DEPARTMENT OF CIVIL ENGINEERING

UNIVERSITY OF PATRAS

**UNDERGRADUATE STUDIES**

**COURSE OUTLINES 2023-24**

**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 5600 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 m2 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 m2. The staff of the Department consists of 22 faculty members, 15 Professors Emeriti, 2 Teaching Associates, 5 Technical Associates, and 6 administrative members. In addition, the Department employs teaching associates and academic fellows on a contract basis.

The Department consists of three Divisions, eight 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 Αˊ: Resilient Materials, Structures and Geotechnical Infrastructures*

*Specialization Bˊ: Hydraulic and Environmental Engineering for Sustainable Infrastructures*

*Specialization Cˊ: Intelligent Systems in Transportation and Construction Project Management*

* *Doctorate Degree (PhD) in Civil Engineering.*

Since the beginning of the Department postgraduate and doctorate programs, 549 postgraduate diplomas and 119 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 Α: **STRUCTURAL ENGINEERING**

Director: Prof. Theodore Karavasilis

Division Β: **GEOTECHNICAL AND HYDRAULIC ENGINEERING**

Director: Assoc. Prof. Andreas Langousis

Division C: **ENVIRONMENTAL ENGINEERING AND TRANSPORTATION**

Director: Prof. Ierotheos Zacharias

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

**LIST OF FACULTY MEMBERS OF THE DEPARTMENT**

**Professors**

Bousias Stathis

Dimas Athanasios

Horsch George

Karavasilis Theodore

Papadakis Vagelis

Triantafillou Thanasis

Zacharias Ierotheos

**Associate Professors**

Chassiakos Athanasios

Economou Polychronis

Kontoe Stavroula

Langousis Andreas

Manariotis Ioannis

Papanicolaou Corina

Petropoulou Eugenia

**Assistant Professors**

Christoforou Zoi

Favvata Maria

Pappas Chtristoforos

Pelekis Panagiotis

Perdiou Aggeliki

Sfakianakis Manolis

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 |
| 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 | Teaching Responsibility |
| Lect. | Lab |
| Applied Mathematics I | CIV\_1105 | 4 | 1 | 5 | 6 | Division A |
| Physics | CIV\_1131 | 4 | 0 | 4 | 5 | Department |
| Computer Programming and Applications | CIV\_2221 | 3 | 2 | 4 | 5 | Division C |
| Engineering Mechanics - Statics | CIV\_1215 | 4 | 0 | 4 | 6 | Division A |
| Technical and Electronic Drawing | CIV\_1709 | 3 | 3 | 4 | 5 | Division A |
| Foreign Language |  | 3 | 0 | 3 | 3 | Foreign Language Unit |
| TOTAL  (Weight Factor = 9.5) |  | 21 | 6 | 24 | 30 |  |

**2nd SEMESTER**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| TITLE | COURSE CODE | Hours / Week | | Teaching units | ECTS credits | Teaching Responsibility |
| Lect. | Lab |
| Applied Mathematics ΙΙ | CIV\_2110Α | 3 | 1 | 4 | 6 | Division A |
| Probability - Statistics | CIV\_2120Α | 3 | 1 | 4 | 6 | Division C |
| Introduction to Mechanics of Materials | CIV\_3217 | 4+1\* | 2 | 6 | 6 | Division A |
| Geology for Civil Engineers | CIV\_2138Α | 2 | 2 | 3 | 6 | Department |
| Building Technology | CIV\_3710Α | 4 | 2 | 5 | 6 | Division A |
| TOTAL  (Weight Factor = 8.5) |  | 17 | 8 | 22 | 30 |  |

The “+1” corresponds to recitation in addition to the lectures hours.

**3rd SEMESTER**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| TITLE | COURSE CODE | Hours / Week | | Teaching units | ECTS credits | Teaching Responsibility |
| Lect. | Lab |
| Applied Mathematics ΙΙΙ | CIV\_3115Α | 4 | 0 | 4 | 4 | Division Β |
| Numerical Methods | CIV\_3127Α | 3 | 2 | 4 | 4 | Division A |
| Mechanics of Materials | CIV\_4218 | 4 | 2 | 5 | 6 | Division A |
| Structural Materials | CIV\_4219 | 4 | 2 | 5 | 6 | Division A |
| Introduction to Geodesy | CIV\_3803 | 2 | 4+1\* | 5 | 6 | Division Β |
| Building Physics | CIV\_4711Α | 3 | 0 | 3 | 4 | Division A |
| TOTAL  (Weight Factor = 10.5) |  | 19 | 11 | 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 | Teaching Responsibility |
| Lect. | Lab |
| Analysis of Framed Structures | CIV\_5220Α | 4 | 0 | 4 | 6 | Division A |
| Dynamics - Vibrations | CIV\_2216 | 3 | 1 | 4 | 6 | Division A |
| Fluid Mechanics | CIV\_4410Α | 4 | 0 | 4 | 6 | Division B |
| Traffic Engineering | CIV\_5605Α | 4 | 1+1 | 6 | 6 | Division C |
| Environmental Chemistry | CIV\_4414 | 3+1 | 0 | 4 | 6 | Division C |
| TOTAL  (Weight Factor = 8) |  | 19 | 3 | 22 | 30 |  |

**5th SEMESTER**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| TITLE | COURSE CODE | Hours / Week | | Teaching units | ECTS credits | Teaching Responsibility |
| Lect. | Lab |
| Matrix Analysis of Framed Structures | CIV\_6221Α | 4 | 1 | 5 | 6 | Division A |
| Design of Steel Structural Components | CIV\_6235Α | 4 | 0 | 4 | 6 | Division A |
| Soil Mechanics I | CIV\_5310Α | 4 | 2 | 5 | 6 | Division B |
| Hydraulics | CIV\_5415Α | 4 | 2 | 5 | 6 | Division B |
| Water Treatment | CIV\_5505Α | 4 | 2+1 | 6 | 6 | Division C |
| TOTAL  (Weight Factor = 9.5) |  | 20 | 8 | 25 | 30 |  |

**6th SEMESTER**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| TITLE | COURSE CODE | Hours / Week | | Teaching units | ECTS credits | Teaching Responsibility |
| Lect. | Lab |
| Design of Reinforced Concrete Linear Elements | CIV\_6230Α | 4 | 2 | 5 | 6 | Division A |
| Design of Steel Structures | CIV\_7236 | 4 | 0 | 4 | 5 | Division A |
| Soil Mechanics II | CIV\_6315 | 4 | 0 | 4 | 5 | Division B |
| Hydrology | CIV\_6420 | 4 | 0 | 4 | 5 | Division B |
| Wastewater Treatment | CIV\_6510Α | 3+2 | 2+1 | 6 | 6 | Division C |
| Technical Terminology in English |  | 3 | 0 | 3 | 3 | Foreign Language Unit |
| TOTAL  (Weight Factor = 10) |  | 24 | 5 | 26 | 30 |  |

**7th SEMESTER**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| TITLE | COURSE CODE | Hours / Week | | Teaching units | ECTS credits | Teaching Responsibility |
| Lect. | Lab |
| Structural Dynamics | CIV\_8223Α | 4 | 0 | 4 | 6 | Division A |
| Design of Planar Reinforced Concrete Elements | CIV\_7231Α | 4 | 0 | 4 | 6 | Division A |
| Foundation Engineering | CIV\_7320Α | 4 | 0 | 4 | 6 | Division B |
| Harbour Works Analysis and Design | CIV\_0480Α | 4 | 0 | 4 | 6 | Division B |
| Road Design and Construction | CIV\_7610Α | 4 | 0 | 4 | 6 | Division C |
| TOTAL  (Weight Factor = 7.5) |  | 20 | 0 | 20 | 30 |  |

**8th SEMESTER**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| TITLE | COURSE CODE | Hours / Week | | Teaching units | ECTS  credits | Teaching Responsibility |
| Lect. | Lab |
| Structural Analysis with the Finite Element Method | CIV\_7222Α | 4 | 2 | 5 | 7 | Division A |
| Design of Water Distribution, Sewage and Rainwater Drainage Networks | CIV\_8435Α | 4 | 0 | 4 | 6 | Division B |
| Construction Project  Management | CIV\_5716Α | 4 | 2 | 5 | 7 | Division C |
| Track Core Course |  |  |  | 3-4 | 5 |  |
| Track Elective Course |  |  |  | 3-4 | 5 |  |
| TOTAL  (Weight Factor = 8.5) |  |  |  | 18-20 | 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 | Teaching Responsibility |
| Lect. | Lab |
| **1st Track: “Structural Engineering”** | | | | | | |
| Design of Reinforced Concrete Structures | CIV\_8232Α | 4 | 0 | 4 | 5 | Division A |
| **2nd Track: “Geotechnical Engineering – Infrastructure Works”** | | | | | | |
| Geotechnical Erthquake Engineering | CIV\_8355Α | 3 | 0 | 3 | 5 | Division B |
| **3rd Track: “Hydraulic Engineering – Environmental Engineering”** | | | | | | |
| Environmental Impact Assessment Studies of Technical Works | CIV\_9560Α | 3 | 0 | 3 | 5 | Division C |
| **4th Track: “Sustainable Transportation and Project Management Systems”** | | | | | | |
| Transportation Systems  Analysis and Design I | CIV\_8665Α | 3 | 0 | 3 | 5 | Division C |

**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 | Teaching Responsibility |
| Lect. | Lab |
| Composite Structures | CIV\_9269Α | 3 | 0 | 3 | 5 | Division A |
| Earthquake Engineering and Earthquake Resistant Structures | CIV\_9255Α | 3 | 0 | 3 | 5 | Division A |

**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 | Teaching Responsibility |
| Lect. | Lab |
| Geotechnical Site Exploration Methods | CIV\_9371Α | 2 | 2+1 | 4 | 5 | Division B |
| Selected Topics in Foundation Engineering | CIV\_8371Α | 3 | 0+1 | 4 | 5 | Division B |
| Geodesy | CIV\_8356A | 2 | 3+1 | 4 | 5 | Division B |
| Earthquake Engineering and Earthquake Resistant Structures | CIV\_9255Α | 3 | 0 | 3 | 5 | Division A |

**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 | Teaching Responsibility |
| Lect. | Lab |
| Hydrodynamics of Bays and Reservoirs | CIV\_8455Α | 3 | 0 | 3 | 5 | Division B |
| Computational Hydraulics | CIV\_8460A | 3 | 0 | 3 | 5 | Division B |
| Renewable Energy Hydraulic Systems | CIV\_8461A | 3 | 0 | 3 | 5 | Division B |
| Groundwater | CIV\_9470A | 3 | 0 | 3 | 5 | Division B |

**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 | Teaching Responsibility |
| Lect. | Lab |
| Construction Project Organization and Management | CIV\_0683Α | 3 | 0 | 3 | 5 | Division C |
| Smart Cities, Infrastructure and Transportation | CIV\_8658A | 2 | 4 | 4 | 5 | Division C |
| Environmental Impact Assessment Studies of Technical Works | CIV\_9560Α | 3 | 0 | 3 | 5 | Division C |

**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 Ι  (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 ΙI  (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 | Teaching Responsibility |
| Lect. | Lab |
| Advanced Mechanics of Materials | CIV\_8270Α | 3 | 0 | 3 | 5 | Division A |
| Design of Concrete Bridges | CIV\_9260Α | 3 | 0 | 3 | 5 | Division A |
| Repair and Strengthening of Reinforced Concrete Structures | CIV\_9263Α | 3 | 0 | 3 | 5 | Division A |
| Theory of Plates and Shells | CIV\_0268Α | 3 | 0 | 3 | 5 | Division A |
| External Elective Course Track\_1\_1 | CIV\_9111Α | 3 | 0 | 3 | 5 |  |
| External Elective Course Track\_1\_2 | CIV\_9112Α | 3 | 0 | 3 | 5 |  |
| External Elective Course Track\_1\_3 | CIV\_9113Α | 3 | 0 | 3 | 5 |  |
| External Elective Course Track\_1\_4 | CIV\_9114Α | 3 | 0 | 3 | 5 |  |

9**th SEMESTER - 2nd TRACK ELECTIVE COURSES**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| TITLE | COURSE CODE | Hours / Week | | Teaching units | ECTS credits | Teaching Responsibility |
| Lect. | Lab |
| Geology of Technical Works and Rock Mechanics | CIV\_8357A | 3 | 0 | 3 | 5 | Department of Geology |
| Computational Geotechnical Engineering | CIV\_9372Α | 3 | 0 | 3 | 5 | Division B |
| Geodetic Applications | CIV\_9810Α | 3 | 0+1 | 4 | 5 | Division B |
| Advanced Mechanics of Materials | CIV\_8270Α | 3 | 0 | 3 | 5 | Division A |
| Hydraulic and Flood Control Structures | CIV\_7430Α | 3 | 0 | 3 | 5 | Division B |
| Coastal Hydraulics | CIV\_9485A | 3 | 0 | 3 | 5 | Division B |
| External Elective Course Track\_2\_1 | CIV\_9121Α | 3 | 0 | 3 | 5 |  |
| External Elective Course Track\_2\_2 | CIV\_9122Α | 3 | 0 | 3 | 5 |  |
| External Elective Course Track\_2\_3 | CIV\_9123Α | 3 | 0 | 3 | 5 |  |
| External Elective Course Track\_2\_4 | CIV\_9124Α | 3 | 0 | 3 | 5 |  |

