INTERNATIONAL HELLENIC UNIVERSITY	SCHOOL OF ENGINEERING **DEPARTMENT OF ENVIRONMENTAL ENGINEERING**	ΔΙ.ΠΑ.Ε.

NEW UNDERGRADUATE STUDY PROGRAMME 2024-2025

DEPARTMENT OF ENVIRONMENTAL ENGINEERING

Thessaloniki, 2024

Code	Course Type	ENVIRONMENTAL ENGINEERING UNDERGRADUATE PROGRAMME	Hours		Total Hours	ECTS
			Th	Lab/Tut		
1st Semester						
200101	BACKGROUND	Mathematics I	3	2	5	5
200102	BACKGROUND	Physics	2	2	4	5
200103	BACKGROUND	Structural Analysis	2	2	4	5
200104	BACKGROUND	Computer Aided Engineering Drawing	2	2	4	5
200105	BACKGROUND	Informatics – Computer Modeling Applications for Engineers	2	2	4	5
200106	CORE	Biology - Ecology	2	2	4	5
				Total	**25**	**30**
2nd Semester						
200201	BACKGROUND	Mathematics II	2	2	4	5
200202	BACKGROUND	Strength of Materials	2	2	4	4
200203	CORE	Atmospheric Chemistry	2	2	4	5
200204	BACKGROUND	Thermodynamics	2	2	4	5
200205	CORE	Environmental Egineering Geology	2	2	4	5
200206	CORE	Environmental Chemistry	3	2	5	6
				Total	**25**	**30**
3rd Semester						
200301	CORE	Hydraulic of Closed Pipes	2	2	4	5
200302	CORE	Soil Mechanics	2	2	4	5
200303	CORE	Atmospheric Pollution	3	2	5	5
200304	CORE	Project Management I	2	2	4	5
200305	CORE	Probability and Numerical Methods	2	2	4	5
200306	CORE	Environmental and Public Works Legislation	2	2	4	5
		Total			**25**	**30**
4th Semester						
200401	SPECIALTY	Analytical Decision Making Methods	2	2	4	5
200402	CORE	Geodesy	2	3	5	5
200403	SPECIALTY	Earthquake Engineering	2	2	4	5
200404	CORE	Open Channel Hydraulics	2	2	4	5
200405	CORE	Environmental Data Processing and Analysis	2	2	4	5
200406	CORE	Physical Process Engineering	2	2	4	5
				Total	**25**	**30**
5th Semester						
200501	SPECIALTY	Photogrammetry – Remote Sensing	2	2	4	5
200502	SPECIALTY	Solid Waste Management and Technology	2	2	4	5
200503	CORE	Reinforced Concrete I	2	2	4	5
200504	CORE	Chemical and Biochemical Processes	2	2	4	5
200505	BACKGROUND	Research Methods	2	2	4	5

200506	SPECIALTY	Water and Sewage Systems	2	3	5	5
				Total	**25**	**30**
6th Semester						
200601	SPECIALTY	Project Management II	2	2	4	5
200602	SPECIALTY	Climate Change and Impacts on Structures	2	2	4	5
200603	SPECIALTY	Geographical Information Systems	2	2	4	5
200604	CORE	Hydrology	2	2	4	5
200605	SPECIALTY	Heat and Mass Transfer	3	2	5	5
200606	SPECIALTY	Energy Design of Buildings	2	2	4	5
				Total	**25**	**30**
7th Semester						
200701	SPECIALTY	Smart Cities	2	2	4	5
200702	CORE	Coastal Engineering	2	3	5	5
200703	SPECIALTY	Pollution and Pollution Control Technologies I	2	2	4	5
200704	SPECIALTY	Wastewater Management and Treatment Technologies	2	2	4	5
	SPECIALTY	Elective 1st	2	2	4	5
	SPECIALTY	Elective 2nd	2	2	4	5
				Total	**25**	**30**
8th Semester						
200801	SPECIALTY	Physical Oceanography	2	2	4	5
200802	SPECIALTY	Environmental Impact Studies	2	2	4	5
200803	SPECIALTY	Pollution and Pollution Control Technologies II	3	2	5	5
200804	SPECIALTY	Business Administration and Entrepreneurship	2	2	4	5
200805	SPECIALTY	Renewable Energy Sources	2	2	4	5
	SPECIALTY	Elective 3rd	2	2	4	5
				Total	**25**	**30**
9th Semester						
200901	SPECIALTY	Groundwater Hydraulics and Hydrogeolgy	3	2	5	5
200902	SPECIALTY	Reinforced Concrete II	2	2	4	5
200903	SPECIALTY	Water Resources Management	2	2	4	5
	SPECIALTY	Elective 4th	2	2	4	5
	SPECIALTY	Elective 5th	2	2	4	5
	SPECIALTY	Elective 6th	2	2	4	5
				Total	**25**	**30**
				TOTAL HOURS OF (1ST+2nd+….+9th SEMESTER)	**225**	
10th Semester						
				Dissertation		**30**
				TOTAL ECTS OF (1o+2o+….+10o semester)		**300**

Code	Course Type	ELECTIVE COURSES BUILT ENVIRONMENT AND MANAGEMENT SECTOR	Hours		Total Hours	ECTS
			Th	Lab/Tut		
7th Semester (Choice of 2)						
200705	SPECIALTY	Risk Management	2	2	4	5
200706	SPECIALTY	Energy Systems Design	2	2	4	5
200707	SPECIALTY	Architecture of the Physical and Built Environment	2	2	4	5
200708	SPECIALTY	Inspection, Maintenance and Rehabilitation of Stuctures	2	2	4	5
200709	SPECIALTY	Environmental Informatics	2	2	4	5
200710	SPECIALTY	Project Planning Software Applications	2	2	4	5
8th Semester (Choice of 1)						
200806	SPECIALTY	Art and Technology	2	2	4	5
200807	SPECIALTY	Mathematics III	2	2	4	5
200808	SPECIALTY	Health and Safety at Work	2	2	4	5
9th Semester (Choice of 3)						
200904	SPECIALTY	Building Materials and Indoor Environmental Quality	2	2	4	5
200905	SPECIALTY	Natural Disaster Management	2	2	4	5
200906	SPECIALTY	Natural Hazards	2	2	4	5
200907	SPECIALTY	Quality Management and Assurance	2	2	4	5
200908	SPECIALTY	Sustainable Development	2	2	4	5
200909	SPECIALTY	Environmental Road Construction	2	2	4	5
200910	SPECIALTY	Spatial and Urban Planning				

Code	Course Type	ELECTIVE COURSES HYDRAULIC AND GEO-ENVIRONMENTAL ENGINEERING SECTOR	Hours		Total Hours	ECTS
			Th	Lab/Tut		
7th Semester (Choice of 2)						
200711	SPECIALTY	Foundations and Supports	2	2	4	5
200712	SPECIALTY	Land reclamation	2	2	4	5
200713	SPECIALTY	Treatment and Management of Toxic and Hazardous Waste	2	2	4	5
200714	SPECIALTY	Industrial Wastewater Treatment	2	2	4	5
200715	SPECIALTY	Hydrodynamic Projects-Dams	2	2	4	5
200716	SPECIALTY	River Training	2	2	4	5
8th Semester (Choice of 1)						
200809	SPECIALTY	Ecotoxicology	2	2	4	5
200810	SPECIALTY	Environmental Geotechnical Engineering	2	2	4	5
200811	SPECIALTY	Geotechnical Projects	2	2	4	5

9th Semester (Choice of 3)						
200911	SPECIALTY	Experimental Fluid Mechanics	2	2	4	5
200912	SPECIALTY	Environmental Management of Ports and Coastal Areas	2	2	4	5
200913	SPECIALTY	Environmental Microbiology and Biotechnology	2	2	4	5
200914	SPECIALTY	Numerical Methods and Mathematical Models in Hydraulic Projects	2	2	4	5
200915	SPECIALTY	Experimental Rock Mechanics	2	2	4	5
200916	SPECIALTY	Unsteady Flows	2	2	4	5
200917	SPECIALTY	Aquatic Ecosystems	2	2	4	5
200918	SPECIALTY	Artificial Plant Ecosystems	2	2	4	5

