, C.N., P.L. McCarty, G.F. Parkin (2003) Chemistry for Environmental Engineering and Science. 5th Edition, McGraw-Hill.
- Harris, D.C. (2010). Ποσοτική χημική ανάλυση, Τόμος Β. Επιστημονική Επιμέλεια Νίκος Χανιωτάκης, Μαρία Φουσάκη, Πανεπιστημιακές εκδόσεις Κρήτης, ISBN Β Τόμος: 978-960-524-281-7
- van Loosdrecht, M.C.M, Nielsen, P.H., Lopez-Vasqeuz, C.M. and Brdjanovic, D. (2016.). Experimental Methods in Wastewater Treatment. IWA Publishing, UK.

Λιοδάκης, Σ. (2001). Αναλυτική Χημεία-Θέματα και Προβλήματα, Στυλιανός, Εκδόσεις Παπασωτηρίου, Αθήνα, ISBN: 960-7510-86-0

9th SEMESTER - 4th TRACK ELECTIVE COURSES

COURSE OUTLINE

1.GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF COURSE	UNDERGRADUATE		
COURSE CODE	CIV_9668A	**SEMESTER**	9th
COURSE TITLE	TRANSPORTATION SYSTEMS ANALYSIS AND DESIGN II		

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	3	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, specialised general knowledge, skills development*	Field of Science
PREREQUISITE COURSES:	Desirable to have knowledge of Transportation Analysis and Design I
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek. Teaching may be performed in English if foreign students attend the course.
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
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

30. *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
31. *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for*

Lifelong Learning and Appendix B
32. Guidelines for writing Learning Outcomes

- Knowledge of general principles of designing various transportation systems.
- Collection and analysis of primary data related to transportation.
- Application of appropriate mathematical models for demand and supply analysis in transportation systems.
- Knowledge and application of computer tools taught in the course for the analysis of transportation systems.

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?

- Ability to demonstrate knowledge and understanding of the essential properties, concepts, and mechanisms related to transportation systems design.
- Ability to apply this knowledge and understanding in describing, simulating, and solving unfamiliar qualitative and quantitative problems.
- Ability to adopt and apply relevant methodology to various problems and studies, such as traffic regulation, transportation systems development, risk assessment, and performance evaluation of transportation systems.
- Ability for study, lifelong learning, and continuous professional development.

Ability to utilize this knowledge for conducting studies as well as interdisciplinary collaboration in problems and studies of interdisciplinary nature.

- Working independently
- Criticism and Self-Criticism
- Production of Free, Creative, and Inductive Thinking
- Working in an interdisciplinary environment
- Project planning and management

3.SYLLABUS

Introduction to transportation systems modeling. Analysis and prediction of transportation demand. Evaluation of transportation system performance. Transportation networks. Simulation of transportation networks.

4.TEACHING AND LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	In class. Lecture, problem-solving seminar. Development of implementation code for

<table>
<tr><td></td><td>examples in the classroom. Execution and delivery of 3 individual assignments.</td></tr>
<tr><td>**USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY**
Use of ICT in teaching, laboratory education, communication with students</td><td>- Students solve exercises in class using the Python programming language on computers. All prerequisite assignments are solved using the Python programming environment.
- Learning support through electronic platform e-class</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>39</td></tr>
<tr><td>Individual assignments</td><td>45</td></tr>
<tr><td>Independent study</td><td>33</td></tr>
<tr><td>***Total number of hours for the Course (25 hours of work-load per ECTS credit)***</td><td>***125***</td></tr>
</table></td></tr>
<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>Projects (assignments and reports): 100%</td></tr>
</table>

5.ATTACHED BIBLIOGRAPHY

- *Suggested bibliography:*

Greek bibliography:

Γιαννόπουλος, Γ. (2005). Σχεδιασμός των μεταφορών. Εκδόσεις Επίκεντρο Α.Ε., ISBN: 978-960-88681-0-6.

Σταθόπουλος, Α., Καρλαύτης, Μ. (2008). Σχεδιασμός Μεταφορικών Συστημάτων. Εκδόσεις Παπασωτηρίου, ISBN 9789607182050.

Foreign bibliography:

Cascetta, E. (2009). Transportation Systems Analysis: Models and Applications, Springer, Berlin.

de Smith, M. J. (2014). *Statistical Analysis Handbook: A comprehensive handbook of statistical concepts, techniques and software tools*. The Winchelsea Press, Winchelsea, U.K. http://www.statsref.com/StatsRefSample.pdf

Manheim, M. (1979). Fundamentals of Transportation Systems Analysis. Cambridge MIT Press.