9**th SEMESTER - 3rd TRACK ELECTIVE COURSES**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| TITLE | COURSE CODE | Hours / Week | | Teaching units | ECTS credits | Teaching Responsibility |
| Lect. | Lab |
| Laboratory Topics in Hydraulic Engineering | CIV\_9480A | 2 | 2 | 3 | 5 | Division B |
| Hydraulic and Flood Control Structures | CIV\_7430Α | 3 | 0 | 3 | 5 | Division B |
| Coastal Hydraulics | CIV\_9485A | 3 | 0 | 3 | 5 | Division B |
| Natural Wastewater Treatment Systems | CIV\_9576Α | 3 | 0 | 3 | 5 | Division C |
| Pollution of Inland and Coastal Waters | CIV\_8558A | 3 | 0 | 3 | 5 | Division C |
| Environmental Measurements | CIV\_9562Α | 2 | 2 | 3 | 5 | Division C |
| External Elective Course Track\_3\_1 | CIV\_9131Α | 3 | 0 | 3 | 5 |  |
| External Elective Course Track\_3\_2 | CIV\_9132Α | 3 | 0 | 3 | 5 |  |
| External Elective Course Track\_3\_3 | CIV\_9133Α | 3 | 0 | 3 | 5 |  |
| External Elective Course Track\_3\_4 | CIV\_9134Α | 3 | 0 | 3 | 5 |  |

9**th SEMESTER - 4th TRACK ELECTIVE COURSES**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| TITLE | COURSE CODE | Hours / Week | | Teaching units | ECTS credits | Teaching Responsibility |
| Lect. | Lab |
| Transportation Infrastructure Management | CIV\_9670A | 3 | 0 | 3 | 5 | Division C |
| Environmental Measurements | CIV\_9562Α | 2 | 2 | 3 | 5 | Division C |
| Geodetic Applications | CIV\_9810Α | 3 | 0+1 | 4 | 5 | Division B |
| Systems and Technologies for Digital and Smart Cities | CIV\_9671Α | 3 | 0 | 3 | 5 | Division C |
| External Elective Course Track\_4\_1 | CIV\_9141Α | 3 | 0 | 3 | 5 |  |
| External Elective Course Track\_4\_2 | CIV\_9142Α | 3 | 0 | 3 | 5 |  |
| External Elective Course Track\_4\_3 | CIV\_9143Α | 3 | 0 | 3 | 5 |  |
| External Elective Course Track\_4\_4 | CIV\_9144Α | 3 | 0 | 3 | 5 |  |

**9th SEMESTER - EXTERNAL ELECTIVE COURSES**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| TITLE | COURSE CODE | Hours / Week | | Teaching units | ECTS credits | Teaching Responsibility |
| Lect. | Lab |
| Introduction to Financial Science for Engineers and Scientists | CIV\_0711Α | 3 | 0 | 3 | 5 | Department of Economics |
| Introduction to Business Administration for Engineers and Scientists | CIV\_0712Α | 3 | 0 | 3 | 5 | Department of Business Administration |

**10th SEMESTER - 1st TRACK ELECTIVE COURSES**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| TITLE | COURSE CODE | Hours / Week | | Teaching units | ECTS credits | Teaching Responsibility |
| Lect. | Lab |
| Design of Reinforced Concrete Structures\* | CIV\_8232Α | 4 | 0 | 4 | 5 | Division A |
| Composite Structures | CIV\_9269Α | 3 | 0 | 3 | 5 | Division A |
| Earthquake Engineering and Earthquake Resistant Structures | CIV\_9255Α | 3 | 0 | 3 | 5 | Division A |
| Principles of Sustainable Construction | CIV\_0275A | 3 | 0 | 3 | 5 | Division A |
| Design of Energy Efficient Buildings | CIV\_0276Α | 3 | 0 | 3 | 5 | Division A |
| External Elective Course Track\_1\_5 | CIV\_9115Α | 3 | 0 | 3 | 5 |  |
| External Elective Course Track\_1\_6 | CIV\_9116Α | 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 | Teaching Responsibility |
| Lect. | Lab |
| Geotechnical Erthquake Engineering\* | CIV\_8355Α | 3 | 0 | 3 | 5 | Division B |
| Geotechnical Site Exploration Methods | CIV\_9371Α | 2 | 2 | 3 | 5 | Division B |
| Selected Topics in Foundation Engineering | CIV\_8371Α | 3 | 0+1 | 4 | 5 | Division B |
| Earthquake Engineering and Earthquake Resistant Structures | CIV\_9255Α | 3 | 0 | 3 | 5 | Division A |
| Groundwater | CIV\_9470A | 3 | 0 | 3 | 5 | Division B |
| External Elective Course Track\_2\_5 | CIV\_9125Α | 3 | 0 | 3 | 5 |  |
| External Elective Course Track\_2\_6 | CIV\_9126Α | 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 | Teaching Responsibility |
| Lect. | Lab |
| Environmental Impact Assessment Studies of Technical Works\* | CIV\_9560Α | 3 | 0 | 3 | 5 | Division C |
| Hydrodynamics of Bays and Reservoirs | CIV\_8455Α | 3 | 0 | 3 | 5 | Division B |
| Computational Hydraulics | CIV\_8460A | 3 | 0 | 3 | 5 | Division B |
| Renewable Energy Hydraulic Systems | CIV\_8461A | 3 | 0 | 3 | 5 | Division B |
| Groundwater | CIV\_9470A | 3 | 0 | 3 | 5 | Division B |
| External Elective Course Track\_3\_5 | CIV\_9135Α | 3 | 0 | 3 | 5 |  |
| External Elective Course Track\_3\_6 | CIV\_9136Α | 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 | Teaching Responsibility |
| Lect. | Lab |
| Transportation Systems Analysis and Design I\* | CIV\_8665Α | 3 | 0 | 3 | 5 | Division C |
| Construction Project Organization and Management | CIV\_0683Α | 3 | 0 | 3 | 5 | Division C |
| Smart Cities, Infrastructure and Transportation | CIV\_8658A | 3 | 0 | 3 | 5 | Division C |
| Environmental Impact Assessment Studies of Technical Works | CIV\_9560Α | 3 | 0 | 3 | 5 | Division C |
| Design of Energy Efficient Buildings | CIV\_0276Α | 3 | 0 | 3 | 5 | Division A |
| External Elective Course Track\_4\_5 | CIV\_9145Α | 3 | 0 | 3 | 5 |  |
| External Elective Course Track\_4\_6 | CIV\_9146Α | 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** | Νο | | | | |
| **COURSE WEBPAGE (URL)** | https://eclass.upatras.gr/courses/CIV1657/ | | | | |

1. **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. | |

1. **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 |

1. **TEACHING AND LEARNING METHODS - EVALUATION**

|  |  |
| --- | --- |
| **DELIVERY** *Face-to-face, Distance learning, etc.* | 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. |
| **USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY** *Use of ICT in teaching, laboratory education, communication with students* | Teaching of a computer algebra system in the computing center |
| **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 (3 conduct hours per week x 13 weeks) | 39 | | Exercises of representative problems (1 conduct hour per wk x 13 wks) | 13 | | Laboratory work (1 conduct hours per week x 13 weeks) | 13 | | Final examination | 4 | | Hours for private study of the student and preparation of home-works | 81 | | ***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.* | 1. Final written examination. 2. Laboratory examination. |

1. **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. Ι. University Editions of Crete, 2009. 4. Papadakis, K. E., “Applied Mathematics & *Mathematica*”. Tziolas Editions, Thessaloniki, 2015 (in Greek). |

**COURSE OUTLINE**

1. **GENERAL**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **SCHOOL** | ENGINEERING | | | | |
| **ACADEMIC UNIT** | CIVIL ENGINEERING | | | | |
| **LEVEL OF STUDIES** | UNDERGRADUATE | | | | |
| **COURSE CODE** | CIV\_1131 | **SEMESTER** | | 1st | |
| **COURSE TITLE** | 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 | | | 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* | Background course | | | | |
| **PREREQUISITE COURSES:** | - | | | | |
| **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/CIV1651/> | | | | |

1. **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 | |

1. **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 |

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

1. **ATTACHED BIBLIOGRAPHY**

|  |
| --- |
| 1) Physics ΙΙ, 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](http://www.upatras.gr/en/departments) | | | | |
| **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** |
| lectures, laboratory exercises | | | 5 | | 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:** | None | | | | |
| **LANGUAGE OF INSTRUCTION and EXAMINATIONS:** | Greek | | | | |
| **IS THE COURSE OFFERED TO ERASMUS STUDENTS** | Yes | | | | |
| **COURSE WEBSITE (URL)** | https://eclass.upatras.gr/courses/CIV1613/ | | | | |

1. **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*  *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 * Search for, analysis and synthesis of data and information, with the use of the necessary technology | |

1. **SYLLABUS**

|  |
| --- |
| 1. Introduction to MATLAB 2. Numerical operations, build-in functions and variables 3. Script files, keeping a record (diary) 4. Logical functions 5. Control flows 6. Data input-output 7. Loop Control Statements 8. Basic plotting 9. Functions (.m files) 10. Polynomials 11. Arrays, matrices 12. Symbolic Math Toolbox 13. MuPAD |

1. **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 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 | 39 | | Laboratory practice | 26 | | Individual study | 43 | | ***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.* | Laboratory exam for the use of MATLAB which includes:  - Multiple choice questions  - Short answer questions  - Development questions  - Problem solving |

1. **ATTACHED BIBLIOGRAPHY**

|  |
| --- |
| *- Suggested bibliography:*  *- Related academic journals:*  • 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. |

**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/ | | | | |

1. **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* | |

1. **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 |

1. **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*  *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.* | Three intermediate exams (30%)  Final Exam (70%) |

1. **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 Α 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/ | | | | |

1. **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* | |

1. **SYLLABUS**

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| * + 1. *Introduction to basic technical drawing for representation of objects and structural elements.*     2. *Elements of projective geometry*     3. *Organizing the design, standardization, symbols, dimensions*     4. *Drawing facets, plans, sections and other details.*     5. *Introduction to AutoCAD.*     6. *Preparation of designs. Drawing strategies.*     7. *Basic commands in AutoCAD.*     8. *Design organization in layers.*     9. *Block of design objects.*     10. *Creating (designing) facets, plans ,sections and other details in AutoCAD.*     11. *Inserting dimensions in designs.*     12. *Text in designs.*     13. *Setting scales for printing. Printing of designs.* |

1. **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, 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 (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 preparation of home-works | 125 -47 =78 | | ***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. |

1. **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. **GENERAL**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **SCHOOL** | ENGINEERING | | | | |
| **DEPARTMENT** | CIVIL ENGINEERING | | | | |
| **LEVEL OF STUDIES** | UNDERGRADUATE | | | | |
| **COURSE CODE** | CIV\_1155 | **SEMESTER** | | 1st | |
| **COURSE TITLE** | ENGLISH | | | | |
| **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)** | <https://eclass.upatras.gr/courses/CIV1800/> | | | | |

1. **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* | |
| **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…*  *…….* |
| HAVING COMPLETED THE COURSE SUCCESSFULLY STUDENTS WILL BE COMPETENT IN:   1. USING THE ENGLISH LANGUAGE CORRECTLY 2. USING BASIC STRUCTURES CHARACTERISTIC TO THE BASIC STRUCTURES OF SCIENTIFIC/ACADEMIC ENGLISH 3. COMMUNICATING/HOLDING A CONVERSATION IN ENGLISH 4. READING AND COMPREHENDING SIMPLE ENGLISH MATERIAL, DIRECTIONS AND INSTRUCTIONS RELATED TO CIVIL ENGINEERING 5. COMMUNICATING/HOLDING A SIMPLE CONVERSATION IN ENGLISH AT CIVIL ENGINEERING SETTINGS WITH FELLOW ENGLISH-SPEAKING STUDENTS 6. USING/UNDERSTANDING BASIC ENGLISH CIVIL ENGINEERING TERMINOLOGY | |

1. **SYLLABUS**

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| * + - 1. WRITTEN AND ORAL EXERCISE WORK FOR UNDERSTANDING AND COMPREHENSION OF CONCEPTS, FOUND IN TEXT MATERIAL AND OTHER HAND-OUTS DISTRIBUTED IN CLASS       2. RULES/EXERCISE WORK/ EXERCISE WORK FOR PRONUNCIATION ENHANCEMENT OF ENGLISH—AUDIO-VISUAL, LISTENING EXERCISE WORK FOUND IN THE TEXT MATERIAL AND IN MATERIAL BROUGHT TO CLASS BY THE INSTRUCTOR. CARRYING OUT/CREATING DIALOGS BETWEEN STUDENTS AND INSTRUCTOR OR BETWEEN/AMONG STUDENTS       3. EXERCISE WORK, -YES/NO, TRUE/FALSE, FILL-N THE BLANKS QUESTIONS’ FOR ENHANCEMENT OF OVERALL WRITING SKILLS IN ENGLISH AND FOR TRANSITIONING INTO SCIENTIFIC ENGLISH AND CIVIL ENGINEERING TERMINOLOGY |