DETAILED COURSES OUTLINE

1st Semester Courses

CODE	COURSES	COURSE DESCRIPTION	ECTS
200101	**MATHEMATICS I**		**5**
	General Background (Th/ Tut)	**Aim:** The aim of the course is to familiarize students with the use of the mathematical tools of single-variable calculus and basic vector algebra on a theoretical and practical level.	
		Content: The concept of the derivative and its threefold use as, tangent slope, curve slope and rate of change. Chain derivative and derivative of complex functions. Linear approximations and differentials. Applications of derivatives (rates of change and graphs, function optimisation). Anti-derivative function and Finite Integer. Integration techniques. The definite integral - the Fundamental Theorem of Integral Calculus. Applications of the definite integral (area, volume, curve length). Vectors in the plane and in space - Vector operations. Internal, external, mixed product of vectors and their applications. Introduction to the calculus of vector functions (derivative, tangent vector, indefinite and definite integral of vector functions). Sequences and Series of real numbers - Power series.	
200102	**PHYSICS**		**5**
	General Background (Th/Tut)	**Aim:** This course is to make students learn and understand basic concepts and principles of physics to analyze practical engineering problems and apply its solutions effectively and meaningfully.	
		Content: Measurement systems and units. Basic concepts of vectors. Movement of point material in a straight line and in two or three dimensions. Forces. Kinetic energy, dynamic energy and work. Elements of fluid mechanics. Fluid density and pressure. Ideal fluids in motion. Heat, temperature. - Basic applications of physics to air pollution (gas masses, gas direction, density, etc.). Basic physics applications in aquatic ecosystems and in solid and liquid waste treatment (volume calculation, sizing, sedimentation and flocculation mechanisms	
200103	**STRUCTURAL ANALYSIS I**		**5**
	General Background (Th/Lab)	**Aim:** The aim of the course is to teach the students the fundamental principles and methods of structural analysis and design	
		Content: Introduction to Construction and computer programs for structural design. Design loads. Linear structures. Types of forces (compression, tension, bending, torsion, buckling). Types of supports. Determinate structures. Beams and frames. Structures in equilibrium (determinate structures): Supports, loads, free body diagrams. Calculation of reactions, axial force, bending moment and shear force diagrams. Beams	

		and frames. Principle of superposition. Trusses: Method of joints. Method of Ritter sections. Centroid and centre of mass: Complex bodies. Static first moment of section area about an axis.Second moments of section areas: Definitions. Theorems of parallel axes, (Steiner). Principal axes of inertia. Mohr's Circle. Earthquake	
200104	**COMPUTER AIDED ENGINEERING DRAWING**		**5**
	General Background (Lab)	**Aim:** The course aims at teaching basic drawing methods and the comprehension of technical drawings using computers	
		Content: Introduction to line drawing, dimensions, drawing scale, drawing of an object. Geometric structures (applications). Drawing of an object – projection system (drawing of elevation and cross-sections). Volumetric representation of an object (global drawing of an object, axonometric drawing, drawing the axonometric from the elevations). Drawing sketches (free designing of an object). Application specialised issues (drawing buildings, mechanical drawing and electromechanical drawing).	
200105	**INFORMATICS-COMPUTER MODELING APPLICATIONS FOR ENGINEERS**		**5**
	General Background (Th/Lab)	**Aim:** The purpose of the course is for the student to become familiar with the use of basic computer components, to understand the wide range of computer applications and to recognize and evaluate the key factors of an environmental problem.	
		Content: Basic concepts of Information and Teleommunication Technology. Computer use and file management (computer structure, software, operating system). Word processing (MS Word). Spreadsheets (MS EXCEL). Presentations (MS Power Point); Internet and search engines. Social Networking. E-mail. Modelling applications for Engineers. Basic principles of environmental modelling. Examples of environmental modelling.	
200106	**BIOLOGY - ECOLOGY**		**5**
	Core (Th/Lab)	**Aim:** The course provides information from the fields of Biology and Ecology, helping students to understand the relationships between organisms and nature, between organisms themselves and the needs of life such as biotic and abiotic factors in an environment in order to understand and mitigate impacts of the built environment based on the the effects of projects on the environment. Methods of mitigation of these impacts.	

		Content: Terrestrial systems and their development (lowland, mountain, forest, lakeside, riverside). Coastal and offshore systems and their development (transitional, perennial, offshore, erosion). Components of sustainable development and infrastructure projects. Impact of transport networks on the environment. Impact of construction on the environment. Transport and diffusion of pollutants in the environment, their management and allowable limits. Structure and organization of life. Organisms (Plant-animal, Morphology, Reproduction, Evolution and Classification). Life cycle (reproduction-growth-age).	

2nd Semester Courses

CODE	COURSES	COURSE DESCRIPTION	ECTS
200201	**MATHEMATICS II**		**5**
	General Background (Th/ Tut)	**Aim:** The aim of the course is to familiarize students with the use of the mathematical tools of multivariable Vector Calculus and to introduce them to Differential Equations.	
		Content: Introduction to multivariable functions. Partial derivatives, chain derivation, rates of change and differentials. Isostatic curve diagrams. Directional derivative, slope of a bivariate function. Local extremes, conditional extremes, Lagrange multipliers. Double, triple integrals & their applications. Elements of Vector Calculus & its applications. Introduction to differential equations, integral curves and gradient fields. Initial value problems, exponential and logistic models. 1st order differential equations of separated variables. 1st order differential equations (Bernoulli, linear).	
200202	**STRENGTH OF MATERIALS**		**4**
	General Background (Th/Lab)	**Aim:** The aim of this subject is to provide the knowledge of simple stress strains flexural stresses in members, shear stresses and deflection in beams so that the concepts can be applied to the Engineering problems.	
		Content: Concept of stress and strain, generalized Hooke's Law, axial load, torsion, (from Catalog) pure bending, transverse loading, transformation of stress and strain components in 2D, design of beams and shafts for strength, deflection of beams, work and energy, columns.	
200203	**ATMOSPHERIC CHEMISTRY**		**5**
	Core (Th/Tut)	**Aim:** The aim of the course is for students to understand the chemical processes that take place in the atmosphere, the tools and simulations for investigating chemical reactions under specific environmental conditions, as well as the causes and effects of the main environmental problems related to the atmospheric environment..	
		Content: Introductory concepts about the atmosphere. The chemistry of the troposphere (methane oxidation, atmospheric chemistry of organic compounds). Henry's law. Greenhouse effect and climate change. Chemical equilibrium in clouds (carbon dioxide and water, ammonia and water, nitric acid and water). Organic volatile, nitrogen and sulphur compounds in the atmosphere. Stratospheric ozone and physico-chemical processes of production and consumption. The effect of halogens, the ozone hole..	
200204	**THERMODYNAMICS**		**5**
	General Background (Th/Lab)	**Aim:** The aim of the course is for students to understand the principles, methodology and basic calculations of thermodynamics.	

		Content: Introduction to Thermodynamics-Basic Concepts. Energy - Energy Transfer. Properties of Pure Substances. Energy analysis of closed systems and control volumes (First law of thermodynamics). Second law of thermodynamics. Entropy. Air and steam power cycles. Refrigeration cycles. Relationships of thermodynamic properties (thermodynamic properties of mixtures of gases and gases with vapours). Atmospheric psychrometric diagram and basic calculations of evaporative cooling. Thermodynamics of chemical reactions. Heat released during combustion. Thermodynamic calculation of the equilibrium constant of chemical systems..	
200205	**ENVIRONMENTAL ENGINEERING GEOLOGY**		**5**
	Core (Th/Lab)	**Aim:** The aim of the course is for the student to be able to know the basic principles and mechanisms governing the geoenvironment and natural disasters, to be aware of the problems created by the anthropocentric approach that ignores the laws of nature and has led to an environmental crisis, to understand the distribution and characteristics of natural disasters and how they are directly determined by geological and geodynamic processes and to train in modern methods for the study of natural hazards.	
		Content: Natural Materials and Processes. Geological cycle and sub-cycles (tectonic, petrological, geochemical, hydrological). Soils and Environment (soil development and time sequences, fertile soils, classification and technical properties of soils, soil contamination). Water (water cycle, groundwater, use, dams, flood basin and canals, water management, pollution, desalination). Mineral resources and the environment. Energy resources (Coal and lignite, Oil and gas, Nuclear energy, Geothermal energy, Renewable energy, Hydropower). Geological Data and Land Use Planning (Geo-environmental mapping, environmental impact assessment, land use planning) Geological Factors and Environmental Health (trace elements, chronic diseases and geological context). Natural Disasters. Seismic risk Tsunami risk. Landslide risk. Flood risk. Volcanic risk. Fire risk. Long-term geo-environmental hazards (coastal changes, erosion, desertification). Glacial risk.	
200206	**ENVIRONMENTAL CHEMISTRY**		**6**
	Core (Th/Lab)	**Aim:** The aim of the course is for students to be able to know basic principles of chemistry and to understand physicochemical mechanisms governing environmental processes and the processes of pollutants**..**	

		Content: Fundamental principles of chemistry. Structure and properties of chemical elements. Solutions. Chemical reactions. Microorganisms. Basic elements of the environment. Biogeochemical cycles. Toxic organic substances. Heavy metals. Basic principles of water pollution. Basic principles of air pollution. Basic principles of soil pollution.	