Meyer, M., Miller, E. (2000). Urban Transportation Planning. New York, NY: McGraw-Hill, 2000. ISBN: 9780072423327.

Ortuzar, J.D., Willumsen, L.G. (2011). Modelling Transport. 4th edition. London: Wiley.

Stopher, P., Mayburg, A. (1975). Urban Transportation and Planning, Lexington.

Sussman, J.M. (2000). Introduction to Transportation Systems, Artech House.

- *Related academic journals:*

Transport Policy, Transportation Research Part A, B, C, D, E, Transportation Research Procedia, Research in Transportation Economics, Transportation Planning and Technology, Journal of Transport Geography, International Journal of Sustainable Transportation.

COURSE OUTLINE

1.GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF COURSE	UNDERGRADUATE		
COURSE CODE	CIV_9669	**SEMESTER**	9th
COURSE TITLE	INTELLIGENT TRANSPORTATION SYSTEMS		

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, seminars and laboratory work	3	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, specialised general knowledge, skills development*	Field of Science
PREREQUISITE COURSES:	Desirable to have knowledge of Transportation Analysis and Design I or II or to attend both simultaneously.
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek. Teaching may be performed in English if foreign students attend the course.
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
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

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

1. Knowledge of general elements of intelligent transportation systems.
2. Application of principles of intelligent transportation systems in the design of urban transportation systems.
3. Application of principles of intelligent transportation systems in data collection and estimation.

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?

- Ability to demonstrate knowledge and understanding of the essential properties, concepts, and mechanisms related to intelligent transportation systems.
- Ability to apply this knowledge and understanding in describing, simulating, and solving unfamiliar qualitative and quantitative problems.
- Ability to adopt and apply relevant methodology to various problems and studies, such as traffic regulation, transportation systems development, risk assessment, and performance evaluation of intelligent transportation systems.
- Ability for study, lifelong learning, and continuous professional development.
- Ability to utilize this knowledge for conducting studies as well as interdisciplinary collaboration in problems and studies of interdisciplinary nature.

- Working independently
- Criticism and Self-Criticism
- Production of Free, Creative, and Inductive Thinking
- Project planning and management

3.SYLLABUS

Introduction to the application of artificial intelligence in transportation. Intelligent data measurement/collection systems for urban transportation systems. Telematics systems in urban transportation. Reliability of transportation systems. Autonomous vehicles. New intelligent mobility services.

4.TEACHING AND LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	In class. Lecture, problem-solving seminar. Discussion of case studies in class.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	- Learning support through electronic platform e-class

<table>
<tr><td>Use of ICT in teaching, laboratory education, communication with students</td><td></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>39</td></tr>
<tr><td>Individual assignments</td><td>41</td></tr>
<tr><td>Independent study</td><td>45</td></tr>
<tr><td>Total number of hours for the Course
(25 hours of work-load per ECTS credit)</td><td>125</td></tr>
</table>
</td></tr>
<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>• Final exam: 70 %
• Projects (assignments and reports):: 30%</td></tr>
</table>

5.ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

Chowdhury, M.A., Sadek, A. (2003). Fundamentals of Intelligent Transportation Systems Planning, Artech House, Inc.
Gordon, R. (2016). Intelligent Transportation Systems. 2nd edition, HEAL-Link Springer ebooks.
Gentile, G., Noekel, K. (2016). Modelling Public Transport Passenger Flows in the Era of Intelligent Transport Systems. Springer Tracts on Transportation and Traffic, HEAL-Link Springer ebooks.
Stephanedes, Y.J. (2004). Intelligent Transportation Systems. Chapter 86, The Engineering Handbook, 2nd Edition, Ed. R. C. Dorf. CRC Press, Boca Raton, Florida.
Sussman, J.S. (2005). Perspectives on Intelligent Transportation Systems (ITS). ISBN 978-0-387-23260-7, Springer.
Vlacic, L., Parent, M., Harashima, f. (2001). Intelligent vehicle technologies: theory and applications. Society of Automotive Engineers.

- Related academic journals:
Journal of Intelligent Transportation Systems: Technology, Planning, and Operations, IET Intelligent Transport Systems, Transport Policy, Transportation Research Part A, B, C, D, E, Transportation Research Procedia, Research in Transportation Economics, Transportation Planning and Technology.