1. **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 students* | 1. E-CLASS FOR: GENERAL COURSE RELATED ANNOUNCEMENTS AND COURSE MATERIAL 2. STUDENT ACCESS TO INSTRUCTOR’S E-MAIL FOR EMERGENCY COMMUNICATION. 3. IN-CLASS ACCESS OF ON-LINE COURSE RELATED WEB MATERIAL, E.G. TECHNICAL TERMINOLOGY DICTIONARIES |
| **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* | |  |  | | --- | --- | | ***Teaching Method*** | ***Semester Workload*** | | PRESENTATION BY INSTRUCTOR | 30% | | STUDENT IN-CLASS PARTICIPATION; READING OF CLASS MATERIAL, EXERCISE WORK, DISCUSSION/ORAL PRESENTATIONS | 50% | | IN-CLASS STUDENT GROUP WORK/PROJECTS | 20% | | ***Total number of hours for the Course*** | ***100%***  ***75*** | |
| **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 ASSESSMENT: ENGLISH  80% OF GRADE IS BASED ON FINAL WRITTEN EXAMINATION, ALL IN ENGLISH; FILL-IN THE BLANKS, LABEL THE DIAGRAMS, READ SHORT PASSAGE AND ANSWER SHORT ANSWER-TYPE QUESTIONS.  20% OF GRADE IS BASED ON OVERALL CLASS PERFORMANCE THROUGHOUT THE SEMESTER AT ALL LEVELS OF THE ENGLISH LANGUAGE LEARNING PROCESS.  LANGUAGE OF INSTRUCTION: 75% ENGLISH, 25% GREEK. (MAY BE 100% IN ENGLISH WHEN NON-GREEK SPEAKING STUDENTS, E.G. ERASMUS PROGRAM STUDENTS, ARE ENROLLED IN THE COURSE). |

1. **ATTACHED BIBLIOGRAPHY**

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| --- |
| **1. ENGLISH GRAMMAR & STRUCTURE REVIEW--A SMOOTH TRANSITION TO CIVIL ENGINEERING.** MATINA STAMISON-ATMATZIDI. ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΣΗΜΕΙΩΣΕΙΣ.  **2. SCIENTIFIC ENGLISH STRUCTURE & STYLE-**CONTEXTUALIZED FOR CIVIL ENGINEERING. MATINA STAMISON-ATMATZIDI. KLIDARITHMOS PUBLISHERS. 1996, 2006  3. **GETTING FAMILIAR WITH ENGLISH**. ELENI KOLETHRA. ΕΚΔΟΣΕΙΣ ΝΕΩΝ ΤΕΧΝΟΛΟΓΙΩΝ. 2002.  4. Αγγλικά των Επιστημών: Εισαγωγή στην Επιστήμη των Μηχανικών, Μηχανολόγων Μηχανικών, Ηλεκτρολόγων Μηχανικών, Πληροφορικής και Δεξιότητες Γραφής και Έρευνας  [Dunn Marian](http://www.brokenhill.com.cy/authors/dunn-marian/), [Fitzgerald Patrick](http://www.brokenhill.com.cy/authors/fitzgerald-patrick/), [Howey David](http://www.brokenhill.com.cy/authors/howey-david/), [Ilic Amanda](http://www.brokenhill.com.cy/authors/ilic-amanda/), [McCullagh Marie](http://www.brokenhill.com.cy/authors/mccullagh-marie/), [Smith Roger](http://www.brokenhill.com.cy/authors/smith-roger/), [Tabor Carol](http://www.brokenhill.com.cy/authors/tabor-carol/), Εκδόσεις Broken Hill Publishers LTD |

**2nd SEMESTER**

**COURSE OUTLINE**

**1. GENERAL**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **SCHOOL** | ENGINEERING | | | | |
| **ACADEMIC UNIT** | CIVIL ENGINEERING | | | | |
| **LEVEL OF STUDIES** | UNDERGRADUATE | | | | |
| **COURSE CODE** | CIV\_2110Α | **SEMESTER** | | SECOND | |
| **COURSE TITLE** | APPLIED MATHEMATICS 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, seminars and laboratory work | | | 3+1 | | 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:** | 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". | | | | |
| **LANGUAGE OF INSTRUCTION and EXAMINATIONS:** | Greek | | | | |
| **IS THE COURSE OFFERED TO ERASMUS STUDENTS** | No | | | | |
| **COURSE WEBSITE (URL)** | <https://eclass.upatras.gr/courses/CIV1554/> | | | | |
|  |  | | | | |

**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 | |

1. **SYLLABUS**

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| --- |
| 1. Continuity at a point and in a region of multivariable functions. 2. Partial derivative and differentiability of functions of several variables 3. Functional determinant and implicit functions 4. Taylor expansion 5. Extremum points and conditional extremum points 6. Vector Analysis 7. Dot, cross and mixed product of vectors 8. Curves in space, Frenet formulas, Surfaces 9. Hamilton operator, directional derivative, vector operators 10. Multiple integrals, curve and surface integrals, Green’s, Gauss’ and Stokes’ theorems. |

1. **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* | |  |  | | --- | --- | | ***Activity*** | ***Semester workload*** | | Lectures | 39 | | Laboratory | 13 | | Preparation of home-works | 40 | | Hours of private study | 58 | |  |  | |  |  | |  |  | |  |  | |  |  | | 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.* | Ι. Final written examination (80%)  ΙΙ. Laboratory examination (20%) |

1. **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](http://www.upatras.gr/en/departments) | | | | |
| **COURSE CODE** | CIV\_2120Α | **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** |
| lectures, laboratory exercises | | | 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/ | | | | |

1. **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…*  *…….* |
| * Working independently * Team work * Search for, analysis and synthesis of data and information, with the use of the necessary technology | |

1. **SYLLABUS**

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| --- |
| 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.   1. **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.   1. **Useful distribution models**   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 ΙΙΙ, log Pearson type III).).   1. **Descriptive statistics**   Arithmetic measures, graphical methods of exploratory data analysis, use of the Minitab package.   1. **Sampling distributions and estimation**   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.   1. **Tests of hypotheses**   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.   1. **Simple linear regression and correlation**   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. |

1. **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 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 | 39 | | laboratory practice | 12 | | Individual study | 99 | | **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.* | I. Written final exam (80%) which includes:  - Multiple choice questions  - Short answer questions  - Development questions  - Problem solving  II. Laboratory test (20%) for MINITAB use including:  - Multiple choice questions  - Short answer questions  - Development questions  - Problem solving |

1. **ATTACHED BIBLIOGRAPHY**

|  |
| --- |
| *- Suggested bibliography:*  *- Related academic journals:*   * “Applied probability and statistics”, Ι.Α. Koutrouvelis, Ekdoseis Gotsis, 2015. (In Greek) * “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. |

**COURSE OUTLINE**

1. **GENERAL**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **SCHOOL** | ENGINEERING | | | | |
| **ACADEMIC UNIT** | CIVIL ENGINEERING | | | | |
| **LEVEL OF STUDIES** | UNDERGRADUATE | | | | |
| **COURSE CODE** | CIV\_3217 | **SEMESTER** | | 2nd | |
| **COURSE TITLE** | INTRODUCTION TO 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 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 not prerequisite course.  Essentially, the students should possess knowledge based on the course “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/CIV1514/ | | | | |

1. **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 | |

1. **SYLLABUS**

|  |
| --- |
| 1. 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. 2. 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. 3. 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. 4. Transformations of stresses and strains from one coordinate system to another. 5. Basic concepts of theories of failure of materials. Introduction to the theory of torsion (cylindrical axial members under pure torsion). |

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

|  |  |
| --- | --- |
| **DELIVERY** *Face-to-face, Distance learning, etc.* | Face-to-face in class and in lab |
| **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 electronic 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 | 30 | | Laboratory exercises | 30 | | Series of individual technical reports (short projects) based on the laboratory exercises | 30 | | Individual study | 60 | | 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.* | For 1st-year students: 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.  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. |

1. **ATTACHED BIBLIOGRAPHY**

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| *- 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 FOUNTASΣ (Εd.). 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**

**GENERAL**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **SCHOOL** | Engineering | | | | |
| **ACADEMIC UNIT** | Civil Engineering | | | | |
| **LEVEL OF COURSE** | [Undergraduate](http://www.upatras.gr/en/departments) | | | | |
| **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/> | | | | |

**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 |

**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 |

**TEACHING AND LEARNING METHODS - EVALUATION**

|  |  |
| --- | --- |
| **DELIVERY** *Face-to-face, Distance learning, etc.* | Face to face and Distance learning |
| **USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY** *Use of ICT in teaching, laboratory education, communication with students* | * 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 |
| **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) | 2×13=26 | | Laboratory work on rock recognition and map understanding focusing in the application of geological methodologies (in small student groups) | 26 | | Autonomous study | 98 | | **Total number of hours for the Course** | **150 hours** | |
| **STUDENT PERFORMANCE EVALUATION**  *Description of the evaluation procedure*  *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other*  *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.* | **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  **ΙΙ.** 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). |

**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\_3710Α | **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.   1. 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.   1. 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.   1. 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.   1. 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).   1. Forms of vertical access routes:   Types and design of stairs. Ramps. Elevators.   1. Internal partitions, linings, coatings, finishes:   Drywall construction. Drywall finishing. Typical drywall details.   1. Installations and services:   Mechanical, Electrical, Plumbing   1. 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**

|  |  |
| --- | --- |
| **DELIVERY** *Face-to-face, Distance learning, etc.* | Face-to-face in class, with support of PowerPoint presentations. Lab with applications of theory and tutorials with solving examples / exercises. |
| **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 |
| **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 and labwork | 85 | | Laboratory exercises | 30 | | Series of individual technical reports (short projects) based on the laboratory exercises  Individual study | 30  60 | | 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.* | 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). |

**5. ATTACHED BIBLIOGRAPHY**

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| --- |
| *-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\_3115Α | **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 EXAMINATIONS:** | Greek. However, teaching may be in English for foreign (Erasmus) students attending the course. | | | | |
| **IS THE COURSE OFFERED TO ERASMUS STUDENTS** | Υes | | | | |
| **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> | | | | |

* 1. **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 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) (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* | |

* 1. **SYLLABUS**

|  |  |
| --- | --- |
| The course covers basic notions of differential equations and methods for their solution. More precisely the course covers:   1. Basic notions of ODEs, 1st order ODEs, orthogonal trajectories. 2. Linear ODEs of higher order, homogeneous and nonhomogeneous 3. Systems of ODEs. Basic notions. Solution by means of eigenvalues and eigenvectors. 4. Basic notions of PDEs. 5. Laplace transform and its application to the solution of ODEs and PDEs. 6. Fourier transform and its application to the solution of ODEs and PDEs. 7. Boundary value problems and eigenvalue problems. Fourier series. 8. Solution of PDEs using the separation of variables method. 9. Applications of ODES, systems of ODEs and PDEs to problems of Civil Engineering. |  |

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

* 1. **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. | *- Suggested bibliography:*  *- Related academic journals:* |

**COURSE OUTLINE**

1. **GENERAL**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **SCHOOL** | ENGINEERING | | | | |
| **ACADEMIC UNIT** | CIVIL ENGINEERING | | | | |
| **LEVEL OF STUDIES** | UNDERGRADUATE | | | | |
| **COURSE CODE** | CIV\_3127Α | **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/> | | | | |

1. **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 | |

1. **SYLLABUS**

|  |
| --- |
| 1. Algebraic equations root finding and iterative solution methods for non-linear simultaneous equations 2. Gaussian elimination, partial pivoting, iterative methods Gauss-Seidel and over-relaxation, algebraic eigenvalue problems 3. Numerical integration 4. Interpolation and curve fitting 5. Numerical solution of ordinary differential equations, Taylor - Euler - Runge-Kutta methods - Midpoint rule - multistep and predictor-corrector methods 6. Numerical instability 7. Two-point boundary value problems, finite differences and shooting methods |

1. **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* | Computing environment of Matlab  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* | |  |  | | --- | --- | | ***Activity*** | ***Semester workload*** | | Lectures | 39 | | Laboratory | 26 | | Preparation of home-works | 13 | | Hours of private study | 22 | |  |  | | Course total | ***100*** | |
| **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.* | Ι. Final written examination (80%)  ΙΙ. Laboratory examination (20%) |

1. **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** | Υes | | | | |
| **COURSE WEBSITE (URL)** | https://eclass.upatras.gr/courses/CIV1501/ | | | | |

1. **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 | |

1. **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. |

1. **TEACHING AND LEARNING METHODS - EVALUATION**

|  |  |
| --- | --- |
| **DELIVERY** *Face-to-face, Distance learning, etc.* | Lectures: In the classroom  Laboratory: In the Structural Materials Laboratory |
| **USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY** *Use of ICT in teaching, laboratory education, communication with students* | Use of simple computer software for laboratory exercises, interaction with students through 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* | |  |  | | --- | --- | | ***Activity*** | ***Work Load per Semester (hours)*** | | Lectures | 52 | | Laboratory | 26 | | Self-study and preparation of Lab. assignments | 72 | | ***Total number of hours for the Course***  ***(25 hours of work-load per ECTS credit)*** | ***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.* | 1. Final written examination (70%) on problem solving 2. Laboratory assignments (10%) 3. Mid-term examination (20%) on problem solving |

1. **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/ | | | | |

1. **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 | |

1. **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. |

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

|  |  |
| --- | --- |
| **DELIVERY** *Face-to-face, Distance learning, etc.* | Face-to-face in class and in lab |
| **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 electronic 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 | 30 | | Laboratory exercises | 30 | | Series of individual technical reports (short projects) based on the laboratory exercises | 30 | | Individual study | 60 | | 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.* | For2nd-yearstudents: 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 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. |

1. **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/ | | | | |

1. **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. | |

1. **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). |

1. **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* | |  |  | | --- | --- | | ***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 | |
| **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 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. |