3rd Semester Courses

CODE	COURSES	COURSE DESCRIPTION	ECTS
200301	**HYDRAULICS OF CLOSED PIPES**		**5**
	Core (Th/Lab)	**Aim:** The aim of the course is to provide students an understanding of the subject of the laws of Hydraulic Closed Pipes and to become familiar with the principles of continuity, momentum and energy and dealing with hydraulic problems.	
		Content: Physical Properties of Fluids (Density and Specific Gravity - Temperature - Pressure - Compressibility, Thermal Expansion and Elasticity Measure - Specific Heats c - Vapor Voltage - Surface tension). Transfer properties (Viscosity - Viscosity coefficient - Thermal conductivity coefficient λ - D molecular diffusion coefficient). Hydrostatic (Pressure as Point Size - Law of Hydrostatic - Hydrostatic Pressure Distribution - Hydrostatic Pressure Diagrams - Transporting Vessels - Isobaric or Isotropic Surfaces - Rotating Fluids - Fluid in a Straight Linear-Influential Linear- of the constituted force - Forces on curved surfaces - Horizontal components of the forces - Vertical component of the force - Association - Recommended force. Hydrodynamics (Flow Field - Flow Lines - Lines - Transmission Lines - Time Lines - Continuity Law - Transfer Theorem or Reynolds - Complete Form of the Law of Continuity - Law of Hydrodynamics (Integral Form) - Law of Hydrodynamic Bernoulli). Closed ducts, loss curves, piezometric line and power line.	
200302	**SOIL MECHANICS**		**5**
	Core (Th/Lab)	**Aim:** The aim of the course is for the student to understand and analyse the basic physical and mechanical properties of soils, to know the basic principles of soil mechanics, to understand and deal with complex problems of soil mechanics in the construction industry.	
		Content: Physical properties of soils. Methods of classification and classification of these. General principles of soil mechanics. Total-active stresses. Shear strength of soil. Mohr-Coulomb criterion. Stress distribution in soil due to external load. Boussinesq Theory - Hiray Theory Ground thrusts. Coulomb's method, Rankine's method. Building subsidence. Bearing capacity of soils	
200303	**ATMOSPHERIC POLLUTION**		**5**
	Core (Th/Lab)	**Aim:** The purpose of the course is for students to gain an understanding of the basic characteristics of the Earth's atmosphere and airborne particles and know the air quality limits for the major air pollutants.	

		Content: Atmosphere (atmospheric layers, wind circulation, transportation of pollutants in the atmosphere, concentration units in the atmosphere). Concentrations and mixing ratios of chemical compounds in the atmosphere. Radiation and the atmosphere. Greenhouse effect. Greenhouse gas emissions. Atmospheric circulation-Basic equations of atmospheric flow-dispersion and diffusion of pollutants in the atmosphere. Characteristics of suspended particles in the atmosphere. Removal of pollutants from the atmosphere, liquid deposition of air pollutants, liquid removal of particles, acid rain. Human exposure to suspended particles through respiration. Air quality limits.	
200304	**PROJECT MANAGEMENT I**		**5**
	Core (Th/Tut)	**Aim:** The purpose of this course is to introduce the student to basics of construction project organization and planning, including scheduling and financial planning.	
		Content: Introduction to Project Management, Construction Site Organization and Set Up, Machinery and Equipment Productivity, Project Scheduling (Linear and Network Scheduling), Project Financial Planning (Cost and Income Curves), Resource Management, Project Control (Earned Value Analysis).	
200305	**PROBABILITY AND NUMERICAL METHODS**		**5**
	Core (Th/Tut)	**Aim:** The objective of this subject is to expose students to understand the basic notions of probability theory and numerical analysis.	
		Content: Probability theory: Axioms of probability, Conditional probability, Independence, Bayes' theorem. Random variables, probability mass function , probability density function , cumulative distribution function, mean, variance and standard deviation. Skewness and Kurtosis. Basic distributions functions (Binomial, Geometric, Poisson, Exponential, Normal) and their applications. Numerical Analysis: Numerical Methods for solving equations (Iteration, false position, Newton Raphson). Numerical methods for solving systems of linear equations (Gauss-Seidel, LU decomposition). Newton- Raphson method for the system of nonlinear equations. Numerical methods for solving ordinary differential equations (Taylor, Euler, Runge – Kutta).	
200306	**ENVIRONMENTAL AND PUBLIC WORKS LEGISLATION**		**5**
	Core (Th/Tut)	**Aim:** The purpose of this course is to familiarize the student with the legal framework in Greece around the procurement of public service, supply and works contracts (design, permits, tender and execution), as well as the procedure for obtaining permits for private owned building projects.	

		Content: Analysis, explanation and examples of the application of National and European legislation for the procurement and execution procedures of works, supplies and consultancy contracts (L.4412/2016). Introduction to the National Environmental Legislation (L. 4014/11), Land Expropriation Code (L. 2882/2001), Building Code (L. 4495/2017). Introduction to Greek and International Standard Contracts.	

4th Semester Courses

CODE	COURSES	COURSES DESCRIPTION	ECTS
200401	**ANALYTICAL DECISION MAKING METHODS**		**5**
	Speciality (Th/Tut)	**Aim:** The purpose of this course is to provide students with decision-making skills and methodologies in relation to project management dilemmas.	
		Content: Leadership and guidance in business and projects. Information and information systems. Introduction to decision theory (concepts of the decision maker, basic steps of the decision making process). Problem-solving methods (Pareto analysis, ISHIKAWA diagrams, decision tables, dynamic field analysis, decision trees, linear programming). Multicriteria Decision Analysis (criteria, preferences, decision structures, classification methods). Multi-criteria decision making methods (utility theory, weighted average method, analytical hierarchical process, PROMETHEE, TOPSIS, Simos' method). Group decision making (brainstorming method, idea logging method, Delphi method). Decision support systems. Intelligent decision systems (neural networks, fuzzy sets)	
200402	**GEODESY**		**5**
	Core (Th/Lab)	**Aim:** This course aims to get the students acquainted with the basic principles and concepts of Geodesy	
		Content: Introductory and fundamental concepts of Geodesy. Surfaces and measurement reporting systems. Design Scales of Topographic Charts. Measurement units of lengths, angles, areas and volumes. Fundamental problems of geodesy. Polygonometry. Installation, measurement and calculation of polygonal routes. Reference systems and introduction to Satellite Geodesy	
200403	**EARTHQUAKE ENGINEERING**		**5**
	Speciality (Th/Tut)	**Aim:** The course aims to familiarise students with the basic principles of earthquakes and the their effects to structures, be able to recognise and resolve problems due to earthquakes and to apply practical methods in the design of structures	
		Content: General knowledge and principles about earthquakes and seismology. Equation of motion of Single Degree Of Freedom (SDOF) systems. Forced vibrations of MDOF systems, damping, natural periods and normal modes. Modelling of structures and seismic loads for dynamic analyses. Dynamic loading and response of structures. Basic concepts of seismic analysis of structures. Seismic analysis methods and applications with the existing Seismic Regulations for Construction.	
200404	**OPEN CHANNEL HYDRAULICS**		**5**

	Core (Th/Lab)	**Aim:** The aim of the course is to provide students of the laws of Open Channels; Hydraulics and to be able to meet the needs of the design and construction of hydraulic projects as much as possible.	
		Content: Open channels (uniform flow, types of Chezy, Cutter, Manning, critical flow, subcritical flow, supercritical flow, financial cross sections, non-uniform flow, hydraulic jump, flow under gate). Leakage through holes. Extruders (Extruder types, flow metrics). Flow in piping networks (Floating and parallel pipes, Cross method). Hydraulic machines Pumps, turbines, characteristic curves, caving.	
200405	**ENVIRONMENTAL DATA PROCESSING AND ANALYSIS**		**5**
	Core (Th/Tut)	**Aim:** The course provides the analysis tools of data with statistical methods comparing and evaluating of results. This knowledge will facilitate the graduate in his academic life to evaluate environmental factors based on research data or collected information in order to make decisions or to propose solutions.	
		Content: The need to collect and process data. Evaluation of the collected data. Use of a statistical package. Parameters and variables. Data control and management. Descriptive statistics. Comparison of samples (t-tests, one way ANOVA). Linear regression. Graphical illustrations of data analysis results. Information Management, Ethics and Intellectual Property. Laboratory: Searching for data and application of appropriate statistical analysis according to the purpose of research.	
200406	**PHYSICAL PROCESS ENGINEERING**		**5**
	Core (Th/Lab)	**Aim:** The aim of the course is for students to gain knowledge of the basic types of pumps, types of mixers (mechanical, pneumatic, hydraulic) and the design parameters of mixing vessels, the basic properties of colloidal solutions, the mechanism of separation of solids from fluids by filtration, the basic types of adsorbent materials and their characteristics and the basic principles of mass transfer through interfaces for the transfer of gases in liquids.	
		Content: Introduction. Pumps-Basic types of pumps. Principles of operation for different types of fluids, Mixing and types of mixers (mechanical, pneumatic, hydraulic). Flocculation - Aggregation. Centrifugation and types of centrifugal separators. Adsorption and types of adsorbent materials. Gas absorption. Oxygen transfer in liquids.	

