INTERNATIONAL HELLENIC UNIVERSITY

DEPARTMENT OF ENVIRONMENTAL ENGINEERING

ΔΙ.ΠΑ.Ε.

	CORE / SPECIALTY	UNDERGRADUATE PROGRAMME OF ENVIRONMENTAL ENGINEERING	Hours		Total Hours	ECTS
			Th	Lab/Tu		
1st Semester						
267-190101	CORE	Mathematics I	3	2	5	6
267-109102	CORE	Physics	2	2	4	5
267-190103	CORE	Structural Analysis I	2	2	4	5
267-190104	CORE	Computer Aided Engineering Drawing	0	4	4	5
267-190105	CORE	Informatics	1	2	3	4
267-190106	CORE	Ecology	2	2	4	5
				Total	**24**	**30**
2nd Semester						
267-190201	CORE	Mathematics II	2	2	4	5
267-190202	CORE	Strength of Materials	2	2	4	4
267-190203	CORE	Biology	2	2	4	5
267-190204	CORE	Computer Modeling Applications for Engineers	2	2	4	5
267-190205	CORE	Environmental Egineering Geology	2	2	4	5
267-190206	CORE	Environmental Chemistry	3	2	5	6
				Total	**25**	**30**
3rd Semester						
267-190301	CORE	Hydraulic of Closed Pipes	2	3	5	5
267-190302	CORE	Soil Mechanics	2	2	4	5
267-190303	CORE	Structural Analysis II	2	2	4	5
267-190304	CORE	Project Management I	2	2	4	5
267-190305	CORE	Probability and Numerical Methods	2	2	4	5
267-190306	CORE	Environmental and Public Works Legislation	2	2	4	5
				Total	**25**	**30**
4th Semester						
267-190401	CORE	Analytical Decision Making Methods	2	2	4	5
267-190402	SPECIALTY	Foundations - Restraints	2	2	4	5
267-190403	CORE	Earthquake Engineering	2	2	4	5
267-190404	CORE	Open Channel Hydraulics	2	3	5	5
267-190405	CORE	Environmental Data Processing and Analysis	2	2	4	5
267-190406	SPECIALTY	Soil Mechanics Laboratory	2	2	4	5
				Total	**25**	**30**

5th Semester						
267-190501	SPECIALTY	Geotechnical Construction	2	2	4	5
267-190502	SPECIALTY	Solid and Waste Management	2	2	4	5
267-190503	CORE	Reinforced Concrete I	2	2	4	5
267-190504	CORE	Geodesy	2	3	5	5
267-190505	SPECIALTY	Research Methods	2	2	4	5
267-190506	SPECIALTY	Water Sysems and Water Treatment	2	3	5	5
				Total	**26**	**30**
6th Semester						
267-190601	CORE	Project Management II	2	2	4	5
267-190602	SPECIALTY	Bridge Engineering	2	2	4	5
267-190603	SPECIALTY	Geographical Information System	2	2	4	5
267-190604	CORE	Hydrology - Ground Water Engineering	2	2	4	5
267-190605	SPECIALTY	Sewage Systems and Calculation	2	3	5	5
267-190606	CORE	Environmental Informatics	2	2	4	5
				Total	**25**	**30**
7th Semester						
267-190701	SPECIALTY	Smart Cities	2	2	4	5
267-190702	CORE	Coastal Engineering	2	3	5	5
267-190703	SPECIALTY	Pollution and Pollution Control Technologies I	2	2	4	5
267-190704	SPECIALTY	Waste Processing Management	2	2	4	5
Z.5	SPECIALTY	Elective 1st	2	2	4	5
Z.6	SPECIALTY	Elective 2nd	2	2	4	5
				Total	**25**	**30**
8th Semester						
267-190801	CORE	Physical Oceanography	2	2	4	5
267-190802	SPECIALTY	Environmental Impact Projects	2	2	4	5
267-190803	SPECIALTY	Pollution and Pollution Control Technologies II	3	2	5	5
267-190804	SPECIALTY	Business Administration and Entrepreneurship	2	2	4	5
267-190805	SPECIALTY	Renewable Energy Sources	2	2	4	5
H.6	SPECIALTY	Elective 3rd	2	2	4	5
				Total	**25**	**30**

9ο ΕΞΑΜΗΝΟ						
267-190901	SPECIALTY	Hydraulics and Hydrogeolgy	3	2	5	5
267-190902	SPECIALTY	Aquatic Ecosystems	2	2	4	5
267-190903	CORE	Reinforced Concrete II	2	2	4	5
Θ.4	SPECIALTY	Elective 4th	2	2	4	5
Θ.5	SPECIALTY	Elective 5th	2	2	4	5
Θ.6	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 (1ο+2ο+….+10ο semester)		**300**