1. **ATTACHED BIBLIOGRAPHY**

|  |
| --- |
| Notes on the e-class platform  Books selected through the EYDOXOS system (in alphabetical order):  **Γεωδαισία Ι: Γεωδαιτικές μετρήσεις και υπολογισμοί**  Σαββαϊδης 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\_4711Α | **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:   1. determine the external and internal environmental conditions of a building and their effects on the design of its shell; 2. calculate the transient thermal conductivity coefficients (U-values) of transparent and opaque structural elements; 3. identify thermal bridges in buildings and calculate the heat losses associated with them; 4. produce and interpret thermographic imaging using a thermal camera; 5. 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; 6. determine the quality characteristics of the indoor environment in buildings; 7. 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**

|  |
| --- |
| 1. Outdoor and indoor ambient conditions (climatic parameters, microclimates around buildings, climatic change and relevant implications to building enclosure design, indoors). 2. 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). 3. 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). 4. 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]. 5. Health and indoor air quality in buildings. 6. Building acoustics (acoustic properties of materials, acoustics of closed spaces, sound absorbing means, acoustic transmission and soundproofing/sound insulation in buildings). 7. 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 TECHNOLOGY** *Use of ICT in teaching, laboratory education, communication with students* | Support of the learning process through the 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 | 50 | | Laboratory exercises | 30 | | Series of individual technical reports (short projects) based on the laboratory exercises  Individual study | 30  60 | | Course total | ***100*** | |
| **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 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.   1. Semester work (30%). |

**5. ATTACHED BIBLIOGRAPHY**

|  |
| --- |
| *-Προτεινόμενη Βιβλιογραφία :*   * + - 1. Παπαμανώλης, Ν. 2015. “Δομική Φυσική και Αρχές Περιβαλλοντικού Σχεδιασμού Κτιρίων”. Σύνδεσμος Ελληνικών Ακαδημαϊκών Βιβλιοθηκών. ISBN 978-960-603-072-7.       2. Hens, H.S., 2016. Applied building physics. Ernst & Sohn.       3. Hens, H.S., 2017. Building physics-heat, air and moisture: fundamentals and engineering methods with examples and exercises. John Wiley & Sons.       4. 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\_5220Α | **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/ | | | | |

1. **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* |

1. **SYLLABUS**

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| --- |
| *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* |

1. **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* | |  |  | | --- | --- | | ***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)*** | |
| **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% of the Final Grade  Minimum Passing Grade = 5 |

1. **ATTACHED BIBLIOGRAPHY**

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| --- |
| * *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/ | | | | |

1. **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 | |

1. **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 |

1. **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 |
| **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 | | Group project on case studies | 50 | | Autonomous study | 48 | | ***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.* | Ι. Final exam (70%) includes:  - Multiple choice questions  - Short answer questions  - Problem solving  ΙΙ. Group project (30%) |

1. **ATTACHED BIBLIOGRAPHY**

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

1. **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* | |

1. **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. |

1. **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.)  Solution of sample problems |
| **USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY** *Use of ICT in teaching, laboratory education, communication with students* | 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. |
| **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 hours per week x 13 weeks) | 52 | | Hours for private study of the student | 98 | | ***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 written examination (100%), during which solution of problems and answer of questions is required. |

1. **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 | |  |
| *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** | Υes | | | | |
| **COURSE WEBSITE (URL)** | <https://eclass.upatras.gr/courses/CIV1771/> | | | | |

1. **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 | |

1. **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. |

1. **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* | - Specialised software for traffic systems analysis and management  - 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* | |  |  | | --- | --- | | ***Activity*** | ***Semester workload*** | | Lectures | 52 | | Practical exercises | 26 | | Field training, laboratory practice | 8 | | Project on laboratory/field trianing | 5 | | Independent study | 59 | | ***Total number of hours for the Course***  ***(25 hours of work-load per ECTS credit)*** | ***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 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. |

1. **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, seminars and laboratory work | | | 3 (lectures) | | 6 |
| *Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d)..* | | |  | |  |
| **COURSE TYPE**  *general background,  special background, specialised general knowledge, skills development* | 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** | Υes | | | | |
| **COURSE WEBSITE (URL)** | https://eclass.upatras.gr/courses/CIV1747 | | | | |

1. **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*  *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):   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. Αbility 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 | |

1. **SYLLABUS**

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| 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 |

1. **TEACHING AND LEARNING METHODS – EVALUATION**

|  |  |
| --- | --- |
| **DELIVERY** *Face-to-face, Distance learning, etc.* | Lectures and seminars. |
| **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 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. |
| **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 (3 conduct hours per week x 13 weeks) | 39 | | Final examination (3 conduct hours) | 3 | | Hours for private study of the student and preparation of home-works (3 per semester) | 108 | | ***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.* | ***ENVIRONMENTAL CHEMISTRY (EC)***  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. |

1. **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\_6221Α | **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 | | | | |

1. **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 | |

1. **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. |

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

|  |  |
| --- | --- |
| **DELIVERY** *Face-to-face, Distance learning, etc.* | Face-to-face – in classroom |
| **USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY** *Use of ICT in teaching, laboratory education, communication with students* | Specialized structural analysis software. Support the learning process through the 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 | | Solution of thematic exercise | 13 | | Independent Study | 85 | | *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.* | 1. Written final exam (50%) which includes:  * Solution of 2 or 3 exercises  1. Delivery of thematic exercise (20%) 2. Computational Laboratoty exam (30%) |

1. **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\_6235Α | **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, 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:** | 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/ | | | | |

1. **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 | |

1. **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. |

1. **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* | |  |  | | --- | --- | | ***Activity*** | ***Semester workload*** | | Lectures (4 contact hours per week x 13 weeks) | 52 | | Hours for private study of the student and preparation of problem sets | 98 | | ***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.* | 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. |

1. **ATTACHED BIBLIOGRAPHY**

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| --- |
| * Design of steel structural members according to EN1993-1-1. TL Karavasilis. University Press. 2019 * Design of steel structures (with examples). I Vayias, Ι 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/ | | | | |

1. **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 | |

1. **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 |

1. **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 | | Laboratory Practice | 26 | | Technical Reports on Laboratory Tests | 26 | | Hours for private study | 46 | | 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.* | 1. Written exams which include problem solving (80%) 2. Evaluation of Laboratory Tests Technical Reports (20%) |
|  |  |

1. **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)** |  | | | | |

1. **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. | |

1. **SYLLABUS**

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| --- |
| 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. |

1. **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. |

1. **ATTACHED BIBLIOGRAPHY**

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| --- |
| *- 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 | | | 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* | 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/ | | | | |

1. **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 | |

1. **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. |

1. **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.*  *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 | | Tutorials for the consolidation of laboratory processes and the understanding of the design of the individual parts of a water treatment unit | 6 | | Group Laboratory work in small groups of students (in pairs) | 4 | | Educational visit / video view of water treatment units / Small individual practice work | 6 | | Independent home work, elaboration and writing of Laboratory Exercises | 20 | | Individual home work on tutorial exercises | 20 | | 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. |

1. **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\_6230Α | **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** | Νo | | | | |
| **COURSE WEBSITE (URL)** | <https://eclass.upatras.gr/courses/CIV1533/> | | | | |

1. **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. | |

1. **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. |

1. **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.*  *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 | | In-class exercises | 15 | | Laboratory exercises and written exam on the laboratory exercises | 20 | | Final exam | 3 | | Hours for student private study | 62 | | ***Total number of hours for the Course***  ***(25 hours of work-load per ECTS credit)*** | ***150 hours*** | |  |  | |
| **STUDENT PERFORMANCE EVALUATION**  *Description of the evaluation procedure*  *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other*  *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.* | Student evaluation is based on:   1. Final (written) exam (75%) 2. Laboratory exercises and examination (25%) |

1. **ATTACHED BIBLIOGRAPHY**

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| --- |
| *- 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/ | | | | |

1. **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 | |

1. **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 |

1. **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* | |  |  | | --- | --- | | ***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)*** | |
| **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 examination.  Minimum passing grade: 5. |
|  |  |

1. **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, Ι 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/ | | | | |

1. **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 | |

1. **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 |

1. **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 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 exams which include problem solving (80%) * Evaluation of Team work Project (20%) |

1. **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** | 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 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:** | | | There are not prerequisite course. Essentially, the students should possess basic knowledge of statistics. | | |
| **LANGUAGE OF INSTRUCTION and EXAMINATIONS:** | | | Greek. | | |
| **IS THE COURSE OFFERED TO ERASMUS STUDENTS** | | | No | | |
| **COURSE WEBSITE (URL)** | | | <https://eclass.upatras.gr/courses/CIV1611/>  <http://www.civil.upatras.gr/el/ProptixiakhEkpaideysh/Mathimata/GEtos/entry/47e0823f-dfd3-4bd0-b651-7c967ff83c9e/?PageNo=0> | | |

1. **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 catchment area.  -Water budget.  -Mean areal values of hydrological variables.  -Mechanisms influencing evapotranspiration and methods to estimate evapotranspiration.  -Mechanisms influencing runoff and methods to estimate flood peaks (unit hydrograph).  -Analysis of frequency of hydrological variables. | | |
| **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 | |

1. **SYLLABUS**

|  |
| --- |
| Hydrological cycle; Water budget equation; Methods to measure precipitation; Mean areal value of precipitation; Methods to measure and methods to calculate evapotranspiration; Unit hydrograph; S-hydrograph; Synthetic hydrograph; Estimation of Intensity-Duration-Frequency curves; Statistical methods in Hydrology. |

1. **TEACHING AND LEARNING METHODS - EVALUATION**

|  |  |
| --- | --- |
| **DELIVERY** *Face-to-face, Distance learning, etc.* | Lectures/Problem Solving face to face. |
| **USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY** *Use of ICT in teaching, laboratory education, communication with students* |  |
| **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/Problem Solving | 52 | | Private 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)*** | |
| **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 Examination |

1. **ATTACHED BIBLIOGRAPHY**

|  |
| --- |
| 1. Sakkas, J., 2004. Technical Hydrology, Vol. 1, Hydrology of Surface Waters. Aivazis Editions, Thessaloniki. 2. Tsakiris, G., 1995. Water Resources: Technical Hydrology. Symmetria Editions, Athens.   3. Papamichail, D.M, 2004. Technical Hydrology of Surface Waters. Pahoudis Editions, Thessaloniki.  4. Mimikou, M.A, and E.A. Baltas, 2012. Technical Hydrology, 5th Edition, Papasotiriou, Athens |

**COURSE OUTLINE**

1. **GENERAL**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **SCHOOL** | ENGINEERING | | | | |
| **ACADEMIC UNIT** | CIVIL ENGINΕERING | | | | |
| **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 | | 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/ | | | | |

1. **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 | |

1. **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 |

1. **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 | 30 | | Laboratory exercises | 15 | | Laboratory assignments for individual or small groups of students | 25 | | Team work in a case study | 14 | | Educational excursion, small individual exercises | 13 | | Independent study | 53 | | ***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 |

1. **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 | | | | |
| **LEVEL OF STUDIES** | UNDERGRADUATE | | | | |
| **COURSE CODE** | CIV\_6610 | **SEMESTER** | | 6th | |
| **COURSE TITLE** | TECHNICAL TERMINOLOGY IN ENGLISH | | | | |
| **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 | | 3 |
|  | | |  | |  |
|  | | |  | |  |
| *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* | CORE CURRICULUM-FOREIGN LANGUAGE REQUIREMENT | | | | |
| **PREREQUISITE COURSES:** | NONE | | | | |
| **LANGUAGE OF INSTRUCTION and EXAMINATIONS:** | TEACHING LANGUAGE: 20% GREEK, 80% ENGLISH  ASSESSMENT/EXAMINATION LANGUAGE: 100% ENGLISH | | | | |
| **IS THE COURSE OFFERED TO ERASMUS STUDENTS** | No | | | | |
| **COURSE WEBSITE (URL)** | <http://e-class.upatras.gr/courses/CIV_1650> | | | | |

1. **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 COURSE COMPLETION STUDENTS WILL HAVE FULLY BEEN:   1. TAUGHT THE LINGUISTIC STRUCTURES & STYLE CHARACTERISTIC TO SCIENTIFIC ENGLISH 2. TAUGHT ACADEMIC NOTE-TAKING TECHNIQUES. 3. PROVIDED WITH LISTENING PRACTICE OF CIVIL ENGINEERING MATERIAL IN ENGLISH 4. EXPOSED TO NECESSARY SKILLS IN CLASS, SO AS TO PRACTICE ENGLISH-SPEAKING & CONVERSATION PERTAINING TO CIVIL ENGINEERING TOPICS 5. EXPOSED TO A WIDE RANGE OF CIVIL ENGINEERING READING/TEXT MATERIAL IN ENGLISH COVERING MOST SECTORS OF THE FIELD. 6. EXPOSED, AT LENGTH, TO CIVIL ENGINEERING TERMINOLOGY IN ENGLISH | |
| **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…*  *…….* |
| HAVING COMPLETED THE COURSE STUDENTS WILL BE ABLE TO:   1. USE THE LINGUISTIC STRUCTURES & STYLE CHARACTERISTIC TO SCIENTIFIC ENGLISH 2. TAKE NOTES IN ENGLISH AT CIVIL ENGINEERING COURSE LECTURES, CONFERENCE PRESENTATIONS, ETC., CONDUCTED IN ENGLISH 3. WRITE-UP OR CONSTRUCT PARAGRAPHS OR PASSAGES IN ENGLISH PERTAINING TO CIVIL ENGINEERING 4. UNDERSTAND SPOKEN ENGLISH RELATING TO CIVIL ENGINEERING TOPICS 5. COMMUNICATE IN ENGLISH AT CIVIL ENGINEERING SETTINGS WITH FELLOW ENGLISH-SPEAKING STUDENTS, GIVE ORAL PRESENTATIONS IN ENGLISH, ETC. 6. READ MECHANICAL ENGINEERING TEXT MATERIAL, USER MANUALS, BIBLIOGRAPHICAL REFERENCES, ETC., IN ENGLISH 7. UNDERSTAND AND USE CIVIL ENGINEERING TERMINOLOGY IN ENGLISH | |