5th Semester Courses

CODE	COURSES	COURSES DESCRIPTION	ECTS
200501	**PHOTOGRAMMETRY - REMOTE SENSING**		**5**
	Specialty (Th/Tut)	**Aim:** Upon successful completion of the course, students will be able to understand the basic objects and the basic principles, methods and problems of photogrammetry and remote sensing.	
		Content: Basic concepts. Analogue and digital image. Analogue and digital receivers. Central projection. Internal and external orientation. Optical, Analytical, Digital Reduction. Stereoscopic vision and observation of analogue and digital images. Relative and absolute orientation. Photogrammetry and digital terrain models. Reduction, orthophotography. Photogrammetry ground, proximal, satellite. Applications of photogrammetry Basics of remote sensing. Passive and active remote sensing techniques. - Atmospheric remote sensing technology. Exploitation of Earth data. Introduction to the principles of remote sensing systems. Applications of remote sensing.	
200502	**SOLID WASTE MANAGEMENT AND TECHNOLOGY**		**5**
	Specialty (Th/Tut)	**Aim:** This module provides students with an understanding of technical issues and the management of solid wastes.	
		Content: Introduction to solid waste management, Sources, quantities and composition, Legislation, regulation and control, Anaerobic Digestion, Anaerobic Digestion of Municipal Solid Waste (MSW), Composting, Incineration, Reuse and recycling, Recycling technologies, Waste management behaviour (people),Industrial solid waste (audits, minimisation), Waste composition and stabilisation behaviour, Landfill site design and management, Risk assessment of landfills, Pollution from landfills, Leachate fate, attenuation and treatment, Industrial waste strategies, Municipal Solid Waste (MSW) strategies, Decision Support Systems (DSS) for MSW, Solid waste issues in emerging and developing countries.	
200503	**REINFORCED CONCRETE I**		**5**
	Core (Th/Lab)	**Aim:** The aim of the course is for students to, understand the basic theory for the design and construction of reinforced concrete structures in accordance with the provisions of the Greek and international standards (EUROCODE), recognise the basic properties of structural steel and concrete, learn how to design of structural elements such as beams and collumns, learn to produce a concrete mix design with reduced environmental footprint such as high performance concrete, to carry out quality control on fresh and hardened concrete and to think critically about current trends in the reinforced concrete construction industry including those of the circular	

		economy.	
		Content: Structural elements and construction systems. .1. Types of foundation systems. Types of surface elements (slabs, shells). Linear elements (beams, columns, walls, cores, nodes). Forms of structural construction systems. Structural design basics according to Eurocode 0. Forces on structures according to Eurocode 1. Design of structures according to Eurocode 2. Protection of concrete against corrosion depending on environmental conditions. The concepts of Failure Limit States and Functionality. Ideal stress-strain diagrams for concrete and steel. Dimensioning of rectangular sections from normal stress quantities. Interaction diagrams. Dimensioning against shear. Rules for structural shaping and reinforcement. High performance concrete. The concept of the circular economy in the reinforced concrete construction industry.	
200504	**CHEMICAL AND BIOCHEMICAL PROCESSES**		**5**
	Core (Th/Lab)	**Aim:** The aim of the course is for students to gain knowledge of the basic principles of chemical reaction kinetics, the differences in the different types of model reactors, the application of mass and energy balances in basic reactor types, the basic principles of catalysis and the characteristics of catalysts, the mathematical models of microorganism growth and the basic types of bioreactors.	
		Content: Elemental chemistry and kinetics of chemical reactions. Design equations of ideal reactors (intermittent work, continuous mixing operation, grooved reactor). Generalised mass balances. Kinetics of chemical reactions. Design of isothermal homogeneous reactors (batch, CSTR, PFR). Reactors with recycling. Non-isothermal reactors. Mathematical models of micro-organism growth (single variable, substrate-limited, maintenance and endogenous metabolism). Design of bioreactors (batch, fed-batch, CSTR). Sterilisation kinetics. Aeration and stirring of bioreactors. Determination of optimal operating conditions	
200505	**RESEARCH METHODS**		**5**
	General Background (Th/Tut)	**Aim:** The course provides the ability to be designed a representative research of environment or a study and demonstrates it in a text or a presentation. The data will be collected using the appropriate sampling methods according to the type of environment, the required information and the frequency of monitoring project. In addition, this knowledge will help the graduate to write, prepare the diploma thesis and in academic life, studies and texts to be structure and presented.	

		Content: Sampling methods according to the type of environment. Samples. Representativeness of samples. Sampling error. Project structure analysis, necessity and utility. Instructions for Authors. Scientific sources of relevant information. Use of bibliography. Sections and contents of the study's text. Presentation of scientific work / Creation of a poster. Power Point use. Data and results Management, Ethics and Intellectual Property. Plagiarism.	
200506	**WATER AND SEWAGE SYSTEMS**		**5**
	Specialty (Th/Lab)	**Aim:** The aim of the course is for students to become familiar with the basic principles and design parameters of water supply and sewerage systems and to acquire the ability to analyse and design modern water supply and sewerage networks.	
		Content: Water abstraction and abstraction - water quality. Determination of water needs of settlements. Study of water supply projects (external aqueduct, gravity and pumping water - volume of tanks - storage - distribution networks (closed - radial - open). Design - dimensioning - hydraulic calculations. Improvement of water quality – sedimentation. Sewer networks (Introduction - Pantower and Separate Sewerage System). Sewer network mapping (horizontal mapping). Elevation of pipelines. Calculate the discharge of impurities for each section of the pipeline. Calculation of the cross-section of conductors. Rainwater Networks. Rainwater mapping (horizontal mapping). Elevation of pipelines. Calculation of the flow of a catchment, rain intensity. Groundwater penetration, pumping of waste water. Drainage ducts (Tube types. Cross sections. Conductor strength testing). Construction (Transportation of materials, excavation, slope mounting - piping - excavation - construction problems). Maintenance (cleaning methods - security video surveillance systems). Ancillary technical works (wells - wells - pipettes). Estuary technical works.	

6th Semester Courses

CODE	COURSES	COURSES DESCRIPTION	ECTS
200601	**PROJECT MANAGEMENT II**		**5**
	Specialty (Th/Tut)	**Aim:** The purpose of this course is to familiarize students with the responsibilities of Greek Public Work Client's Contracting and Managing Authorities during the execution of public works construction contracts.	
		Content: Project Management on behalf of the Client: Legal framework for the execution of Greek Public Works - Construction Supervision. Remeasurement. Activity Certification and Payment. Quality Control. Damages and Defects. Project Handover - Contract Management. Contractual Budget. Change Management: Variation orders, New Unit Rates, Supplementary Contracts and Extensions of Time. - Claims Management. Disputes Resolutions.	
200602	**CLIMATE CHANGE AND IMPACT ON STRUCURES**		**5**
	Specialty (Th/Tut)	**Aim:** The purpose of this course is to familiarize students with the fundamentals of strucutral engineering concepts in order to be able participate in the designing, constructing and quantity surveying of several types of bridges while understanding the role of the environmental engineer in the holistic approach to sustainable development by option evaluation and being able to understand the impacts of climate change on structures to provide viable solutions.	
		Content: Designing bridges for sustainability. Aesthetics of bridges. Bridges: iconic, special, typical, poorly designed bridges and upgrading techniques. Green bridges. Bridge drainage and water management. Safety parapets and sound barriers. Innovative systems. Environmental integration techniques. Methods of construction of modern bridges, constructability and performance, The impact of climate change on bridges and current trends in dealing with it. Examples of good practice. Bridge lifecycle assessment. Initial construction costs. Life cycle cost analysis. Integration in the circular economy..	
200603	**GEOGRAPHICAL INFORMATION SYSTEMS**		**5**
	Specialty (Th/Lab)	**Aim:** The main aim of the course is to provide an overview of the potentials of digital dynamic mapping. It also aims to manage data and to map it. The purpose is to use maps as means of decision making.	
		Content: Spatial and descriptive data. Philosophy and Political Nature of GIS. Geographic problem solving. Computer-aided cartography. Principles and Applications of Satellite Remote Sensing. Global Navigation and Positioning System. Databases and Management Systems. Spatial data models. Projection Systems. Basic	

		GIS functions. Decision Support Systems. Data modelling in a GIS environment. Application of GIS in Hydrogeoinformatics.	
200604	**HYDROLOGY**		**5**
	Core (Th/Tut)	**Aim:** The aim of the course is to provide students with an understanding of the subject of hydrology, the basics of ground water hydraulics, and to familiarize and work on basin and general hydrology studies	
		Content: Hydrological Cycle, Measurement - Calculation and Analysis of Rainfall (Precipitation), Evaporation and Evapotranspiration, Infiltration, Catchment and Runoff Models, Coefficient of Runoff, Concentration Time, Hydrographs of Runoff, Unit Hydrograph, Flood Design, Sustainable technologies for the design of construction projects based on hydrological data.	
200605	**HEAT AND MASS TRANSFER**		**5**
	Specialty (Th/Tut)	**Aim:** The aim of the course is for the students to understand the mechanisms and processes of heat and mass transfer during fluid movement in a pipeline and the principles governing the transfer and diffusion of heat and mass.	
		Content: Introduction to transport phenomena. Concentration. Heat and mass. Heat transfer mechanisms. Conduction - Radiation - Mass transfer - Mass transfer mechanisms. Diffusion. Diffusion coefficient. Diffusion in liquids. Diffusion in steady state. Diffusion in non-steady state. Mass balance.	
200606	**ENERGY DESIGN OF BUILDINGS**		**5**
	Specialty (Th/Tut)	**Aim:** The purpose of the course is for students to become familiar with modern trends and techniques for the design and construction of buildings in a way that saves energy, to become familiar with the provisions of the Energy Performance of Buildings Regulation (EPBD) and to become familiar with its application.	
		Content: Energy sources today and the energy problem. Economic dimension of the energy problem. The evolution of the energy problem, and the global outlook. The energy problem and the environment. Soft forms of energy. Soft energy technology. Buildings and energy consumption. Energy saving in buildings. Thermal insulation of buildings. Architectural design for passive heating and lighting of the building. History of construction of 'energy' buildings. Modern trends in architectural 'energy design'. Solar energy technology. Solar panels. Electronic thermocouples. Solar energy building design. Wind energy technology. Use of wind energy in construction. Techno-economic study of wind energy source in buildings. Alternative methods of heating buildings used to save energy (natural gas,	

		district heating, etc.).	