ELECTIVE COURSES				
SECTOR OF STRUCTURED ENVIRONMENT AND MANAGEMENT		Hours		Total Hours
		Th	Lab/Tut	
267-191001	Risk Management	2	2	4
267-191002	Natural Disaster Management	2	2	4
267-191003	Natural Hazards	2	2	4
267-191004	Architecture of Physical and Structure Environment	2	2	4
267-191005	Energy Design of Buildings	2	2	4
267-191006	Building Materials and Indoor Environmental Quality	2	2	4
267-191007	Mathematics III	2	2	4
267-191008	Quality Management and Assurance	2	2	4
267-191009	Inspection, Maintenance and Rehabilitation of Stuctures	2	2	4
267-191010	Health and Safety at Work	2	2	4
267-191011	Art and Technology	2	2	4
267-191012	Project Planning and Management Software Applications	2	2	4
267-191013	Sustainable Development	2	2	4
267-191014	Environmental Road Construction	2	2	4
267-191015	Spatial and Urban Planning	2	2	4

SECTOR OF HYDRAULIC AND GEO-ENVIRONMENTAL ENGINEERING		Hours		Total Hours
		Th	Lab/Tut	
267-192001	Numerical Methods and Mathematical Models in Hydraulic projects	**2**	**2**	4
267-192002	Environmental Geotechnical Engineering	2	2	4
267-192003	River Training	2	2	4
267-192004	Environmental Microbiology and Biotechnology	2	2	4
267-192005	Environmental Management of Ports and Coastal Areas	2	2	4
267-192006	Ecotoxicology	2	2	4
267-192007	Hydrodynamic Projects	2	2	4
267-192008	Land Reclamation	2	2	4
267-192009	Climate Change and Impact	2	2	4
267-192010	Management of Marine Protectied Areas	2	2	4
267-192011	Heat and Mass Transfer	2	2	4
267-192012	Photogrammetry - Remote Sensing	2	2	4
267-192013	Experimental Fluid Mechanics	2	2	4
267-192014	Unsteady Flows	2	2	4
267-192015	Rocks Mechanics Laboratory	2	2	4
267-192016	Natural Artificial Ecosystems	2	2	4

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1st Semester				
CODE	**COURSES**	**COURSES DESCRIPTION**	**ERASMUS**	**ECTS**
267-190101	**MATHEMATICS I**		**STUDY/PROJECT**	**6**
	Core (Theory/ Tutorial)	**Aim:** The course gives the basic principles of Differential & Integral Calculus, their presentation and to understand their use as tools that help in describing and solving real problems.		
		Content: Exponential, logarithmic, trigonometric functions and their applications, limits and continuity of functions, Derivatives, differentials, related rates of change, maxima and minima, optimization of functions, definite and indefinite integrals – integration techniques, applications of integration (Areas between two curves, volumes and surfaces of solids by revolution, moments and centroids), sequences and series of real numbers – Power series.		
267-190102	**PHYSICS**		**STUDY/PROJECT**	**5**
	Core (Theory/ Laboratory)	**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: Mechanics of materials (kinematics, statics, dynamics). Work. Power. Energy. Gravity filed. Periodic motions (simple harmonic oscillation, Fourier analysis, applications). Fluid mechanics. Heat, temperature, temperature measuring, calorimetry. Thermal expansion, heat transfer, heat insulation. Waves. Wave energy. Doppler phenomenon. Sound, acoustics, ultrasounds, noise pollution. Graphical representation, least square method, theory of errors, determination of ground acceleration, friction coefficient, vibrations, impact loading, calculation of fluid density. Computer simulation.		

267-190103	**STRUCTURAL ANALYSIS I**		**STUDY/PROJECT**	**5**
	Core (Theory/ Laboratory)	**Aim:** The aim of the course is to teach the students the fundamental principles and methods of structural analysis and design		
		Content: 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.		
267-190104	**COMPUTER AIDED ENGINEERING DRAWING**		**STUDY/PROJECT**	**5**
	Core (Laboratory)	**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).		