1. **SYLLABUS**

|  |
| --- |
| **STRUCTURE & STYLE OF SCIENTIFIC ENGLISH:**  COHERENCE, SYNTAX OF TECHNICAL DIRECTIONS AND INSTRUCTIONS, USE OF THE DEFINITE ARTICLE COMPOUND TERM VARIETIES, VERB CLASSIFICATION DESCRIPTIONS, SENTENCE COMBINING, CLASSIFYING IN SCIENTIFIC ENGLISH.  **MATERIAL COVERING:**  THE CIVIL ENGINEERING PROFESSION, TRANSPORTATION SYSTEMS, CONCRETE TECHNOLOGY, GEOTECHNICAL ENGINEERING, FOUNDATION ENGINEERING, STRUCTURES AND MATERIALS, BRIDGES AND TUNNELS, WATER RESOURCES, SURVEYING, PLANNING, CONSTRUCTION CONTRACTS AND PROPOSALS, SI-UNITS.  ENGLISH CIVIL ENGINEERING TERMINOLOGY |

1. **TEACHING and LEARNING METHODOLOGY AND evaluation**

|  |  |
| --- | --- |
| **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 students* | 1. E-CLASS FOR: GENERAL COURSE RELATED ANNOUNCEMENTS. ADDITIONAL EXERCISE WORK. ANSWER SHEETS OF CLASS WORK. 2. STUDENT ACCESS TO INSTRUCTOR’S E-MAIL FOR EMERGENCY COMMUNICATION. 3. IN-CLASS ACCESS OF ON-LINE COURSE RELATED WEB MATERIAL, E.G. TECHNICAL TERMINOLOGY DICTIONARIES |
| **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*** | | PRESENTATION/TEACHING | 20% | | PARTICIPATION/PRACTICE IN CLASS—WRITTEN EXERCISE WORK, LISTENING AND TAKING NOTES, READING AND COMPREHENSION OF MATERIAL RELATING TO THE FIELD OF CIVIL ENGINEERING | 60% | | IN-CLASS STUDENT GROUP WORK/PROJECTS | 20% | | ***Total number of hours***  ***for the Course:*** | **100%**  **75** | |  | |  |  | |  |  | |
| **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.* | ASSESSEMENT/TESTING LANGUAGE:  80% OF GRADE BASED ON FINAL WRITTEN EXAMINATION ALL IN ENGLISH; FILL-IN THE BLANKS, LABEL THE DIAGRAMS, READING OF CLASS RELATED SHORT PASSAGES AND ANSWERING COMPREHENSION QUESTIONS.  20% OF GRADE BASED ON CLASS PARTICIPATION; COMPLETION OF IN-CLASS EXERCISE WORK; SPEAKING, LISTENING, WRITING.  LANGUAGE OF INSTRUCTION: 80% ENGLISH, 20% GREEK. (LANGUAGE OF INSTRUCTION CAN BE: 100% IN ENGLISH WHEN NON-GREEK STUDENTS E.G. ERUSMUS PROGRAM STUDENTS, ARE TAKING THE COURSE) |

1. **ATTACHED BIBLIOGRAPHY**

|  |
| --- |
| 1. **EFFECTIVE ENGLISH FOR CIVIL ENGINEERING**. MATINA-STAMISON ATMATZIDI. KLIDARITHMOS PUBLISHERS, 2010. 2. **SCIENTIFIC ENGLISH STRUCTURE AND STYLE.** MATINA STAMISON-ATMATZIDI.KLIDARITHMOS PUBLISHERS, 1997, 2006. 3. **THE LANGUAGE OF ARCHITECTURE & ENGINEERING.** (PDF)-ON-LINE. CAMBRIDGE SCHOLARS PUBLICATIONS. 2011 4. AMERICAL SOCIETY OF CIVIL ENGINEERING JOURNALS |

**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/> | | | | |

1. **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. | |

1. **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). |

1. **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* | |  |  | | --- | --- | | ***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)*** | |
| **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. |

1. **ATTACHED BIBLIOGRAPHY**

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| --- |
| *- 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\_7231Α | **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.)  2 (recit.) | | 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/ | | | | |

1. **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. | |

1. **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 |

1. **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* | |  |  | | --- | --- | | ***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*** | |  |  | |
| **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. Midterm exam – design problem solving (20%) 2. Final exam –design problem solving (80%) |

1. **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**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **SCHOOL** | ENGINEERING | | | | |
| **ACADEMIC UNIT** | Civil Engineering | | | | |
| **LEVEL OF STUDIES** | UNDERGRADUATE | | | | |
| **COURSE CODE** | CIV\_7320Α | **SEMESTER** | | 7th | |
| **COURSE TITLE** | 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 | | | 4 | | 6 |
|  | | |  | |  |
|  | | |  | |  |
| *Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).* | | |  | |  |
| **COURSE TYPE**  *general background,  special background, specialised general knowledge, skills development* | Specialised General Knowledge | | | | |
| **PREREQUISITE COURSES:** | There are no prerequisite courses. It is however recommended that students have a good understanding of the content of the course Soil Mechanics I & II | | | | |
| **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/CIV1659/ | | | | |

1. **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 | |

1. **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 |

1. **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 | 52 | | Hours for private study | 46 | |  |  | | 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.* | 1. Written exams which include problem solving (70%) 2. Evaluation of Team work Project (30%) |
|  |  |

1. **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\_0480Α | **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/ | | | | |

1. **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 | |

1. **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.~~ |

1. **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* | Support of the learning process using the 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 | | Team project. Preliminary Design of Harbour Works | 50 | |  |  | | Study | 48 | | **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.* | Ι. Final exam which includes design problems (75%).  ΙΙ. Collaborative project on the preliminary design of harbor works (technical report and brief oral examination) by students working in teams of 5-6 (25%). |

1. **ATTACHED BIBLIOGRAPHY**

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| --- |
| *- 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\_7610Α | | **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/> | | | | |

1. **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 | |

1. **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. |

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

|  |  |
| --- | --- |
| **DELIVERY** *Face-to-face, Distance learning, etc.* | Face-to-face lectures |
| **USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES** *Use of ICT in teaching, laboratory education, communication with students* | PowerPoint presentations as part of the lectures, 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* | |  |  | | --- | --- | | **Activity** | **Semester workload** | | Lectures | 52 | | Study and analysis of bibliography | 48 | | Exercises | 50 | |  |  | |  |  | |  |  | | ***Total number of hours for the course (25 hours of work-load per ECTS credit)*** | ***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.* | Language of evaluation: Greek  Methods of evaluation:  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/> |

1. **ATTACHED BIBLIOGRAPHY**

|  |
| --- |
| *- Suggested bibliography:*   * A. Apostoleris, "Highway Engineering: Theory and Practice”, Athens 2015 (in Greek) * Α. 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\_7222Α | **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/ | | | | |

1. **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 | |

1. **SYLLABUS**

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| --- |
| 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). |

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

|  |  |
| --- | --- |
| **DELIVERY** *Face-to-face, Distance learning, etc.* | **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 |
| **USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY** *Use of ICT in teaching, laboratory education, communication with students* | **Yes** |
| **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 hours | | Study and analysis of bibliography | 65 hours | | Laboratory | 26 hours | | Laboratory study – reports | 29 hours | | Examination | 3 hours | |  |  | |  |  | | 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 |

1. **ATTACHED BIBLIOGRAPHY**

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| --- |
| *- 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/ | | | | |

1. **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*  *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 | |

1. **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. |

1. **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* | |  |  | | --- | --- | | ***Activity*** | ***Semester workload*** | | Class lectures and problem solving recitation sessions. | 52 | | Independent 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*  *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.* | Final written examination:   * multiple choice questionnaires * problem solving |

1. **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, Μ. (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\_5716Α | | **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**

|  |
| --- |
| 1. Introduction to construction project management 2. Methods for economic evaluation of investment plans and projects 3. Machinery replacement analysis, economic life of assets 4. Economic analysis of public projects, cost-benefit analysis, feasibility studies 5. Accounting and depreciation, income tax considerations, effect of inflation, sensitivity analysis of economic proposals 6. Project initiation, planning and organization, work breakdown structure (WBS) 7. Project estimating: resource selection, activity duration and cost estimation 8. Project scheduling, resource allocation and financial management 9. Project tracking and control 10. Risk management in construction projects 11. Optimization methods and applications in construction project management 12. 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, laboratory education, communication with students* | 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 course announcements and material handling, student team forming, 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* | |  |  | | --- | --- | | **Activity** | **Semester workload** | | Lectures | 52 | | Laboratory practice | 26 | | Study and analysis of bibliography | 40 | | Project | 45 | | Essay writing | 12 | |  |  | | ***Total number of hours for the course (25 hours of work-load per ECTS credit)*** | ***175*** | |
| **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:  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/> |

**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\_8232Α | **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/> | | | | |

1. **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 | |

1. **SYLLABUS**

|  |
| --- |
| Course content:   1. Design of foundations: dimensioning and detailing of shallow foundations and foundation elements. 2. Staircases: design and detailing, influence on the seismic response of the structure. 3. Calculation and verification of deformations. 4. Principles of seismic design: capacity design and ductility. 5. Seismic design of reinforced concrete structures according to Eurocode 8. |

1. **TEACHING AND LEARNING METHODS - EVALUATION**

|  |  |
| --- | --- |
| **DELIVERY** *Face-to-face, Distance learning, etc.* | Lectures, seminars in-class. |
| **USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY** *Use of ICT in teaching, laboratory education, communication with students* | Use of ICT in teaching (eg. powerpoint presentations, photos etc)  Support of learning process through 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 (4 conduct hours per week x 13 weeks) | 52 | | Self-study and optional individual written work (two or three home-works) | 73 | | ***Total number of hours for the Course***  ***(25 hours of work-load per ECTS credit)*** | ***125 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.* | 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%)  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. |

1. **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** | | 8ο ή 10 ο | |
| **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 |
|  | | |  | |  |
|  | | |  | |  |
| *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/CIV1737/ | | | | |

* 1. **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**

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| --- |
| **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**

|  |  |
| --- | --- |
| **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 | 13 | | Team work Project | 39 | | Hours for private study | 42 | |  |  | |  |  | |  |  | |  |  | |  |  | | 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.* | 1. Assessment of assignments (30%) 2. Assessment of semester project (70%) |
|  |  |

1. **ATTACHED BIBLIOGRAPHY**

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| --- |
| *- Suggested bibliography:*  *- Related academic journals:*   1. Course notes (digital form) 2. Αθανασόπουλος, Γ. (2001) “Μαθήματα Δυναμικής του Εδάφους”, Εκδόσεις Πανεπιστημίου Πατρών 3. Kramer, S L, Geotechnical Earthquake Engineering. Prentice-Hall, 1996 4. Ishihara, R, Soil Behaviour in Earthquake Geotechnics, Clarendon Press, Oxford 1995 5. Semblat, J. F. and Pecker, a. (2009), “Waves and Vibrations in Soils: Earthquakes, Traffic, Shocks, Construction Works” IUSS Press, 2009 6. Idriss, IM; Boulanger, Ross W; Soil liquefaction during earthquakes, Earthquake Engineering Research Institute, MNO-12, 2008 |

**3rd Track: “Hydraulic Engineering – Environmental Engineering”**

**COURSE OUTLINE**

1. **GENERAL**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **SCHOOL** | ENGINEERING | | | | |
| **ACADEMIC UNIT** | CIVIL ENGINEERING | | | | |
| **LEVEL OF STUDIES** | UNDERGRADUATE | | | | |
| **COURSE CODE** | CIV\_9560Α | **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/CIV1620/ | | | | |

1. **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 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 with the use of the necessary technology  *•* Working independently  *•* Team work | |

1. **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. |

1. **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.*  *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 | 39 | | Tutorial exercises to consolidate concepts and understand the implementation of methods for identifying, assessing and addressing environmental impacts | 6 | | 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. |

1. **ATTACHED BIBLIOGRAPHY**

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| --- |
| *- 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)** |  | | | | |

1. **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. 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* | |

1. **SYLLABUS**

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| --- |
| 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. |

1. **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* | |  |  | | --- | --- | | ***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*** | |
| **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 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. |

1. **ATTACHED BIBLIOGRAPHY**

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| --- |
| *- 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, Μ., 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, Α., Ampt, Ε., Meyburg, Α. (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/ | | | | |

1. **LEARNING OUTCOMES**

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| **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:   * 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 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 | |

1. **SYLLABUS**

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| 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. |