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	CIV_9670A	**SEMESTER**	9th
COURSE TITLE	TRANSPORTATION INFRASTRUCTURE MANAGEMENT		

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	3	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, specialised general knowledge, skills development*	Specialised general knowledge, skills development
PREREQUISITE COURSES:	Highway Construction and Maintenance
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CIV1532/

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

36. *Description of the level of learning outcomes for each qualifications cycle,*

according to the Qualifications Framework of the European Higher Education Area

37. *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning*

and Appendix B

38. *Guidelines for writing Learning Outcomes*

By the end of this course, the student will be able to:

- Identify the main defects of transportation infrastructure.
- Determine the main impacts of transportation infrastructure deterioration.
- Propose alternative maintenance and rehabilitation measures.
- Evaluate and propose optimal maintenance and rehabilitation strategies in a network level.
- Utilise software for optimizing life cycle maintenance and rehabilitation decisions.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking

……

Others…

…….

By the end of this course, the student will have developed the following general abilities (from the list above):

- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Decision making
- Project planning and management
- Production of free, creative and inductive thinking

3. SYLLABUS

xiii. Introduction to transportation infrastructure life-cycle management
xiv. Economics of transportation infrastructure projects, life cycle analysis, cost-benefit analysis
xv. Road pavement defects, triggering causes, monitoring methods
xvi. Pavement condition evaluation, impact assessment on users and the environment

xvii. Pavement condition deterioration in time under traffic loading
xviii. Maintenance and rehabilitation strategies for road pavements
xix. Defects, maintenance and rehabilitation treatments for bridges and road structures
xx. Prioritization of maintenance and rehabilitation needs, resource allocation optimization
xxi. Traffic safety considerations in road maintenance and rehabilitation
xxii. Computerized pavement and bridge management systems

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Lectures face to face
USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES *Use of ICT in teaching, laboratory education, communication with students*	PowerPoint presentations as part of the lectures, seminars in optimization software (Palisade Evolver), systematic use of eclass platform for course announcements and material handling, etc.
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*	see table below
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,*	Language of evaluation: Greek Methods of evaluation: Final exam (60%) or (alternatively) Mid-term exam (30%) and final-term exam (30%). Homework assignments (40%). Evaluation criteria are accessible to students in: https://eclass.upatras.gr/courses/CIV1532/

Activity	Semester workload
Lectures	39
Study and analysis of bibliography	40
Project	32
Essay writing	14
Total number of hours for the course (25 hours of work-load per ECTS credit)	***125***

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.*	

5. ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- A. Mouratides, “Highway Engineering: Highway Maintenance and Management”, University Studio Press, 2008 (in Greek)

- Related academic journals:

- ASCE Journal of Infrastructure Systems
- ASCE Journal of Construction Engineering and Management
- Journal of Pavement Engineering
- Computer-Aided Civil and Infrastructure Engineering
- Automation in Construction

9th SEMESTER – EXTERNAL ELECTIVE COURSES

COURSE OUTLINE

1.GENERAL

SCHOOL	ECONOMICS & BUSINESS ADMINISTRATION		
DEPARTMENT	ECONOMICS		
LEVEL OF COURSE	UNDERGRADUATE		
COURSE CODE	CIV_0711A	**SEMESTER OF STUDIES**	Fall
COURSE TITLE	Introduction to Economics		

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*	**TEACHING HOURS PER WEEK**	**ECTS CREDITS**
Lectures and tutorials	3 (lect.)	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, specialised general knowledge, skills development*	General Knowledge
PREREQUISITE COURSES:	None
TEACHING AND ASSESSMENT LANGUAGE:	Greek with the use of English terminology
THE COURSE IS OFFERED TO ERASMUS STUDENTS	No
COURSE WEBPAGE (URL)	https://eclass.upatras.gr/courses/ECON1524/ & https://eclass.upatras.gr/courses/ECON1238/

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 the course, students are expected to be able to:

- Understand basic economic concepts
- Describe the main economic functions at the micro level of both the firm and the consumer
- Identify and understand basic macroeconomic variables
- Recognise the effects of key macroeconomic developments on business variables
- Understand the role and process of technological innovation
- Identify and define the forms of entrepreneurship
- Understand and use basic tools for evaluating investments

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

By the end of the course they will have acquired:

- Ability to understand the effects of economic phenomena on technical issues
  Ability to interact with others in resolving issues related to business strategies
- To learn to interact with other business professionals in order to learn how to deal with business strategies

Upon completion of the course, students will have developed the generic competencies:

- Search and analysis of information and use of appropriate methodological tools
- Decision making
- - Working in an interdisciplinary environment

3.COURSE CONTENT

The course is basically an introduction to the two general subfields of economics: macroeconomics and microeconomics. The course is complemented by basic principles of the economics of innovation and investment appraisal. The sub-modules are:

- The Economic Problem
- Consumer behaviour
- Production and firm costs
- Demand and Supply
- Elasticities, Endogenous and exogenous shocks
- Competition and Business Strategies
- Key Macroeconomic Ratios
- The Role of the State and Open Economies
- Elements of Innovation and Entrepreneurship
- Investment Evaluation Tools

4.TEACHING AND LEARNING METHODS - ASSESSMENT

<table>
<tr><td>TEACHING METHOD
<i>Face-to-face, Distance learning, etc.</i></td><td>Face to face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>• Use of PowerPoint during lectures
• Posting of educational material on the asynchronous e-learning platform in the course area
• -Communication via e-mail/eclass</td></tr>
<tr><td>TEACHING ORGANIZATION
<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></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures (3 hours/week x 13 weeks)</td><td>13X3 = 39 ώρες</td></tr>
<tr><td>Independent study</td><td>111ώρες</td></tr>
<tr><td>Total number of hours for the Course (25 hours of work-load per ECTS credit)</td><td>150 hours (total student work-load)</td></tr>
</table>
</td></tr>
<tr><td>STUDENT ASSESSEMNT</td><td>Lectures and examinations within the course are conducted in person. Student assessment is based</td></tr>
</table>

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.*	on a written final examination which may include multiple choice questions, short answer questions, solving exercises, interpretation of results and/or a combination of the above.

5.ATTACHED BIBLIOGRAPHY

Suggested bibliography:

- **Cowen, Tyler, Tabarrok, Alex. (2019).** Priciples of Economics, Papazisi Pub.**, ISBN: 978-960-02-3515-9**
- **Bernheim, Douglas B., Whinston, Michael D. (2021).** Microeconomics**,** Papazisi Pub**, ISBN: 978-960-02-3674-3**
- ***Open Course "Economics for non-economists" Lectures (in greek)*** *«Οικονομικά για μη Οικονομολόγους»*

COURSE OUTLINE

1.GENERAL

SCHOOL	SCHOOL OF ECONOMICS AND BUSINESS
DEPARTMENT	BUSINESS ADMINISTRATION
LEVEL OF COURSE	UNDERGRADUATE

COURSE CODE	CIV_0712A	**SEMESTER OF STUDIES**	1st	2nd	3rd	4th	5th	6th	7th	8th
			x							

COURSE TITLE	BUSINESS ADMINISTRATION I

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	**TEACHING HOURS PER WEEK**	**ECTS CREDITS**
Lectures	3	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, specialised general knowledge, skills development*	Field of science
PREREQUISITE COURSES:	There are no Prerequisite Courses:
TEACHING AND ASSESSMENT LANGUAGE:	Greek
THE COURSE IS OFFERED TO ERASMUS STUDENTS	
COURSE WEBPAGE (URL)	https://eclass.upatras.gr/courses/BMA471/

2.LEARNING OUTCOMES

Leraning 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 introduce students in Management Science giving emphasis on planning, organizing, leading and controlling, as well as on managerial roles and managers' competences. Moreover, relevant theories and key concepts will be analyzed with critical perspective in today's turbulent business environment.

At the end of this course the student should be able to:

1. Understand the basic concepts and theories related to Business Administration.

2. Develop critical thinking regarding managerial functions in today's business.

General Abilities

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

Search for, analysis and synthesis of data and information, with the use of the necessary technology	x	
Adapting to new situations	x	
Decision-making		
Working independently		

Team work		
Working in an international environment		
Working in an interdisciplinary environment		
Production of new research ideas		
Project planning and management		
Respect for difference and multiculturalism		
Respect for the natural environment		
Showing social, professional and ethical responsibility and sensitivity to gender issues		
Criticism and self-criticism		
Production of free, creative and inductive thinking	x	

Others:

3.COURSE CONTENT

1. Introduction to Management
2. Planning
3. Organizing
4. Leading
5. Controlling

4.TEACHING AND LEARNING METHODS - ASSESSMENT

TEACHING METHOD *Face-to-face, Distance learning, etc.*	Face to face	x
	Distance learning (asynchronous)	
	Distance learning (synchronous)	
	Others:	
USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES *Use of ICT in teaching, laboratory education, communication with students*	Slides	x
	E-class	x
	Virtual (simulated) laboratory training	
	Others	

TEACHING ORGANIZATION

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

Δραστηριότητα	***Φόρτος Εργασίας Εξαμήνου***
Lectures	42
Tutorials	
Laboratory practice	
Essay writing	
Seminars	
Exersices	26
Project	
Study and analysis of bibliography	
Placements	
Clinical practice	
Art workshop	
Interactive teaching	
Educational visits	
Artistic creativity	
Private study	57
Others:	
Total number of hours for the Course (25 hours of work-load per ECTS credit)	***125 hours (total student work-load)***

STUDENT ASSESSEMNT

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

Written work, essay/report		
Problem solving		
Multiple choice questionnaires		
Final exam with Multiple choice questionnaires		
Oral examination		
Clinical examination of patient		

<table>
<tr>
<td><i>where they are accessible to students.</i></td>
<td>
<table>
<tr><td>Mid-term exam (concluding)</td><td></td><td></td></tr>
<tr><td>Final exam with developing questions</td><td>x</td><td>θεωρία, σύντομες μελέτες περίπτωσης</td></tr>
<tr><td>Public presentation</td><td></td><td></td></tr>
<tr><td>Mid-term exam (formative)</td><td></td><td></td></tr>
<tr><td>Laboratory work</td><td></td><td></td></tr>
<tr><td>Art interpretation</td><td></td><td></td></tr>
</table>

Others :
</td>
</tr>
</table>

5.RECOMMENDED LITERATURE

Χυτήρης Λ. (2013). Μάνατζμεντ - Αρχές Διοίκησης Επιχειρήσεων, Εκδόσεις Φαίδιμος.
Mullins L. και Christy G. (2014). Μάνατζμεντ και Οργανωσιακή Συμπεριφορά, Εκδόσεις

10th SEMESTER - 1st TRACK ELECTIVE COURSES

COURSE OUTLINE

1. GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	CIV_0275A	**SEMESTER**	10th
COURSE TITLE	PRINCIPLES OF SUSTAINABLE CONSTRUCTION		

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**
Theory	3	
Exercises		
TOTAL	**3**	**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, specialised general knowledge, skills development*	Specialised general knowledge & Skills Development
PREREQUISITE COURSES:	Prerequisite for the course is considered the understanding and consolidation of the content of the courses "*Structural Materials*" and "*Construction Project Management*"
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
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

39. *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*

40. *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
41. *Guidelines for writing Learning Outcomes*

The construction sector accounts for over 40% of total energy consumption in the EU and produces more than 35% of greenhouse gas emissions, while building materials consume 30-50% of the available raw materials worldwide and produce about 40% of landfill waste (OECD countries). In addition, an important parameter that is directly related to long-term environmental impact, in addition to technical and economic one, is the durability of materials and structures.

The aim of the course is to first highlight the size and extent of this issue (building materials, construction and environment) and its contribution in the creation and evolution of global phenomena, such as the greenhouse effect and climate change. It then develops and provides the student with methodological tools for qualitative and quantitative assessment of overall environmental impact, such as Life Cycle Analysis (LCA), also enhancing knowledge by listing methods for estimating the total service lifetime of structures and infrastructure. In addition to this general approach, the term “environmental cost” is presented and analyzed, which together with the financial cost and technical adequacy, give through optimization, the best possible solutions for the design and implementation of projects. Furthermore, specific techniques and materials for reducing environmental cost are presented, by applying principles of circular economy and industrial ecology.

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

- know what Life Cycle Analysis (LCA) is, and how this methodological tool works, but also how it is applied to various issues of selection of building materials, specific structures, etc., through appropriate software.
- be able to estimate the service lifetime of a structure (application in reinforced concrete); a property necessary according to the LCA.
- become familiar with methods / models of environmental assessment of structures.
- be able to calculate the fixed, operational and total environmental cost of building materials and structures, also knowing the respective regulations and instructions for sustainable construction.
- know the basic principles of circular economy and industrial ecology.
- have basic information on the use of supplementary cementing materials and industrial by-products in construction.
- know how the recycling of construction and demolition waste (CDW) is done.
- be informed about the possibilities of CO_2 capture in structures and contribution of structures in the mitigation of the climate change.