7th Semester Courses

CODE	COURSES	COURSES DESCRIPTION	ECTS
200701	**SMART CITIES**		**5**
	Specialty (Th/Tut)	**Aim:** The aim of the course is for students to understand the technological, environmental and socio-economic aspects of the sustainable smart city, the changes that a city must undergo be categorised as a smart city ang the required digital applications related to the management of a smart city.	
		Content: Introduction to the concept and dynamics of smart cities and the role of urban technologies: understanding the term "smart city" by presenting examples of smart cities, Information and Communication Technologies (ICT) and smart cities. Presentation of National, European and International applications, surveys, studies and guidelines for smart cities, smart city design and structure (classification of Smart Cities and smart city standards and indicators), smart cities examples. The process of innovation and the model of technology transfer in the city: the three levels of a smart city, activities that determine the development path of the city, institutional mechanisms for social cooperation for learning and innovation and digital innovation support tools and applications that create a virtual information and knowledge management environment. Challenges, hurdles and engines of innovation in a smart city: key technologies used in the development of digital applications, technical network infrastructure and components that make communication possible (fiber optic, wireless infrastructure, connections, access points, application platforms), the innovative services offered by Smart Cities with the local economy, strategies for developing successful integrated services across the six pillars (smart economy, smart mobility, smart environment, smart citizens, smart living and smart governance). Analysis and Study of Smart Cities based on planning and organizing good practices. Laboratory Exercises for the course: study and evaluate an example city that has developed a smart city strategy, technology/application creation of digital urban space and smart city structure and architecture.	
200702	**COASTAL ENGINEERING**		**5**
	Core (Th/Tut)	**Aim:** The aim of the course is to provide students with an understanding of marine wave mechanics, coastal hydrodynamics and coastal processes as well as familiarity and work on issues related to the study and design of port and coastal protection projects.	

		Content: Theory of gravity sea-waves - Wave propagation in shallow, deep and intermediate waters. – Formation of the waves on the shores: shoaling effects, refraction, diffraction - reflection, wave breaking, wave run up - Generation and development of wind waves - prognosis. Statistical study of stochastic waves- Types of port works (parallel and perpendicular to the shore) Breakwater - Moles - Bridges - Seawalls – Hydrodynamic loads on submerged body of pipes and front levels – Dimensioning and control of stability of port structures. Projects with vertical or/and sloping fronts (sea walls and inclined breakwaters). - Theories of coastal matter transport. - Morphological interactions from coastal technical projects. Exercises and Case Study.	
200703	**POLLUTION AND POLLUTION CONTROL TECHNOLOGIES I**		**5**
	Specialty (Th/Tut)	**Aim:** The aim of the course is for students to know the basic sources of air, water and soil pollution and the propagation mechanisms, to choose the optimal pollution control technology depending on the source and the pollutants emitted, to know how to dimension, implement, operate, safely maintain and control the basic environmental protection technologies.	
		Solid waste (Municipal, Industrial, Hazardous). Water and Liquid waste. Gases: Exhaust emissions. Air pollution. Water pollution. Pollution treatment technologies. Waste water treatment plants. Solid waste treatment methods. Air quality assurance technologies.	
200704	**WASTEWATER MANAGEMENT AND TREATMENT TECHNOLOGIES**		**5**
	Specialty (Th/Tut)	**Aim:** The aim of the course is for students to know and explain the basic principles of the processes that govern modern wastewater treatment and disposal, to understand modern methods of designing these processes, to become familiar with current trends and practices in Greece and the rest of the world and to explore research and development trends in the field.	
		Content: Need for processing Levels of processing. Waste water supply. Wastewater quality characteristics. Sewerage networks. Pretreatment of urban waste water. Primary treatment. Elements of microbiology and growth kinetics. Secondary treatment - biological processes. Hybrid systems. Nitrogen and phosphorus removal. Disinfection. Sludge management. Recovery - reuse of wastewater.	
	ELECTIVE 1st		
	ELECTIVE 2nd		

8th Semester Courses

CODE	COURSES	COURSES DESCRIPTION	ECTS
200801	**PHYSICAL OCEANOGRAPHY**		**5**
	Specialty (Th/TuT)	**Aim:** The aim of the course is to provide students with an understanding of the parameters of seawater and sea water masses, marine hydrodynamics and coastal processes and to familiarize students with environmental issues related to marine environment.	
		Content: Introduction to the marine environment - Introduction to Descriptive Oceanography - Physicochemical parameters of water - Temperature - Salinity - Pressure - Density - Seawater masses - Water types - Mixing of seawater masses. Sound and Light in the Marine Environment. Introduction to Dynamic Oceanography - Hydrodynamic Circulation. Sea currents Coriolis force, Wind currents, Geostrophic currents, Density currents, Inertia currents, Tidal currents. Upwelling and Downwelling of water masses - Marine Waves. Linear Wave Theory – Shoaling effects - Refraction, Diffraction, Reflection, Wave Breaking. Astronomical Tide. Transport of matter in the marine environment. Models - Mathematical Simulation.	
200802	**ENVIRONMENTAL IMPACT STUDIES**		**5**
	Specialty (Th/Tut)	**Aim:** The aim of the course is to provide students with an understanding of the relationship between technical projects and the environment and the need for sustainable development and management of natural resources. Moreover, the aim for the students is to become familiar with the European and Greek institutional framework for environmental protection, to assess the environmental impacts of infrastructure construction, know the legislation, stages and content of Environmental Impact Assessments, and produce Environmental Impact Assessments for infrastructure projects.	
		Content: Environment. Natural resources. Sustainable development and management of natural resources. European and Greek institutional framework for environmental protection. Natural environment and human activities. Pollution, environmental pressures from construction works. Environmental Impact Assessment. Environmental Impact Studies. Necessity and Legislation. Stakeholders. Stages (Planning Approval, Approval of Environmental Terms) and content of Environmental Impact Assessment. Examples of Environmental Impact Assessment. Environmental	

		Impact Assessment Applications for Infrastructure Projects.	
200803	**POLLUTION AND POLLUTION CONTROL TECHNOLOGIES II**		**5**
	Specialty (Th/Tut)	**Aim:** The aim of the course is for students to know advanced pollution control methods, to evaluate the operation of existing plants, to be able to recommend the appropriate technology where appropriate, to evaluate environmental limits, to combine knowledge from different courses and to implement an environmental monitoring plan.	
		Content: Advanced treatment methods for liquid, solid and gaseous pollutants. Legal limits and inspections. Establishment of an environmental inspection system where appropriate. Evaluation of anti-pollution technologies. Environmental protection management systems.	
200804	**BUSINESS ADMINISTRATION AND ENTREPRENEURSHIP**		**5**
	Specialty (Th/Tut)	**Aim:** The aim of the course is to familiarize students with the conceptual framework, the content of business management and entrepreneurship and the environment in which a business operates, as well as to introduce them to the basic aspects of management, business development and the process of establishing and developing a business, from the identification of the business opportunity to the financing and implementation of the business plan.	
		Content: The concept and importance of entrepreneurship and innovation. Business and economic environment. Business opportunity, uncertainty, business risk and decision making. Entrepreneurial skills, profile of the entrepreneur. The entrepreneurial process cycle (conception of a business idea, evaluation of business opportunity, development of business model, creation of business plan, sources of finance). Establishing a business. International entrepreneurship. Social entrepreneurship. Corporate social responsibility and business ethics.National entrepreneurship policies and Community actions. Innovation	
200805	**RENEWABLE ENERGY SOURCES**		**5**

	Specialty (Th/Tut)	**Aim:** The aim of the course is to provide students with an understanding of the subject of Renewable Energy Sources and the acquisition of the ability to identify the source of renewable energy from where it can be used in real life, as well as the promotion at the level of study-implementation by the help of an assignment that will they will have to work on.	
		Content: Introduction, definitions. Environment and energy. Basic principles of renewable energy. Biomass - Biofuels. Solar energy utilization systems. Passive-Active Systems, Photovoltaic, Bioclimatic. Wind power. Small hydroelectric systems. Geothermal. Energy saving pinciples. Standard energy applications (desalination, autonomous energy systems, solar cooling). Dimensioning of RES systems. Environmental impacts from renewable and conventional energy sources. Elaboration of a topic related to a series of exercises in the above topics that the course deals with.	
	ELECTIVE 3rd		