1. **TEACHING AND LEARNING METHODS - EVALUATION**

|  |  |
| --- | --- |
| **COURSE TYPE**  *general background,  special background, specialised general knowledge, skills development* | Lectures in the classroom |
| **PREREQUISITE COURSES:** | Use of simple computer software for problem sets, interaction with students through the electronic platform e-class |
| **LANGUAGE OF INSTRUCTION and EXAMINATIONS:** | |  |  | | --- | --- | | ***Activity*** | ***Semester workload*** | | Lectures | 39 | | Self-study and work on the problem sets | 86 | | ***Total number of hours for the Course***  ***(25 hours of work-load per ECTS credit)*** | ***125*** | |
| **IS THE COURSE OFFERED TO ERASMUS STUDENTS** | 1. Final written examination (75%) on problem solving 2. Problem sets (25%) |
| **COURSE WEBSITE (URL)** | 1. <https://eclass.upatras.gr/courses/CIV1503/> |

**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/> | | | | |

1. **LEARNING OUTCOMES**

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| --- | --- |
| **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 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). | |

1. **SYLLABUS**

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| --- |
| 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 |

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

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| --- | --- |
| **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.*  *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 | 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)*** | |
| **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. |

1. **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. |

**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**

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| --- | --- |
| **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. 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**

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| **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**

|  |  |
| --- | --- |
| **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 | | Laboratory Practice | 26 | | Technical Reports | 33 | | Field work | 10 | | Hours for private study | 30 | |  |  | |  |  | |  |  | |  |  | | 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.* | 1. Written exams which include problem solving (50%) 2. Evaluation of Laboratory Tests Technical Reports (50%) |
|  |  |

**5.ATTACHED BIBLIOGRAPHY**

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| --- |
| *- 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\_8371Α | **SEMESTER** | | 8ο or 10ο | |
| **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 | | | | |

1. **LEARNING OUTCOMES**

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| --- | --- |
| **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 design:*   1. *Bored piles.* 2. *Flexible retaining walls.* 3. *Anchors for flexible retaining structures and soil slopes.* 4. *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 | |

1. **SYLLABUS**

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| **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. |

1. **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 | 13 | | Field work | 10 | | Team work Project | 34 | | Hours for private study | 42 | |  |  | |  |  | |  |  | |  |  | | 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.* | 1. **Assessment of individual assignments during the course term (40%)** 2. **Assessment of team project (60%)** |
|  |  |

1. **ATTACHED BIBLIOGRAPHY**

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| --- |
| *- Suggested bibliography:*  *- Related academic journals:*   1. Course notes (digital form) 2. Braja M. Das, ”Principles of Foundation Engineering”, PWS Publishing, ITP, 1998 3. Budhu, M. (2010). *Soil mechanics and foundations* (No. Ed. 3). John Wiley & Sons. 4. 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 | | 2 |
| Field training | | | 3 | | 2 |
| 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* | 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** | Υes | | | | |
| **COURSE WEBSITE (URL)** | https://eclass.upatras.gr/courses/CIV1750/ | | | | |

1. **LEARNING OUTCOMES**

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| **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. | |

1. **SYLLABUS**

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| (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. |

1. **TEACHING AND LEARNING METHODS - EVALUATION**

|  |  |
| --- | --- |
| **DELIVERY** *Face-to-face, Distance learning, etc.* | (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. |
| **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 various scientific and teaching resources available online. |
| **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*** | | Interactive lectures | 30 | | Field training and technical reports | 60 | | Individual exercises | 25 | | Integrated field project | 10 | | ***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.* | Grading through a parametric algorithm (Generalized Weighted Average) that evaluates the student's performance in each component of the course (comprehension exercises, laboratory Exercises, technical reports, etc.). |

1. **ATTACHED BIBLIOGRAPHY**

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

**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\_8461A | **SEMESTER** | | 8th or 10th | |
| **COURSE TITLE** | RENEWABLE ENERGY HYDRAULIC 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 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 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)** |  | | | | |

1. **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 be learn to:   1. Identify the most important renewable energy sources constructed in the vicinity of water bodies (inland coastal and marine) and know their main principles for energy generation 2. Understand main hydraulic design principles of these structures 3. Understand key processes relevant to the hydraulic design of renewable energy arrangements such as dams, offshore wind turbines (floating and fixed bottom) and wave energy devices. 4. Ability to use design tools available to estimate the size and layout of these structures 5. Ability to work as a team for planning and delivering a small scale 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 | |

1. **SYLLABUS**

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| 1. Basic types of hydraulic and marine structures for renewable energy 2. Basic economic data of each type and national / international trends 3. Basic principles of hydraulic design of dams 4. Basic principles of hydraulic design of offshore wind turbines 5. Basic principles of wave energy generation and examples of hydraulic design of specific arrangements 6. Basic principles of tidal power generation and examples of hydraulic design of specific arrangements |

1. **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* | |  |  | | --- | --- | | ***Activity*** | ***Semester workload*** | | Lectures (3 contact hours per week x 13 weeks) | 39 | | Preparation project assignment and writing of technical report | 30 | | Hours for study by the student | 56 | | ***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.* | Final exam 50% and project 50% |

1. **ATTACHED BIBLIOGRAPHY**

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| --- |
| *- 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   1. Goda, Y., 2010. Random seas and design of maritime structures (Vol. 33). World Scientific Publishing Company. 2. Willi H. Hager, Anton J. Schleiss, Robert M. Boes Michael Pfister. Hydraulic Engineering of Dams. CRC Press 3. 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 |

**COURSE OUTLINE**

1. **GENERAL**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **SCHOOL** | ENGINEERING | | | | |
| **ACADEMIC UNIT** | CIVIL ENGINEERING | | | | |
| **LEVEL OF COURSE** | UNDERGRADUATE | | | | |
| **COURSE CODE** | CIV\_8455A | **SEMESTER OF STUDIES** | | 8th or 10th | |
| **COURSE TITLE** | HYDRODYNAMICS OF BAYS AND RESERVOIRS | | | | |
| **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 no formal prerequisites. Familiarity with undergraduate Fluid Mechanics and Hydraulics is, however, assumed. | | | | |
| **LANGUAGE OF INSTRUCTION and EXAMINATIONS:** | Greek. | | | | |
| **IS THE COURSE OFFERED TO ERASMUS STUDENTS** | No | | | | |
| **COURSE WEBSITE (URL)** | <http://www.civil.upatras.gr/en/ProptixiakhEkpaideysh/Mathimata/EEtos/entry/317fc45d-4ea5-49c6-8e1e-cec8a4db35d3/?PageNo=0>  <https://eclass.upatras.gr/courses/CIV1642/> | | | | |

1. **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* | |
| Students are intended to become familiar with:   * The basic components of hydrodynamic circulation in coastal and lacustrine waters and in reservoirs. * Basic forms of the equations which govern the hydrodynamic circulation, estimation of the order of magnitude of various terms and analysis of the intrinsic scales of problems. * Simple, one-dimensional models of wind-induced and tidal circulation and density currents. * Complications introduced in the circulation by complex bathymetry and stratification (strong coastal currents, the cycle of thermal stratification, internal waves). | |
| **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…*  *…….* |
| *Students are expected to develop the following skills:*   * *Ability to identify which of the components of the hydrodynamic circulation may be important in specific situations* * *Ability to estimate order of magnitude of various parameters of circulation through simple models* * *Develop the required theoretical background in hydrodynamics (but not in numerics) for the interpretation of numerical simulations of hydrodynamics circulation.* | |

1. **SYLLABUS**

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| * Prerequisites from fluid mechanics (Navier-Stokes and Reynolds equations, equations on a rotating frame, scaling of the equations). * Overview of circulation in bays, lakes and reservoirs. * Wind induced circulation. * Tidal circulation. * Density currents. * Complications introduced by irregular bathymetry. * Stratification in reservoirs. |

1. **TEACHING AND LEARNING METHODS - EVALUATION**

|  |  |
| --- | --- |
| **DELIVERY** *Face-to-face, Distance learning, etc.* | Blackboard lecturing and solution of sample problems, supplemented with projection of video movies (Britannica, N.S.F. U.S.A.) |
| **USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY** *Use of ICT in teaching, laboratory education, communication with students* | Use of material in 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* | |  |  | | --- | --- | | ***Activity*** | ***Semester workload*** | | Lectures (3 conduct hours per week x 13 weeks) | 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)*** | |
| **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.* | Five series of homework problems (20%)  Final written examination (80%), during which solution of problems and answer of questions is required. |

1. **ATTACHED BIBLIOGRAPHY**

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| --- |
| 1. G.M. Horsch (2017) Hydrodynamics of Bays and Reservoirs, Lecture Notes. |

**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/ | | | | |

1. **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 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. | |

1. **SYLLABUS**

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|  |

1. **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* | |  |  | | --- | --- | | ***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)*** | |
| **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 30% and projects 70% |

1. **ATTACHED BIBLIOGRAPHY**

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| --- |
| *- 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 COURSE** | UNDERGRADUATE | | | | |
| **COURSE CODE** | CIV\_9470A | **SEMESTER** | | 8th or 10th | |
| **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> | | |

1. **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* | |
| * 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 | |

1. **SYLLABUS**

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| 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. |

1. **TEACHING AND LEARNING METHODS - EVALUATION**

|  |  |
| --- | --- |
| **DELIVERY** *Face-to-face, Distance learning, etc.* | Lectures/Problem Solving face to face. |
| **USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY** *Use of ICT in teaching, laboratory education, communication with students* |  |
| **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/Problem Solving | 39 | | 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)*** | |
| **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 Examination |

1. **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. |

**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\_0683Α | | **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/> | | | | |

1. **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*   1. *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 | |

1. **SYLLABUS**

|  |
| --- |
| 1. Introduction to construction and construction site organization and management 2. Construction site location selection and layout planning, facility selection and configuration 3. Machinery and equipment selection and management 4. Organizational structure of project team, human resource management 5. Material and procurement management, construction warehouse organization, inventory analysis 6. Quality assurance and management in construction 7. Construction safety and health 8. Protection and restoration of the construction site environment 9. Construction law principles 10. Risk management in construction 11. Information and communication technologies in construction 12. Lean construction principles |

1. **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-directed study according to the principles of the ECTS* | |  |  | | --- | --- | | **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*** | |
| **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/> |

1. **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 | | | 6 | | 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)** |  | | | | |

1. **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:   * 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* | |

1. **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. |

1. **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 solution in groups of 5-8. |
| **USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY** *Use of ICT in teaching, laboratory education, communication with students* | - Specialised software for smart cities systems design such as intelligent transportation systems, energy systems and infrastructure.  - 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* | |  |  | | --- | --- | | ***Δραστηριότητα*** | ***Φόρτος Εργασίας Εξαμήνου*** | | Lectures | 35 | | Practical exercises that focus on the application of methods and the analysis of case studies in small groups | 10 | | Group project on case study.  Group project on systems design. | 35 | | Educational visit/ individual work exercises | 10 | | Independent study | 35 | | ***Total number of hours for the Course***  ***(25 hours of work-load per ECTS credit)*** | ***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.* | + 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. |

1. **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. |

**9th SEMESTER - 1st TRACK ELECTIVE COURSES**

**COURSE OUTLINE**

1. **GENERAL**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **SCHOOL** | ENGINEERING | | | | |
| **ACADEMIC UNIT** | Civil Engineering | | | | |
| **LEVEL OF STUDIES** | Undergraduate | | | | |
| **COURSE CODE** | CIV\_8270Α | **SEMESTER** | | 9th | |
| **COURSE TITLE** | Advanced 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 solution of thematic exercises | | | 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:** | Good understanding of the material covered in the lesson  courses of “Introduction to Mechanics of Materials” and  “Mechanics of Materials” | | | | |
| **LANGUAGE OF INSTRUCTION and EXAMINATIONS:** | Greek | | | | |
| **IS THE COURSE OFFERED TO ERASMUS STUDENTS** | No | | | | |
| **COURSE WEBSITE (URL)** | https://eclass.upatras.gr/modules/document/?course=CIV1550 | | | | |

1. **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 students will have develop the following abilities:  1. They know the basic concepts of mechanics of deformable solids (theory of elasticity).  2. They can formulate solutions for classic elasticity problems. | |
| **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 | |

1. **SYLLABUS**

|  |
| --- |
| Generalized Hooke’s Law for elastic solids. Isotropic – anisotropic – homogenous – non-homogenous materials. The Saint-Venant principle. The exact theory of stress analysis for straight and curved beams under tension, torsion and bending. Beams on elastic foundations. Simple problems of 2-D elasticity (prismatic wall elements under hydrostatic pressure, thick-walled cylinders under internal and external uniform pressure, stress concentration at the boundary of perforations in plates under plane stress). Simple problems of beams on elastic foundation, 2-D and 3-D elasticity (thick-walled spheres under internal and external uniform pressure, torsion theory of circular beams). Theory and simple applications of thin plates and shells. |

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

|  |  |
| --- | --- |
| **DELIVERY** *Face-to-face, Distance learning, etc.* | Face-to-face – in classroom |
| **USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY** *Use of ICT in teaching, laboratory education, communication with students* | Specialized structural analysis software. Support the learning process through the 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 | 39 | | Solution of thematic exercises | 30 | | Independent Study | 56 | | *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.* | 1. Written final exam (70%) which includes:  * Solution of 2 or 3 exercises  1. Delivery of thematic exercises (30%) |

1. **ATTACHED BIBLIOGRAPHY**

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| --- |
| *- Suggested bibliography:*  *- Related academic journals:*  Course notes entitled “Advanced Mechanics of Materials”, by Manolis Sfakianakis and Catherine Papanicolaou, University of Patras, 2009. |