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

Project planning and management

Respect for difference and

the necessary technology *Adapting to new situations* *Decision-making* *Working independently* *Teamwork* *Working in an international environment* *Working in an interdisciplinary environment* *Production of new research ideas*	*multiculturalism* *Respect for the natural environment* *Showing social, professional and ethical responsibility and sensitivity to gender issues* *Criticism and self-criticism* *Production of free, creative and inductive thinking*

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Teamwork
Working in an international environment
Working in an interdisciplinary environment
Project planning and management
Respect for the natural environment

3. SYLLABUS

1. **Introduction and analysis of the subject of the course.** Environmental impact of the construction sector. Production of building materials (BM) and environmental footprint. Applications and use of BM and correlation with environmental cost. Participation of production and use of BM in climate change. Service life of structures. Methods and tools for environmental cost (EC) assessment. Directions for reduction of total environmental cost and current trends. Terminology.

2. **Life cycle analysis (LCA).** The LCA methodological framework. Definition of goal and scope. Life cycle inventory. Environmental impact assessment. Interpretation. LCA software tools. Evaluation and certification systems for sustainability of buildings (BREEAM, LEED, etc.).

3. **Estimation of service lifetime**. Durability of building materials. General mechanisms for reducing the durability of building materials and structures. Common mechanisms for reducing the durability of reinforced concrete. Service life estimation through prediction models.

4. **Environmental cost**. Fixed environmental cost (EC). Operational environmental cost. Total environmental cost. EC calculation and optimization. Review of regulations and guidelines for sustainable construction.

5. **EC reduction techniques and materials**. Principles of circular economy and industrial ecology. Design and brief reference to industrial building systems with the possibility of disassembly / reuse. Use of supplementary cementing materials and industrial products in construction ("green" substitutes for conventional

building materials: fly ash, slag, biomass ash, etc. – current situation in Greece). Recycling of construction and demolition waste (CDW) and legal framework. CO_2 capture in construction and mitigation of climate change.

6. **Application examples and case studies**. Calculation of service life of specific concrete structures made of reinforced concrete. Application of LCA in specific building materials and structures. LCA as part of policy making during the design phase. Implementation of certification systems for the viability of projects and buildings (BREEAM, LEED, etc.). Use of specific industrial by-products in construction. Proposals for the recycling of specific CDW streams (recycling of concrete, bricks, plasterboard, etc.).

4. TEACHING and LEARNING METHODS – EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face teaching of theory at the Lecture Room: three (3) hours per week.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Projection of presentations for teaching, software use for elaborating LCA (i.e., SimaPro) and software use for estimation of structure service life.
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*	See table below
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure*	Subject, during the semester (30%) Final written exam (70%): Short-answer questions / exercises and multiple-choice questionnaires.

Activity	***Semester workload***
Lectures	39 hours
Bibliography study and analysis	40 hours
Elaboration of semester Subject (or stand-alone study)	40 hours
Preparation and presentation of the Subject (or stand-alone study)	6 hours
Course total (25 hours of workload per credit)	***125***

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.*	The undertaking and elaboration of an **Implementation Work / Case Study** (named **Project**) that concerns a real project or activity is offered and encouraged. The Projects are assigned to groups of students (1-3 people), who are guided throughout the semester for their elaboration and are finally presented in front of all the students who have taken the course, and are evaluated. The relevant bibliography and guidelines for the implementation of the Projects are provided. Throughout the semester at a specific time, the Instructor together with all the groups analyze the problems encountered so that all students are familiar with how to face difficulties in conducting such studies. At the end of the semester each group submits a written report and at the same time presents the Project to all students who have taken the course. There is also an oral examination-evaluation by the Instructor. These Projects are optional, graded (oral examination and written report), and count by 30% in the Overall Grade, if of course the grade is higher than the written examination. If a student does not get such assignment, he / she takes a regular written final exam (100%).

5. ATTACHED BIBLIOGRAPHY

- *Suggested bibliography:*

A. Greek language:

1. V.G. Papadakis, *Principles of Sustainable Construction*, University Course Notes, University of Patras, Patras, 2022.
2. A. Dimoudi, *Ecological Building Materials*, Democritus University of Thrace, Xanthi, 2011.