9th Semester Courses

CODE	COURSES	COURSES DESCRIPTION	ECTS
200901	**GROUNDWATER HYDRAULICS AND HYDROGEOLOGY**		**5**
	Specialty (Th/Tut)	**Aim:** The aim of the course is to provide students with an understanding of the subject of ground water hydraulics and hydrogeology and to familiarize them with the methods of calculating various problems related to these subjects.	
		Content: Introduction to ground water hydraulics, Water movement in underground aquifers. Water movement and transport phenomena in porous media and underground aquifers. Watershed elements, definitions, types of aquifers. Methods for solving equations of ground water hydraulics. Transport mechanisms in ground water hydraulics. Special topics.	
20090	**REINFORCED CONCRETE II**		**5**
	Specialty (Th/Tut)	**Aim:** The aim of the course is for students to understand the basic theory for the design and implementation of reinforced concrete structures according to the provisions of the Eurocode and the Greek and international standards, to be able to understand and deal with complex problems related to the design of specialized reinforced concrete structures such as tanks and pumping stations and to develop critical thinking and responsible scientific and professional behaviour in the field of proper design and safety of structures.	
		Content: Column bending. Plate function and design. Ultimate limit state in shear. Ultimate limit state in torsion. Operational limit state tests. 6. Elements of seismic design of reinforced concrete structures. Design of tanks and pumping stations.	
200903	**WATER RESOURCE MANAGEMENT**		
	Specialty (Th/Tut)	**Aim:** The aim of the course is for students to acquire knowledge of water resources assessment methods and anthropogenic impacts on water, specific topics such as reservoirs, basins, groundwater management, reuse of treated wastewater and to acquire skills in the preparation of water resources management studies, water balances and basin management plans.	
		Content: Introduction to Environmental Systems Management. Water scarcity. Water demand management. Costing and pricing. Introduction to water resource systems design and analysis. Methods of analysis. Objectives of water resources planning. Management of coastal groundwater systems. Marine intrusion - Methods of protection. Desalination - Desalination technologies, environmental problems, economics. Water resources management during drought. Drought indicators.	
	ELECTIVE 4th		

	ELECTIVE 5th		
	ELECTIVE 6th		

Elective Courses

BUILT ENVIRONMENT AND MANAGEMENT SECTOR			
7th Semester (Choice of 2)			
CODE	**COURSES**	**COURSES DESCRIPTION**	**ECTS**
200705	**RISK MANAGEMENT**		**5**
	Speciality (Th/Tut)	**Aim:** To allow the student to proceed deeper into project planning (scheduling and Cost) in order to learn methods for optimization of plans taking into consideration risk management and analysis techniques	
		Content: Schedule optimization, Budget optimization and investment evaluation, Risk Management, Definition of risks (SWOT analysis, Delphi method), Risk Analysis (Monte Carlo, PERT).	
200706	**ENERGY SYSTEMS DESIGN**		**5**
	Speciality (Th/Tut)	**Aim:** The aim of the course is for students to evaluate the energy needs of heating and cooling, ventilation and lighting of buildings, to analyse innovative energy saving technologies, to analyse and calculate the basic elements of individual energy production and saving systems and to evaluate the optimal energy solution from an environmental and techno-economic point of view.	
		Content: Introduction. Heat transfer in buildings. Calculations of energy loads (thermal-cooling loads). Energy saving in buildings. Design of energy systems. Desalination, autonomous energy systems. Life cycle analysis for Environmental Impact Assessment. Optimisation of Energy Systems.	
20707	**ARCHITECTURE OF THE PHYSICAL AND BUILT ENVIRONMENT**		**5**
	Speciality (Th/Tut)	**Aim:** The aim of the course is for students to produce realistic answers to land use planning challenges and to be able to assess and plan landscape restoration after construction or destruction of the environment.	
		Content: Introduction to the architecture of the built environment. Anthropometric elements, landscaping, ramps, staircases, signage, housing, public buildings and spaces. Emerging building typologies with emphasis on residential development, offices, skyscrapers, public buildings. Building mapping. Contemporary architecture with evolving materials and technologies to mitigate impacts on the built environment. Architecture of the natural landscape. Strategies for restoration of the natural landscape. Evaluation of landscape restoration. Protection and restoration methods in road and urban projects. Quarries - borrow pits. After fires or other natural disasters. Economics of restoration.	
200708	**INSPECTION, MAINTENANCE AND REHABILITATION OF STRUCURES**		**5**
	Speciality (Th/Tut)	**Aim:** The aim of this course is for the students to understand the role of inspection, the various concepts of repairs, rehabilitation and retrofitting of structures.	

		Content: Pathology of structures. Damage lists. Impact of climate change on structures. Existing situation assessment procedures. Evaluation and rating of individual structural element. Non-destructive methods of damage diagnosis. Inspector characteristics and qualifications. Use of inspection manuals. Health and safety issues during inspection. Methodologies for maintenance of structures. Methodologies for the restoration of civil engineering works.	
200709	**ENVIRONMENTAL INFORMATICS**		**5**
	Speciality (Th/Tut)	**Aim: :** The aim of this course is to leverage opportunities from the digital revolution to enable improved and sustainable management of natural resources by addressing challenges across the entire information supply chain, including social, technical and informational aspects.	
		Content: Information and Computer Science: basic concepts, properties and types of data and information, knowledge production mechanisms, presentation of European Union Environmental Information Systems, environmental data collection, distribution, storage, use, and monitoring of the environment, quantitative data analysis with Microsoft Excel and the United States Environmental Protection Agency (U.S. EPA) ProUCL software package. Environmental Information Systems: Presentation of the ENVIROSOFT Environmental Information System and the CHERRY Environmental Grid Computing System. Information systems and Database management: Data processing data entry, data models, database systems, information systems, presentation of applications of geographic information systems (GIS) and in their use in environmental science. Information and Communication Technologies (ICT) and the Environment: computer networks, key concepts, environmental ICT applications, selected services, Web and information retrieval, relational database and data organization, data protection, database design, database management, types of data communication. Environmental Informatics Case Study: The case of West Thessaloniki. Laboratory: use of Microsoft Excel and the United States Environmental Protection Agency (U.S. EPA) ProUCL software package for applications and approaches of environmental information systems. Creating and Managing an Environmental Database Using Microsoft Access.	
200710	**PROJECT PLANNING AND SOFTWARE APPLICATIONS**		**5**
	Speciality (Th/Tut)	**Aim:** The aim of the course is the practical application of the basic principles of project management acquired through the courses Project Management I and Project Management II through the use of appropriate software.	
		Content: Introduction to the user interfaces of the selected software (e.g. MS Project, CellBIM, Primavera P6). Project organisation: structural analysis by Work Packages. Time scheduling; financial planning. Scheduling optimization. Project Planning Monitoring and Control. BIM model creation.	
8th Semester (Choice of 1)			
200806	**ART AND TECHNOLOGY**		**5**

		Aim: The course aims to explore the intersections of art and technology in a wide range of experimental/interdisciplinary practices.	
		Content: Through readings, screenings, group discussions, works, critiques and presentations by invited artists and scholars, a range of technologically mediated art practices, such as digital imaging, sound art, interactive installations, physical/tactile computing, digital writing, computer-mediated performance, as well as emerging issues of art and new media research, are studied and examined. Particular emphasis is placed on the field of virtual reality.	
200808	**MATHEMATICS III**		**5**
	Speciality (Th/Tut)	**Aim:** The aim of the course is to familiarize students with the basic concepts of Linear Algebra and their use in Environmental Engineering.	
		Content: Matrices - Types of matrices - Algebra of matrices . Linear systems: Method of Gauss-Jordan elimination. Vector form of linear systems. Order of matrix. Linear independence of vectors.Vector spaces and subspaces.Basis and dimension of a vector space. Eigenvalues and eigenvectors. Determinants - Applications of determinants.	
200808	**HEALTH AND SAFETY AT WORK**		**5**
	Speciality (Th/Tut)	**Aim:** Thε aim of this course is to teach the principles, concepts and legislation for Health and Safety of Workers.	
		Content: Introductory concepts. The accident and its announcement. Accident statistics.Institutions and authorities for the health and safety of workers at international, European and Greek levels. Legal framework for hygiene and safety at work. Workplace specifications. Workplace labeling. Harmful risk factors in the workplace (noise, lighting, chemical agents, asbestos, fire, electricity, heat, radiation, mice, stagnant waters, paints and solvents). Tar and its derivatives etc. Personal protective equipment. Specifications of personal protective equipment. Obligations of all factors. The update and the employee training. Personal protective equipment for the respiratory system, eyes and face, head, hands, lower limbs etc. The written occupational risk assessment, evaluation and identification of control measures. Occupational diseases and diseases. REACH and CLP regulations on chemicals.	
9th Semester (Choice of 3)			
200904	**BUILDING MATERIALS AND INDOOR ENVIRONMENTAL QUALITY**		**5**
	Speciality (Th/Tut)	**Aim:** The aim of the course is for students to know the concepts and general principles governing the physical and mechanical properties of building materials as well as the various innovations and developments in the field of building materials, to know the elements that affect the quality of the indoor environment and to plan for its upgrading and design in the context of the circular economy.	