**COURSE OUTLINE**

1. **GENERAL**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **SCHOOL** | Engineering | | | | |
| **ACADEMIC UNIT** | Civil Engineering | | | | |
| **LEVEL OF COURSE** | Undergraduate | | | | |
| **COURSE CODE** | CIV\_9260Α | **SEMESTER OF STUDIES** | | 9th | |
| **COURSE TITLE** | DESIGN OF CONCRETE BRIDGES | | | | |
| **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:** | NO | | | | |
| **LANGUAGE OF INSTRUCTION and EXAMINATIONS:** | Greek | | | | |
| **IS THE COURSE OFFERED TO ERASMUS STUDENTS** | NO | | | | |
| **COURSE WEBSITE (URL)** | https://eclass.upatras.gr/courses/CIV1511/ | | | | |

1. **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 have knowledge of:   1. Bridge Categories 2. Static systems and structural parts of bridges 3. Construction methods 4. Principles of bridge design 5. Code frame for bridge design 6. Design actions for bridges 7. Modelling and analysis approaches 8. Design methods for bridge surepstructure and substructure 9. Seismic design and seismic isolation of bridges 10. Prestress concept 11. Materials and requirements for the selection of the prestressing system 12. Calculation of the prestress forces and losses 13. Design methodology of prestressed bridges at ULS and SLS 14. Detailing of the prestress anchorage regions   Also, by the end of this course the students will be able to:   1. Compose and design bridges 2. Apply design forces according to Eurocodes 3. Design bridge superstructure and substructure according to Eurocodes 4. Select prestressing system and perform relevant calculations and checks | |
| **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…*  *…….* |
| Generally, by the end of this course the student will, furthermore, 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 * Teamwork * Project planning and management * Criticism and self-criticism * Production of free, creative and inductive thinking | |

1. **SYLLABUS**

|  |
| --- |
| 1. Bridge elements and design principles 2. Design actions on bridges: traffic and seismic actions 3. Deck types: prefabricated girders, slab on fixed formwork, balanced cantilevers with prefabricated or cast-in-place segments, incremental launch 4. Design of piers and abutments, capacity design of piers and their components according to Eurocode 8 5. Introduction - Basic principles of prestressed concrete 6. Materials, Types of prestressing, prestressing systems. 7. Prestressing losses (immediate and long term). 8. Analysis of prestressed structures. 9. Design for Serviceability Limit State 10. Design for Ultimate Limit State. 11. Synthesis of prestressed structures (selection of cross-section, determination of prestressing force, analysis employing the equivalent loading method, selection of tendon profile). 12. Detailing of anchorage regions. |

1. **TEACHING AND LEARNING METHODS - EVALUATION**

|  |  |
| --- | --- |
| **DELIVERY** *Face-to-face, Distance learning, etc.* | Face-to-face lectures (slides presentation, use of whiteboard for explanations, exercises etc.)  Distance learning (if necessary) (slides presentation, use of tablet for explanations, exercises etc.) |
| **USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY** *Use of ICT in teaching, laboratory education, communication with students* | The lectures content of the course, exercises, e-books, papers and other material are uploaded on the e-learning platform (e-class), where the students can freely download them.  Use of teleconference platforms (e.g. MS Teams, Zoom etc) for the distance learning, and communication with the students |
| **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 | 39 | | Field trip | 4 | | Project preparation | 25 | | Final examination | 3 | | Hours for private study of the students | 54 | | ***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.* | 1. Project (bridge composition and design) with technical report calculation report and relevant drawings submission (60% of the final grade)  2. Oral final exam (40% of the final grade) |

1. **ATTACHED BIBLIOGRAPHY**

|  |
| --- |
| 1. M.N. Fardis, “Prestressed concrete (in Greek)”. 3rd Edition, University of Patras Publishing House 2001 2. M.N. Fardis, “Design of earthquake resistant concrete structures (in Greek)”. Hellenic Open University 2003, ISBN 960-538-351-9 3. M.N. Fardis, “Reinforced concrete (in Greek)”. 3rd Edition, University of Patras Publishing House 2003: Vol Ι, ΙΙ, ΙΙΙ 4. M.N. Fardis, “Seismic design, assessment and retrofitting of concrete buildings (based on EN-Eurocode 8)”. Springer 2009, ISBN 978-1-4020-9841-3 5. M.N. Fardis, “Design of concrete bridges (in Greek)”. 2nd edition, University of Patras Publishing House 2006 6. M.N. Fardis, V. Kolias, T. Panagiotakos, C. Katsaras, T. Psychogios, “Guide for bridge design with emphasis on seismic aspects”. University of Patras Publishing House, ISBN 978-960-89691-1-7 (available also in Greek, ISBN 978-960-89691-9-3) 7. Β. Kolias, M.N. Fardis and Α. Pecker, “Designers’ guide to Eurocode 8: Design of bridges for earthquake resistance, EN 1998-2”. Institution of Civil Engineers (ICE) Publishing 2012, ISBN 978-0-7277-5735-7 8. M. J. N. Priestley, F. Seible, G. M. Calvi-Seismic Design and Retrofit of Bridges-Wiley-Interscience ISBN: 978-0-471-57998-4 (1996) 9. C. Menn “Prestressed Concrete Bridges” ISBN 978-3-0348-9131-8 (1990) 10. [W. Lin](https://bookauthority.org/author/Weiwei-Lin) and [T. Yoda](https://bookauthority.org/author/Teruhiko-Yoda) “Bridge Engineering” ISBN-13: 978-0128044322 (2017) 11. A.J. Reis and J.J. Oliveira Pedro “Bridge Design: Concepts and Analysis” ISBN:9780470843635 (2019) 12. “Structural Engineering International (SEI)” the quarterly Journal of International Association For Bridge And Structural Engineering (IABSE), ISSN 1016-8664 and E-ISSN 1683-0350 |

**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/ARCH148/ | | | | |

1. **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* | |
| At the end of the course, the student will:  1. Be able to recognize the types and causes of damage to elements of reinforced concrete structures,  2. Know and be able to choose appropriate strategies for the redesign of existing structures,  3. Know the materials and technologies of intervention,  4. Be aware of the models simulating the contact between old and new elements and  5. Be able to structurally design repaired and strengthened components depending on the selected intervention | |
| **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 identify the causes of failure and recognise the deficiencies of reinforced concrete structures based on observed damage and the assessment of residual resistance,  2. An ability to select an appropriate strategy and method of intervention as well as the specialized technology of application depending on the deficiencies of the structure and  3. An ability to structurally design columns, shear walls, beams, beam-column joints, slabs and foundation elements in relation to the recognized deficiencies and the selected intervention. | |

1. **SYLLABUS**

|  |
| --- |
| **1. Pathology of Construction**  Damage to columns, damage to shear walls, damage to beams, damage to beam-column joints, damage to slabs and damage to foundations. Empirical method of estimating the residual strength and stiffness of components and the structure.  **2. Strategy and Process of Redesign**  Redesign as a multi-dimensional problem, a strategy for intervention, structural strengthening as a whole.  **3. Materials and Technologies of Interventions.**  Special types of concrete, polymer adhesives, repair mortars, gluing steel sheets or fibre reinforced polymers, shear links/anchors, anchors and welding new reinforcing bars.  **4. The Basis for Redesign**  Material safety factors, monolithic correction factors, design of metal connections, anchors and new welded reinforcement, designing the interface between old and new concrete.  **5. Repair-Strengthening Structural Elements**  Repair-strengthening of columns, repair-strengthening of shear walls, repair-strengthening of beams and slabs, repair-strengthening of beam-column joints and repair-strengthening of foundations. |

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

|  |  |
| --- | --- |
| **DELIVERY** *Face-to-face, Distance learning, etc.* | PowerPoint presentations and blackboard lectures supplemented with handouts. Tutorials. Final project and presentation within the framework of a student conference. |
| **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* | |  |  | | --- | --- | | ***Activity*** | ***Semester workload*** | | Lectures | 39 | | Project | 36 | | Writing report | 15 | | Hours for private study of the student | 36 | | ***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.* | Progress work (70% of the final grade).  Progress work with a participation rate of 70% in the formation of the final grade.  Εργασία προόδου με ποσοστό συμμετοχής 70% στη διαμόρφωση του τελικού βαθμού.  Progress work participation rate of 70% in the formulation of the final grade.  Ποσοστό συμμετοχής στην εργασία προόδου 70% στη διαμόρφωση του τελικού βαθμού.  Δεν είναι δυνατή η φόρτωση όλων των αποτελεσμάτων  Επανάληψη  Επανάληψη…  Επανάληψη…  The final exam is oral and/or written. |

1. **ATTACHED BIBLIOGRAPHY**

|  |
| --- |
| *- Suggested bibliography:*  *- Related academic journals:*  1. "Theory of Planning Repairs and Strengthening", T. Tassios, Civil Engineering Technical Publications, 2009.  2. “Greek Retrofitting Code of Structural Interventions”, Earthquake Planning and Protection Organization of Greece (E.P.P.O.), 2017.  3. "Provisional National Technical Specification (PETEP): Repair and Rehabilitation of Structures due to Damage from Earthquake and Other Harmful Factors”, S.E. Dritsos, S. Theodorakis, C. Spanos, G. Tzanetos, ed. TEE, 2008.  4. "Repair and Strengthening of Reinforced Concrete Structures", S.E. Dritsos, Patras, 2005.  5. Comite Europeen de Normalisation, *European Standard EN 1998-3:2005* *Eurocode 8: Design of structures for earthquake resistance - Part 3: Assessment and Retrofitting of Buildings*, 2005 |

**COURSE OUTLINE**

1. **GENERAL**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **SCHOOL** | ENGINEERING | | | | |
| **ACADEMIC UNIT** | CIVIL ENGINEERING | | | | |
| **LEVEL OF COURSE** | UNDERGRADUATE | | | | |
| **COURSE CODE** | CIV\_0268A | **SEMESTER** | | 9th | |
| **COURSE TITLE** | Theory of Plates and Shells | | | | |
| **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:** |  | | | | |
| **LANGUAGE OF INSTRUCTION and EXAMINATIONS:** | Greek | | | | |
| **IS THE COURSE OFFERED TO ERASMUS STUDENTS** | No | | | | |
| **COURSE WEBSITE (URL)** | https://eclass.upatras.gr/courses/CIV1745/ | | | | |

1. **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* | |
| 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*  *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 | |

1. **SYLLABUS**

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| --- |
| 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 |

1. **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 |
| **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 | 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)*** | |
| **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.* | Ι. Final exam (70%) includes:  - Multiple choice questions  - Short answer questions  - Problem solving  ΙΙ. Group project (30%) |
|  |  |

1. **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. “Theory of Plates and Shells”, Stephen Timoshenko, S. Woinowsky-Krieger 5. “Elementary statics of Shells”, Alf Pfluger |

**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*   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*   *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:   1. 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) 2. 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…*  *…….* |
| * Search for, analysis and synthesis of data and information, with the use of the necessary technology * Decision making * Adapting to new situations * Working independently * Working in an interdisciplinary environment * Project planning and management * 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 Ε103-84 standards |

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

|  |  |
| --- | --- |
| **DELIVERY** *Face-to-face, Distance learning, etc.* | Face to face and Distance learning |
| **USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY** *Use of ICT in teaching, laboratory education, communication with students* | * 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 |
| **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) | 2×13=26 | | Laboratory work (2 conduct hours per week x 13 weeks) in (a) rocks (Rock Mechanics) and (b) in situ rockmass measurements for geotechnical design | 2×13=26 | | Autonomous study | 73 | | **Total number of hours for the Course** | **125 hours** | |
| **STUDENT PERFORMANCE EVALUATION**  *Description of the evaluation procedure*  *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other*  *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.* | Language of evaluation Greek (English for Erasmus students)  Ι) 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%  ΙΙ) 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**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **SCHOOL** | School of Engineering | | | | |
| **ACADEMIC UNIT** | Department of Civil Engineering | | | | |
| **LEVEL OF STUDIES** | UNDERGRADUATE | | | | |
| **COURSE CODE** | CIV\_9372Α | **SEMESTER** | | 9ο | |
| **COURSE TITLE** | computational geotechnical 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 |
|  | | |  | |  |
|  | | |  | |  |
| *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/CIV1859 | | | | |

1. **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. *Apply the limit equilibrium method in slope stability problems and in remediation of landslides* 2. *Appreciate the basic principles underpinning the application of the finite element method on geotechnical problems* 3. *Select, calibrate and use appropriate constitutive models for the simulation of soils’ mechanical behaviour* 4. *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 | |

1. **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. |

1. **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 | 13 | | Team work Project | 39 | | Hours for private study | 42 | |  |  | |  |  | |  |  | |  |  | |  |  | | 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.* | Assessment of individual assignments during the course term and semester project (100%) |
|  |  |

1. **ATTACHED BIBLIOGRAPHY**

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| --- |
| *- Suggested bibliography:*  *- Related academic journals:*   1. Course notes (digital form) 2. Υπολογιστική Γεωτεχνική: Αλληλεπίδραση Εδάφους--Κατασκευών, Εκδόσεις Κλειδάριθμος, ISBN-13: 9789604612017. 3. Potts, D. M., & Zdravković, L. (1999). Finite element analysis in geotechnical engineering: Theory. Thomas Telford. https://doi.org/10.1680/feaiget.27534 4. 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** | ENGINEERING | | | | |
| **ACADEMIC UNIT** | CIVIL ENGINEERING | | | | |
| **LEVEL OF COURSE** | UNDERGRADUATE | | | | |
| **COURSE CODE** | CIV\_9810Α | **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** | Υes | | | | |
| **COURSE WEBSITE (URL)** | https://eclass.upatras.gr/courses/CIV1552/ | | | | |