B. English language:

3. C.J. Kibert, *Sustainable Construction: Green Building Design and Delivery*, 5th Edition, Wiley, 2022.
4. H.S. Matthews, C.T. Hendrickson, D. Matthews, *Life Cycle Assessment: Quantitative Approaches for Decisions that Matter*, 2014. Open access textbook, retrieved from https://www.lcatextbook.com/
5. *Life Cycle Assessment for Buildings: Why it matters and how to use it*, ebook, https://oneclicklca.drift.click/building-lca-ebook
6. M. Alexander, A. Bentur, S. Mindess, *Durability of Concrete - Design and Construction*, CRC Press, 2017.

- *Related academic journals:*
  - Building and Environment
  - Construction and Building Materials
  - Case Studies in Construction Materials
  - Developments in the Built Environment

- Sustainable Environment Research
- Resource-Efficient Technologies
- Journal of Cleaner Production
- Resources, Conservation and Recycling
- Waste Management

COURSE OUTLINE

1. GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	CIV_0274A	**SEMESTER**	10th
COURSE TITLE	BUILDING INFORMATION MODELING		

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**
Theory	3	
Exercises		
TOTAL	**3**	**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, specialised general knowledge, skills development*	Specialised general knowledge & Skills Development
PREREQUISITE COURSES:	Prerequisite for the course is considered the understanding and consolidation of the content of the courses *"Building construction", "Building Physics"* "*Structural Materials*" and "*Construction Project Management*"
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES (English version of the BIM software)
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 objectives of this course are:

The requirements of contemporary constructions are based both on the technical perfection and on their ability to minimize the construction costs as well as their environmental effects. The use of BIM software can significantly contribute to the optimization of the design, to the study of alternative scenarios of construction and to the better cooperation of the various specialties of engineers involved in the design and construction process.
The aim of the course is to introduce students to the holistic design of construction projects through their familiarity with BIM software.

Therefore, the general goal of the course is to provide the students with the necessary scientific knowledge to:
• design and configure building elements, taking into account all the necessary studies required to manage all possible construction issues that may arise from the assembly of the various building elements and installations,
• evaluate the selection and use of construction solutions and materials in terms of their impact on construction costs, energy costs and environmental costs, while providing quantitative assessment, analysis and optimization,
• optimize the planning and management of the construction of technical projects.

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

- recognize the BIM features,
- parameterize the building elements during the design phase in order to optimize the project planning and management and the construction process,
- be able to have control of all studies (architectural, structural, electromechanical) in a single three-dimensional model,
- be able to formulate alternative scenarios at the design stage in a BIM environment and to evaluate them in terms of economic, energy and environmental costs,
- set the parameters of building elements and building design in order to check the compliance of the building with the environmental assessment tools prerequisites (LEED, BREEAM etc.).

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

Respect for difference and multiculturalism

Adapting to new situations
Decision-making
Working independently
Teamwork
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Teamwork
Working in an international environment
Working in an interdisciplinary environment
Project planning and management
Respect for the natural environment

3. SYLLABUS

1. **Introduction and analysis of the subject of the course.** Introduction and analysis of the subject of the course. The BIM software application in the design, construction, and management of technical projects. Description of the features of BIM and a brief presentation of their working environment. Holistic design, structural system design, design of the water and sewage installations, 3D modelling, parametric design of library objects and building elements, introduction of construction details in the 3D model, construction costs, analysis tools, (sustainability assessment, LCA, analysis of lighting levels).
2. **Introduction to the work environment of BIM.**
   Navigation in floor plans, views, sections, 3D model. Creating floor levels, creating 3D views, creating floor plans, facades, sections, worksheets. Geolocation.
3. **Three-dimensional modelling and configuration I (**Building Geometry).
   Modification of geometry and parameterization of structural elements in the three-dimensional model. Openings, masonry walls, floors, flat roofs, inclined roofs, staircases, structural elements, grid design and adjustment. Customization of building equipment. Analysis in different scales.
4. **3D modeling and configuration II** (Load bearing structure).
   Reinforced concrete load bearing structure, Parameterization of elements (columns, beams, foundations). Steel load bearing structure and parameterization of the geometry and dimensions of the elements. Introduction and parameterization of prefabricated elements.
5. **3D modelling and configuration III** (Mechanical installations).

Heating, cooling, ventilation systems.