		Content: Properties and classification of building materials. Natural stones and stone products. Mortars, fillers, metallic materials, ceramic materials, glass, wood, plastics, asphalt products, paints and varnishes. Types of cement and cement technology. Indoor quality. Basic elements for healthy buildings. Bioaerosol and its importance for indoor environmental quality. Housing and health. Health effects, identification of signs and symptoms of diseases related to indoor environmental quality. The circular economy in building materials. Indoor evironment certification.	
200905	**NATURAL DISASTER MANAGEMENT**		**5**
	Speciality (Th/Tut)	**Aim:** The aim of this course is to provide the students with the basic conceptual understanding of disasters, also to understand approaches of disaster management and to build skills to respond to disaster.	
		Content: Definition and types of disaster: Hazards and Disasters, Risk and Vulnerability in Disasters, Natural and Man-made disasters, earthquakes, floods drought, landside, land subsidence, cyclones, volcanoes, tsunami, avalanches, global climate extremes. Man-made disasters: Terrorism, gas and radiations leaks, toxic waste, disposal, oil spills, forest fires study of Important disasters, mitigation and management techniques of disaster, training, awareness program and project on disaster management. Study of Important disasters:Earthquakes and its types, magnitude and intensity,drought types and its management, landside and its managements case studies of disasters in Sikkim (e.g) Earthquakes, Landside). Social Economics and Environmental impact of disasters. Mitigation and Management techniques of Disaster: Basic principles of disasters management, Disaster Management cycle, Disaster management policy, National and State Bodies for Disaster Management, Early Warming Systems, Building design and construction in highly seismic zones, retrofitting of buildings.	
200906	**NATURAL HAZARDS**		**5**
	Speciality (Th/Tut)	**Aim:** The aim of this course is to introduce to the students to natural disasters and their phenomenon, ground deformations, land-level changes, event recurrence intervals, associated environmental and depositional changes, sedimentation patterns, and all the related hazards.	

		Content: Extraterrestrial hazards: asteroids, projectiles, radiation events and solar storms. Geological hazards: mainly those arising from solid earth processes. Hydro-meteorological hazards: associated with processes in the coupled system of the hydrosphere-atmosphere. Biological hazards: pandemics, rodents, insects, algal blooms, extinction. Chemical hazards: changes leading to modification in the composition of the atmosphere, oceans, soil, water (including pollution, acid rain, ocean acidification, changes in greenhouse gases). Technological risks: accidents, malfunction, artificial intelligence, nanotechnology. Social risks: involuntary migration, unrest, racism, genocide, wars, imperialism, failed governance. Economic risks: recession, bubbles, speculation, peak oil. Effects of natural disasters on the built environment and management procedures in accordance with guidelines from national and international organisations.	
200907	**QUALITY MANAGEMENT AND ASSURANCE**		**5**
	Speciality (Th/Tut)	**Aim:** The aim of this course is to allow the student to become familiar with the principles, system of values, standards and methods behind quality control and assurance in construction projects by making full use of human resources, considering client-user needs and optimizing the performance of contracting companies.	
		Content: Quality in construction, Quality Management Standards, Quality Management Systemns, Quality Control, Certification, Accreditation, Total Quality Management.	
200908	**SUSTAINABLE DEVELOPMENT**		**5**
	Speciality (Th/Tut)	**Aim:** The course will provide the modern aspects on sustainability due to urgent current status of the quality of the global environment. The pylars of sustainable development under national and international priorities analyse in order the knowledge will take into account in any project of a Environmental Engineer.	
		Content: Theory: Sustainability Concept & Its Principles. Institutional Sustainability Frameworks, Green and Blue Development. Environmental Sustainability. Natural environment. Urban environment and its ecological dimension. Limits to good living. Value of free urban space. Restoration of degraded areas. Suitability of use of vegetation in relation to lighting, shading, reduction of pollutants and rain amounts, recreational areas, etc. Financial Sustainability. Circular Economy. Social Sustainability. Educational and Cultural Sustainability. Assessment of Sustainable Development Goals.	
200909	**ENVIRONMENTAL ROAD CONSTRUCTION**		**5**
	Speciality (Th/Tut)	**Aim:** The aim of the course is for students to become familiar with the concepts and general principles governing the design of forest roads, to cultivate critical thinking with regard to the basic concepts that underpin the design, layout and construction of forest roads and to propose the necessary technical works and calculate earthworks.	

		Content: Introduction-Definitions. The basic parts of the road. Horizontal road curves - vertical road curves. The basic features of the road.Layout and environment. Design in space. The cross-section of the road. Earthworks. Design of level and unlevel junctions. Road surfaces. (categories of pavements, flexible pavements, rigid pavements, asphalt pavements). Technical road works.	
200910	**SPATIAL AND URBAN PLANNING**		**5**
	Speciality (Th/Tut)	**Aim:** the aim of this course is to provide an overview of the various fields within planning, such as housing, community development, transportation, environmental planning, urban sprawl and growth management.	
		Content: Urbanization and current urban trends. Planning Theory and urban design. The legal basis, politics and social issues in planning. The comprehensive plan and tools of land use planning. Role of outside investments and forces beyond local control. Urban Design. Urban renewal and community development. Transportation planning. Economic development planning. Growth management and sustainable development. Environmental and energy planning. Planning for metropolitan regions. Planning in other nations.	

HYDRAULIC AND GEO-ENVIRONMENTAL ENGINEERING SECTOR			
CODE	**COURSES**	**COURSES DESCRIPTION**	**ECTS**
7th Semester (Choice of 2)			
200711	**FOUNDATIONS AND SUPPORTS**		**5**
	Specialty (Th/Lab)	**Aim:** The aim of the course is for the student to be able to understand and analyse the basic principles of design and construction of various types of foundations and supports ant understand and address complex problems of design and construction of foundations for engineering works and structures.	
		Content: Foundation design principles. Selection of foundation type. Bearing capacity and settlements of shallow foundations. Admissible settlements of structures. In-situ tests for the design of foundations. Spread footings, combined footings, beams on elastic foundations, raft foundations. Retaining walls and earth pressure theories. Slope stability. Deep foundations. Piled foundations and construction methods. Bearing capacity and settlements of piles.	
200712	**LAND RECLAMATION**		**5**
	Speciality (Th/Tut)	**Aim:** The aim of the course is to provide students an understanding of the demands of the market at the level of study of irrigation networks (individual-collective), drainage networks as well as at the level of construction of the above networks.	
		Content: The first part provides the necessary introductory concepts and knowledge about the needs of water crops, the movement of water in the soil, the water potential of the soil and the water available to plants. The second part examines the collective irrigation networks with a timetable and free demand with an emphasis on irrigation networks (Design - Benefits - Dimensioning - Hydraulic calculations - Securing required hydraulic load). At the same time, extensive reference is made to the operation of the pumping stations. The third part deals with the drainage networks (open conductor networks at the level of layout - dimensioning). Elaboration of a topic related to the study of irrigation network in plots.	
200713	**TREATMENT AND MANAGEMENT OF TOXIC AND HAZARDOUS WASTE**		**5**
	Speciality (Th/Tut)	**Aim:** The aim of the course is for the student to be able to identify toxic and hazardous wastes, to know how to label, transport and store them, to apply the basic principles of risk analysis, risk identification, exposure and toxicity assessment and to know how to dispose of toxic waste safely in landfills.	
		Content: Definition of toxic and hazardous waste. Basic characteristics of hazardous waste. Properties, classification, treatment and disposal of hazardous wastes based on their physical and chemical characteristics. Toxicology and hazard analysis. Management of hazardous waste. Disposing of hazardous waste in landfills. Physico-chemical treatment processes. Thermal treatment processes. Applications.	
200714	**INDUSTRIAL WASTEWATER TREATMENT**		**5**

	Speciality (Th/Tut)	**Aim:** The aim of the course is for the student to learn the technologies and practices used in industrial wastewater management, to understand the biological and physicochemical methods of industrial wastewater treatment and to be able to design and optimize industrial wastewater treatment plants.	
		Content: Liquid waste supply. Qualitative and quantitative characteristics of wastewater. Categories of industrial wastewater. Waste volume and pollution load control measures. Methods of treatment of industrial wastewater. Co-treatment of industrial wastewater with municipal wastewater. Reuse and recovery of wastewater. Treatment of wastewater from the olive oil, paper, textile, pharmaceutical, livestock and dairy industries.	
200715	**HYDRODYNAMIC PROJECTS - DAMS**		**5**
	Speciality (Th/Tut)	**Aim:** The aim of the course is to provide students with an understanding of the construction and design of hydrodynamic dam - works as well as their familiarity and work on relevant topics of study of such projects.	
		Content: Introduction (General issues, types of dams). Solid gravity dams (forces, resistance to overturning and sliding, forces in the base of the dam, heat hydration, cooling of concrete, construction). Hollow gravity dams (types, advantages-disadvantages). Buttress dams (types, wall and buttresses). Arc dams Earthfill dams (types of earthfill dams, failures, type-height of dam, width of crest and foundation- inclination of dam slopes- core, filters, protection of slopes, foundation in rock and sand, calculation of filtration). Rock Fill.	
200716	**RIVER TRAINING**		**5**
	Speciality (Th/Tut)	**Aim:** The aim of the course is to provide students with an understanding of the design and construction of river training projects.	
		Content: Calculation and flow measurement - development of river hydraulics (rivers and streams) as well as the problem of transport of matter transport in a river (the problem of erosion) - Stairways – River Training (materials-type of slope and bottom protection works). Assignment related to the study of a river basin and the river training. Assignment related to a series of exercises in the above topics that the course deals with.	
		8th Semester (Choice of 1)	
200809	**ECOTOXICOLOGY**		**5**
	Speciality (Th/Tut)	**Aim:** The aim of the course is to give the students knowledge and skills that allow an overall assessment of the fate of foreign chemicals in the environment and of their effects on different biological organisation levels.	
		Content: The aim of the course is for students to understand the basic concepts of ecotoxicology, the relationships between substances and their effects on organisms, to analyse the transport mechanisms and kinetics of pollutants in various ecosystems and to understand the technologies that can be used to reduce toxic effects.	