1. **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. | |

1. **SYLLABUS**

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| 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. |

1. **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-directed study according to the principles of the ECTS* | |  |  | | --- | --- | | ***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*** | |
| **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%). |

1. **ATTACHED BIBLIOGRAPHY**

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| 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\_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 |
|  | | |  | |  |
|  | | |  | |  |
| *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/ | | | | |

1. **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* | |
| The student familiarizes with concepts and methods of engineering hydraulics, as applied to 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 | |

1. **SYLLABUS**

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| --- |
| 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. |

1. **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* | |  |  | | --- | --- | | ***Activity*** | ***Semester workload*** | | Class lectures and problem solving recitation sessions. | 39 | | Independent study | 86 | |  |  | | 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.* | Final written examination: problem solving |

1. **ATTACHED BIBLIOGRAPHY**

|  |
| --- |
| *- Suggested bibliography:*  *- Related academic journals:*  1. Noutsopoulos, G., G. Christodoulou and Τ. 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 | | | | |
| **COURSE CODE** | CIV\_9485Α | **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/ | | | | |

1. **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* | |
| 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 | |

1. **SYLLABUS**

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| --- |
| 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. |

1. **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* | Support of the learning process using the 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 | 39 | | Project on coastal sediment transport balance. | 30 | |  |  | |  |  | |  |  | | Study | 56 | | **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.* | Ι. Final exam which includes environmental and design problems (75%).  ΙΙ. Project on coastal sediment transport (technical report) (25%). |

1. **ATTACHED BIBLIOGRAPHY**

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| *- 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 |

9**th 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/> | | | | |

1. **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* | |
| 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 | |

1. **SYLLABUS**

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| --- |
| * 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. |

1. **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, laboratory education, communication with students* | 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 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.* | 1. 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 2. Personal oral examination. |

1. **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 ENGINΕERING | | | | |
| **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/ | | | | |

1. **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* | |
| 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 | |

1. **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. |

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

|  |  |
| --- | --- |
| **DELIVERY** *Face-to-face, Distance learning, etc.* | Classroom and Laboratory |
| **USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY** *Use of ICT in teaching, laboratory education, communication with students* | 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 | 35 | | Individual and team assignments | 45 | | Independent study | 45 | | ***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 (60%) consisting of:  - Multiple choice questions  - Problems solving  - Comparative evaluation of theory  II. Written assignments (40%) |

1. **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 | | | | |
| **ACADEMIC UNIT** | CIVIL ENGINEERING | | | | |
| **LEVEL OF COURSE** | UNDERGRADUATE | | | | |
| **COURSE CODE** | CIV\_8558A | **SEMESTER** | | 9th | |
| **COURSE TITLE** | POLLUTION OF INLAND AND COASTAL WATERS | | | | |
| **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 (lectures) | | 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:** | Environmental chemistry | | | | |
| **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** | Υes | | | | |
| **COURSE WEBSITE (URL)** | https://eclass.upatras.gr/courses/CIV1746 | | | | |

1. **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* | |
| 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 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):   1. Ability to exhibit knowledge and understanding of the essential facts, concepts, theories and applications which are related to Water Pollution. 2. Ability to apply this knowledge and understanding to the solution of problems related to Water Pollution of non-familiar nature. 3. Αbility to adopt and apply methodology to the solution of non-familiar problems of Water Pollution. 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 | |

1. **SYLLABUS**

|  |
| --- |
| 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 |

1. **TEACHING AND LEARNING METHODS - EVALUATION**

|  |  |
| --- | --- |
| **DELIVERY** *Face-to-face, Distance learning, etc.* | Lectures and seminars. |
| **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 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. |
| **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 (3 conduct hours per week x 13 weeks) | 39 | | Final examination (3 conduct hours) | 3 | | Hours for private study of the student and preparation of home-works (3 per semester) | 83 | | ***Total number of hours for the Course***  ***(25 hours of work-load per ECTS credit)*** | ***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.* | 1. Obligatory preparation of personal work by each student. After each lecture there is an exercise to be answered-solved in order to better understand the lecture. Students are required to solve and deliver the exercises to pass exams.  2. There are two mandatory advance examinations with 35% weight each and a final written examination after the end of the semester with a weight of 30%. The final grade comes out of the sum of the three scores.  3. If the student does not pass the course in June then the grade of the advance examinations is not applicable.  Minimum level of examination: 5. |

1. **ATTACHED BIBLIOGRAPHY**

|  |
| --- |
| 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** | ENGINEERING | | | | |
| **ACADEMIC UNIT** | CIVIL ENGINΕERING | | | | |
| **LEVEL OF STUDIES** | Undergraduate Elective | | | | |
| **COURSE CODE** | CIV\_9562A | **SEMESTER** | | 9th | |
| **COURSE TITLE** | Environmental Measurements | | | | |
| **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+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* | Scientific Area | | | | |
| **PREREQUISITE COURSES:** | Environmental Chemistry, Water Treatment, Wastewater Treatment | | | | |
| **LANGUAGE OF INSTRUCTION and EXAMINATIONS:** | Greek | | | | |
| **IS THE COURSE OFFERED TO ERASMUS STUDENTS** | No | | | | |
| **COURSE WEBSITE (URL)** | https://eclass.upatras.gr/courses/CIV1740/ | | | | |

1. **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* | |
| 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 | |

1. **SYLLABUS**

|  |
| --- |
| 1. Introduction and laboratory safety. 2. Types of pollutants. 3. Sampling design and samples handling. 4. Precision and accuracy of measurements. 5. Determination of pH, dissolved oxygen, electric conductivity and salinity. 6. Determination of chemical and biochemical oxygen demand. 7. Determination of nitrogen (ammonia, nitrate and Kjeldahl nitrogen) and phosphorus. 8. Spectrophotometric methods of analysis. 9. Ion chromatography. 10. Atomic emission spectroscopy. |

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

|  |  |
| --- | --- |
| **DELIVERY** *Face-to-face, Distance learning, etc.* | Classroom and Laboratory |
| **USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY** *Use of ICT in teaching, laboratory education, communication with students* | 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 | 20 | | Laboratory exercises | 40 | | Laboratory assignments | 30 | | Independent study | 35 | | ***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 (50%) consisting of:  - Multiple choice questions  - Problems solving  - Comparative evaluation of theory  II. Laboratory (50%) consisting of:  - Laboratory assignments |

1. **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 STUDIES** | Undergraduate | | | | | |
| **COURSE CODE** | CIV\_9670Α | | **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/> | | | | |

1. **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*   1. *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 | |

1. **SYLLABUS**

|  |
| --- |
| 1. Introduction to transportation infrastructure life-cycle management 2. Economics of transportation infrastructure projects, life cycle analysis, cost-benefit analysis 3. Road pavement defects, triggering causes, monitoring methods 4. Pavement condition evaluation, impact assessment on users and the environment 5. Pavement condition deterioration in time under traffic loading 6. Maintenance and rehabilitation strategies for road pavements 7. Defects, maintenance and rehabilitation treatments for bridges and road structures 8. Prioritization of maintenance and rehabilitation needs, resource allocation optimization 9. Traffic safety considerations in road maintenance and rehabilitation 10. Computerized pavement and bridge management systems |

1. **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* | |  |  | | --- | --- | | **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*** | |
| **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/CIV1532/> |

1. **ATTACHED BIBLIOGRAPHY**

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| --- |
| *- Suggested bibliography:*   * Α. 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 |

**COURSE OUTLINE**

1. **GENERAL**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **SCHOOL** | ENGINEERING | | | | | |
| **ACADEMIC UNIT** | Department of Civil Engineering | | | | | |
| **LEVEL OF STUDIES** | Undergraduate | | | | | |
| **COURSE CODE** | CIV\_9671A | | **SEMESTER** | | 9th | |
| **COURSE TITLE** | Systems and Technologies for Digital and Smart Cities | | | | | |
| **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:** | | Smart Cities, Infrastructure and Transportation | | | | |
| **LANGUAGE OF INSTRUCTION and EXAMINATIONS:** | | Greek/English | | | | |
| **IS THE COURSE OFFERED TO ERASMUS STUDENTS** | | No | | | | |
| **COURSE WEBSITE (URL)** | |  | | | | |

1. **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*   1. *Guidelines for writing Learning Outcomes* | |
| By the end of the course the student should be able to:   1. Demonstrate a thorough understanding of the key challenges associated with smart city development. 2. Design and develop interconnected patterns of smart city systems. 3. Apply risk management principles and tools in complex systems. 4. Analyze models for smart city development. 5. Evaluate the role of Digital Twins at a building, infrastructure, or city operation level. 6. Develop digital replicas of elements within the physical environment. | |
| **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 * Teamwork * Working in an interdisciplinary environment * Project planning and management * Respect for the natural environment * Production of free, creative and inductive thinking | |

1. **SYLLABUS**

|  |
| --- |
| 1. Concepts and challenges of digital / smart cities: from Smart towards Responsive Cities. 2. Good practices in smart city design and development. 3. Smart Grids and applications. 4. Introduction to Systems: Systems Thinking, Systems Analysis and System Dynamics. 5. Smart city architecture: The City as a ‘System of Systems’. 6. Case study: Development of a system dynamics model for smart city operation. 7. Risk management in complex systems, application in Smart Grids. 8. Introduction to Digital Twins technology. 9. Applications of Digital Twins in the built environment. 10. Applications of Digital Twins at a city-level. |

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

|  |  |
| --- | --- |
| **DELIVERY** *Face-to-face, Distance learning, etc.* | Lectures face to face, distance learning |
| **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 software, 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* | |  |  | | --- | --- | | **Activity** | **Semester workload** | | Lectures | 30 | | Seminars | 9 | | Study and analysis of bibliography | 35 | | Educational visits | 5 | | Project | 32 | | Essay writing | 14 | | ***Total number of hours for the course (25 hours of work-load per ECTS credit)*** | ***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.* | Language of evaluation: Greek/English  Methods of evaluation:  Written or Oral Final exam (40%) or (alternatively)  Mid-term written or oral exam (20%) and final-term written or oral exam (20%).  Homework assignments (60%).  Evaluation criteria are accessible to students in:  <https://eclass.upatras.gr/courses/CIV1782/> |

1. **ATTACHED BIBLIOGRAPHY**

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| --- |
| *- Suggested bibliography:*   * Juan Martín García “Modeling Sustainable Development: Selected papers on System Dynamics. A book written by experts for beginners”, Kindle Edition, 2019 * “Digital twins for the built environment: An introduction to the opportunities, benefits, challenges and risks”, The Institution of Engineering and Technology, 2019 * Leveson N. and Thomas J. “STPA Handbook”, MIT, 2019   *- Related academic journals:*   * ASCE Journal of Infrastructure Systems * ICE Smart Infrastructure and Construction Journal * International Journal of Systems of Systems Engineering * Energy Efficiency * International Journal of Risk Assessment and Management |

**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)** | - | | | | |

1. **LEARNING OUTCOMES**

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| **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* | |
| 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 CO2 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 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* | *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  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 | |

1. **SYLLABUS**

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| * + - 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. CO2 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.). |

1. **TEACHING and LEARNING METHODS – EVALUATION**

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| **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* | |  |  | | --- | --- | | ***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*** | |
| **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.* | Subject, during the semester (30%)  Final written exam (70%): Short-answer questions / exercises and multiple-choice questionnaires.  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%). |

1. **ATTACHED BIBLIOGRAPHY**

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| --- |
| *- Suggested bibliography:*  Α. 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.   Β. English language:   1. C.J. Kibert, *Sustainable Construction: Green Building Design and Delivery*, 5th Edition, Wiley, 2022. 2. 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/> 3. *Life Cycle Assessment for Buildings: Why it matters and how to use it*, ebook, <https://oneclicklca.drift.click/building-lca-ebook> 4. 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** | ENGINEERING | | | | |
| **ACADEMIC UNIT** | CIVIL ENGINEERING | | | | |
| **LEVEL OF COURSE** | UNDERGRADUATE | | | | |
| **COURSE CODE** | CIV\_0276Α | **SEMESTER OF STUDIES** | | 10th | |
| **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/ | | | | |

1. **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* | |

1. **SYLLABUS**

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| 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. |

1. **TEACHING AND LEARNING METHODS - ΑSSESSMENT**

|  |  |
| --- | --- |
| **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* | |  |  | | --- | --- | | ***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*** | |
| **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 (100%): solve problems in energy-design of buildings. |

1. **ATTACHED BIBLIOGRAPHY**

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| --- |
| 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. |

**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\_9811Α & CIV\_9811Α | | **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)** | |  | | | | |

1. **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*   1. *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. | |

1. **SYLLABUS**

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| 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. |

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

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| --- | --- |
| **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** *Use of ICT in teaching, laboratory education, communication with students* |  |
| **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** | | Project | 750 | |  |  | |  |  | |  |  | | ***Total number of hours for the course (25 hours of work-load per ECTS credit)*** | ***750*** | |
| **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.* | Evaluation of the dissertation and an oral examination of the student. |

1. **ATTACHED BIBLIOGRAPHY**

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| *- Suggested bibliography:*  *- Related academic journals:*  Depends on the explored theme. |