Configuration of the water supply and sewerage installation. Conflicts' checking.

6. **Estimation of materials' quantities.**

   Window schedules. Materials schedules per building element. Tables configuration.
7. **Cost assessment.**

   Cost data. Estimation of construction costs.
8. **Analysis of sustainability parameters.**

   Environmental footprint assessment, CO_2 emission assessment. Construction life cycle analysis, Analysis of the energy performance of the building and optimization.
9. **Case studies.**

   Study of a building and formation of alternative scenarios in order to compare them in terms of the sustainability of the construction. Implementation of certification requirements for the sustainability of projects and buildings (BREEAM, LEED, etc.). Case of a new building and case of a renovated building.

4. TEACHING and LEARNING METHODS – EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face teaching of theory at the Lecture Room: three (3) hours per week.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Projection of presentations for teaching, BIM software use (Revit, Archicad).

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-

Activity	*Semester workload*
Lectures	39 hours
Bibliography study and analysis	40 hours
Elaboration of semester Subject (or stand-alone study)	40 hours
Preparation and presentation of the Subject (or stand-alone study)	6 hours
Course total (25 hours of workload per credit)	***125***

directed study according to the principles of the ECTS	
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.*	Project assigned (50%) Final short exam (50%) The course includes the undertaking and elaboration of an **Implementation project / Case Study** that concerns a real building. The projects are assigned to groups of students (1-3 people), who are guided throughout the semester for their elaboration and are finally presented in front of all the students who have taken the course and are evaluated. The relevant bibliography and guidelines for the implementation of the Projects are provided. Throughout the semester at a specific time, the instructor together with all the groups analyze the problems encountered so that all students are familiar with how to face difficulties in conducting such studies. At the end of the semester each group submits a written report and at the same time presents the Project to all students who have taken the course. There is also an oral examination-evaluation by the instructor. These Projects are mandatory. The final score is obtained 50% form the project grade and 50% form a short exam.

5. ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

1. **ISO 19650-1:2018: Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) — Information management using building information modelling — Part 1: Concepts and principles.**

2. **Sacks R., Eastman Ch., Lee G., Teicholz P., BIM Handbook: A Guide to Building Information Modeling for Owners, Designers, Engineers, Contractors, and Facility Managers, 3rd Edition, 2018.**

3. **Sacks R., Korb S., Barak R., Building Lean, Building BIM, Improving Construction the Tidhar Way, Routledge, 2017. E-book, https://doi.org/10.1201/9781315300511.**

10th SEMESTER – 2rd TRACK ELECTIVE COURSES

10th SEMESTER – 3rd TRACK ELECTIVE COURSES

10th SEMESTER – 4th TRACK ELECTIVE COURSES

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	CIV_9811A & CIV_9812A	**SEMESTER**	9th and 10th
COURSE TITLE	DIPLOMA THESIS I AND II		

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**
		30
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*	Diploma Thesis
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek or English if the work (full or part time) has been developed in collaboration with a foreign University.
IS THE COURSE OFFERED TO ERASMUS STUDENTS	
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

42. *Description of the level of learning outcomes for each qualifications cycle,*

according to the Qualifications Framework of the European Higher Education Area

43. *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning*

and Appendix B

44. *Guidelines for writing Learning Outcomes*

In this work, the student deals with a topic of research and/or the application of study to analyse and synthesise data through exploring the chosen specialised field in-depth by:
1. Evaluating data from experiments or field measurements and developing concepts from the bibliography,
2. Processing data by using analytical simulations, related software or civil engineering processes and
3. Evaluating results of particular interest or those that have originality.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

After this work, the student acquires the ability to investigate a topic of expertise in-depth, using generated or collected data and resulting in conclusions that have originality and/or useful applications for civil engineering.

3. SYLLABUS

The student performs the diploma work (analysis, synthesis, research) in any subject matter of the taught courses in order to complete the chosen in-depth study.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Meetings with the supervisor who provides guidance, reviews progress and identifies weaknesses.
USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES	

<table>
<tr><td>Use of ICT in teaching, laboratory education, communication with students</td><td></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>Project</td><td>750</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Total number of hours for the course (25 hours of work-load per ECTS credit)</td><td>750</td></tr>
</table>
</td></tr>
<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>Evaluation of the dissertation and an oral examination of the student.</td></tr>
</table>

5. ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Related academic journals:

Depends on the explored theme.