200810	**ENVIRONMENTAL GEOTECHNICAL ENGINEERING**		**5**
	Speciality (Th/Tut)	**Aim:** The aim of the course is to create the appropriate theoretical and practical knowledge and skills for the identification, study and practical management of environmental geotechnical problems caused by natural processes and/or anthropogenic actions.	
		Content: Environmental geotechnical risks and problems. Types, causes and treatment of pollution. Interaction of water with soil. Hydrogeology. Influence of the presence and flow of water on soil behaviour and stability. Behaviour of unsaturated soils. Solidification of saturated soils, subsidence. Soil structures. Landslides. Methods of calculation. Interaction of pollutants with soil. Elements of geochemistry and soil science. Hydraulic erosion of soils. Soil pollution. Soils with litter. Methods of improving soils with litter. Geological and geotechnical aspects of design of centralised urban drainage systems. Environmental impact of engineering works. Environmental impact of the construction of geotechnical works. Environmental impact of opencast and underground mining. Adaptation of geotechnical works to the natural environment. Geotechnical rehabilitation of old landfills. Aesthetics of engineering works.	
200811	**GEOTECHNICAL PROJECTS**		**5**
	Specialty (Th/Tut)	**Aim:** The aim of the course is that the student will be able to understand and analyze the basic principles of design and construction of various specialized geotechnical structures, be able to understand and address complex design and construction problems of various geotechnical structures.	
		Content: - Design and calculation of various types of geotechnical structures. Stability control of dam slopes. Tunnel stability control, theoretical assessment and field applications. Design and construction of artificial embankments. Design and construction of foundations in underwater areas. Soil and rock improvement methods - examples of applications.	
9th Semester (Choice of 3)			
200911	**EXPERIMENTAL FLUID MECHANICS**		**5**
	Speciality (Th/Tut)	**Aim:** The objective is the contact of the student with the experiment, i.e. with the experimental arrangement, the measurement and analysis of experimental data.	
		Content: Introduction. Dimensional analysis, Buckingham Π-theorem. Non – dimensional Navier-Stokes equations, characteristic dimensionless numbers. Full (dynamic) and partial (kinematic or geometric) similarity. Reynolds and Froude similarity. Theory and implementation of hydraulic laboratory models. Measurement of density, kinematic viscosity and hydrostatic pressure of liquids. Static flow pressure measurement. Velocity measurements. Pilot tube. Discharge measurement in pipes and open channels. Error analysis, experimental error estimates. Statistical analysis of experimental data. Turbulence theory, response of measuring devices, spectra and data acquisition in turbulent flows, Nyquist theorem, measurements. Laser Anemometry. Hot-wire	

		anemometry. Techniques: LIF (laser-induced fluorescence), PLIF (planar LIF), PIV (particle image velocimetry). Visit to hydraulics laboratory. Display of the use of measurement devices as well as experiments from Diploma and Masters Theses. Experiment on energy losses in pipe flow. Experiment of velocity measurement with Pitot tube. Measurement of the velocity distribution along the axis and across a turbulent air jet with Pitot tube. Experiment in an open channel. Free surface profile and hydraulic jump measurement. Use of sharp crested weir and sluice gate for flow control. Experiment of the discharge time of a tank.	
200912	**ENVIRONMENTAL MANAGEMENT OF PORTS AND COASTAL AREAS**		**5**
	Speciality (Th/Tut)	**Aim:** The aim of the course is to provide students with an understanding of coastal and port environmental management projects.	
		Content: Coastal erosion and deposition of material on the shore - response measures - Renewal of waters of coastal zones and ports - Coastal matter (sand) transport – Pollution Transport in the marine environment – Interaction between coastal structures and coastline, Impact of constructions and coastal - marine environments.	
200913	**ENVIRONMENTAL MICROBIOLOGY AND BIOTECHNOLOGY**		**5**
	Speciality (Th/Tut)	**Aim:** The aim of the course is for students to understand the structure and physiology, abundance and biodiversity of microorganisms and their interactions with the environment, the fundamental principles of microbial growth in environmental engineering systems, the role of microbial communities in nutrient recycling and biodegradation processes, and the role of microorganisms in pollution control technologies. They will also delve into microbial communities and their processes in wastewater treatment systems and become familiar with modern molecular techniques with application to environmental engineering..	
		Content: Introduction to microbiology. Introduction to microscopy. Types of microorganisms based on their respiration and feeding habits. Physiology of microorganisms. Growth of microorganisms - Models of growth. Microorganisms in activated sludge systems - microbial grids and relationships. Biodegradation processes. Biological nitrogen - phosphorus removal. Methanogenic microorganisms and methanogenesis. Bioreactors and operation. Molecular techniques of environmental microbiology - bioenhancement - bioremediation.	
200914	**NUMERICAL METHODS AND MATHEMATICAL MODELS IN HYDRAULIC PROJECTS**		**5**
	Speciality (Th/Tut)	**Aim:** The aim of the course is to provide students with an understanding of the numerical methods of calculating various problems in hydraulics and hydraulic projects as well as their familiarity with the structure and application of mathematical models to hydraulic problems.	

		Content: Elements of numerical analysis (numerical interpolation, numerical integration, solving equation systems, Fourier series, finite difference method). Study of differential equations (introduction, parabolic equations, hyperbolic equations - method of attributes, elliptic equations). Application to closed-flow flows (continuous flow in pressure networks - Cross method, non-constant flow - Hydraulic water-hummer). Applications in open conductor flows (constant non-uniform flow, non-constant mathematical simulation, flood wave transmission). Applications in porous media flows. Applications to diffusion-dispersion problems. Introduction to Finite Differences and Finite Element Method. Mathematical Models - Applications.	
200915	**EXPERIMENTAL ROCK MECHANICS**		**5**
	Speciality (Th/Tut)	**Aim:** The purpose of the course is to teach the student the basic principles of rock mechanics, with a view to their application in engineering projects and to provide the future engineer with the necessary knowledge that will enable him/her to request and then interpret, evaluate and adapt the results of a geological study in order to achieve the safe and economical construction and operation of a technical project.	
		Content: Origin and composition of rocks. Geomorphology and geological structures. Engineering properties of rocks. Mechanical behavior of rocks discontinuities. Rock mass classification systems. Mechanical behavior of rocks mass. Hoek & Brown failure criterion. Rock slope stability – landslides. Rock mass permeability. Permeability field testing. The role of geology in the design and construction of dams and tunnels.	
200916	**UNSTEADY FLOWS**		**5**
	Speciality (Th/Tut)	**Aim:** The objective of this course is to introduce the students to the water-hammer phenomena (both in theoretical and applied level).	
		Content: Unsteady flow in closed conduits. Equations of motion-Continuity equation. Hydraulic water-hammer. Sudden-slow-partial flow interruption. Flow interrupts in non-uniform channel. Kinematic waves. Flood waves. Bergeron's method. Method of characteristics. Wave propagation on flows with a free surface. Unsteady flow in open channels. Slowly-rapidly varied flow. Applications-Exercises. Special topics.	
200917	**AQUATIC ECOSYSTEMS**		**5**
	Specialty (Th/Tut)	**Aim:** The aim of the course is to give an overview of aquatic ecosystems, marine and fresh water, as well as to make a first distinction between natural and artificial. An important element of the course is the analysis of indicators for the ecological assessment of these ecosystems	
		Content:General characteristics of aquatic ecosystems, lake ecosystems, river ecosystems, marine ecosystems, aquatic artificial ecosystems, ecological Indicators and ecological quality, prevention actions, rehabilitation actions. Aquatic Organisms Plant-Animal, Morphology, Reproduction, Evolution & Classification by ecosystem type. Factors affecting the living conditions of organisms.	

		Anthropogenic effects on aquatic ecosystems. Protection policies.	
200918	**ARTIFICIAL PLANT ECOSYSTEMS**		**5**
	Speciality (Th/Tut)	Aim: The aim of this course is to introduce the students to natural and artificial ecosystems, their functions and the differences between these two ecosystems.	
		Content: Introduction to natural ecosystems and artificial ecosystems. Natural vs. Artificial Ecosystems. Types of Natural Ecosystems: aquatic ecosystems (freshwater,transitional communities, marine), terrestrial ecosystems (Forest, Desert, Grassland, Mountain). How ecosystems work. International trends for the protection of the environment and biodiversity. Global, European and national legal protection regimes.	