267-190105	INFORMATICS		STUDY/PROJECT	4
	Core (Theory/ Laboratory)	**Aim:** The purpose of this course is to provide computer literacy to the student. The course is designed to prepare the student for a successful working relationship with computerized systems and will present to him/her what the computer is, what it can and cannot do, how it operates, how it is programmed, how it is used as a tool in decision making, and what are the social implementations of computer usage.		
		Content: Concept of IT, IT Sections, IT Autonomy, Limitations and Risks of IT, Historical Evolution of Computer Science, Organization of Computer Systems (Binary, Gates and Logic Circuits, Von Neumann Architecture), Computer Hardware (Input / Output and Mass Storage, Numeric and Logic Course, Control Course, Pyramid of Memory), Computer Software (Software Concept, Algorithm) , Creative Application Packages, Graphics & Multimedia, Computer Exploration - Networks & Internet, Artificial Intelligence. Computer Problem Solving, Logic Chart, Algorithms (Algorithm Design, Algorithm Efficiency), Computational Algorithms and Statistical Descriptive Algorithms, Risks and Internet Protection, Computer Bad and "Partial" Ways (Privacy, Hacking-Cracking, Cryptography. Windows, Ms Office (Word, Excel, PowerPoint.)		

267-190106	**ECOLOGY**		**STUDY/PROJECT**	**5**
	Core (Theory/ Laboratory)	**Aim:** The course provides information for the thematic field of 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.		
		Content: Objectives and basic concepts of Ecology. Types of Environmental Ecosystems. Food chains and productivity. Relationships of species. Energy flow. Succession. Biodiversity and Abundance. Species and populations. Abiotic parameters, Clima, Soil, Temperature, Light and organisms. Biogeochemical and hydrological cycles. Disturbance of cycles, Pollution and effects. Microplastics. Population dynamics, age and generations, life tables. Laboratory and/or in situ Exercises: Identification of Land & Aquatic Ecosystems. Recognizing relationships of organizations. Biodiversity and Species. Biodiversity analysis with diversity assessment (Shannon, Simpson indices). Natural and disturbed ecosystems.		

2nd Semester				
CODE	**COURSES**	**COURSES DESCRIPTION**	**ERASMUS**	
267-190201	**MATHEMATICS II**		**STUDY/PROJECT**	**5**
	Core (Theory/ Tutorial)	**Aim:** The purpose of this course is to provide the basic principles of Differential & Integral Calculus in several variables and Vector Calculus and to understand their use as tools that help in describing and solving real problems		
		Content: Vectors in space (inner product, cross product, triple product, Lines and Planes in the Space, Polar, Cylindrical and Spherical Coordinates, Partial derivatives of functions in several variables, Directional derivatives, Gradient vectors & Tangent planes, Maxima and minima, Double, triple integrals & their applications, Line integrals, Surface integrals & their applications.		
267-190202	**STRENGTH OF MATERIALS**		**STUDY/PROJECT**	**4**
	Core (Theory/ Laboratory)	**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.		

267-190203	**BIOLOGY**		**STUDY/PROJECT**	**5**
	Core (Theory/ Laboratory)	**Aim:** The course provides knowledge for the life origin, the cellular function, species evolution and diversity in order to understand the regulation of populations growth, the processes that occur at the community level, to forecast the population growth and what parameters are crucial for the growth.		
		Content: Cells, Structure and function. Plant-Animal Organisms, Morphology, Reproduction, Evolution & Classification. Life Cycle (Reproduction-Growth-Age). Factors affecting living conditions. Utility-Application of biological knowledge. Laboratory: Identification of plant and animal species in the laboratory and in the field.		
267-190204	**COMPUTER MODELING APPLICATIONS FOR ENGINEERS**		**STUDY/PROJECT**	**5**
	Core (Theory/ Laboratory)	**Aim:** The course bridges the gap between the science of environmental modeling and working models of environmental systems.		
		Content: Introduction to modeling, science and art of mathematical modeling. A primer on mathematics with examples of computer implementation of standard mathematical calculi. Reviews of the fundamentals of environmental processes, engineered systems, and natural systems, respectively. Description and comparison of software packages for developing environmental models. Modeling examples covering engineered and natural systems, respectively.		

267-190205	**ENVIRONMENTAL ENGINEERING GEOLOGY**		**STUDY/PROJECT**	**5**
	Core (Theory/ Laboratory)	**Aim:** The aim of the course is to understand the interaction between geology and the environment in the context of human activity and in particular the construction of technical works.		
		Content: Hydrodynamic processes in the coastal and nearshore regions. Waves, tides, and currents. Morphology and modification of shoreline. Protection, and restoration of coastal areas. Design of coastal and maritime structures. Coastal and maritime structures management. Emphasis is placed on the impact of anthropogenic interventions on the environment in the context of geological hazards (earthquakes, floods, landslides, subsidense, etc), natural resources, water use and sustainability.		
267-190206	**ENVIRONMENTAL CHEMISTRY**		**STUDY/PROJECT**	**6**
	Core (Theory/ Laboratory)	**Aim:** The aim of this course is to study the chemistry of air, water, and toxic organic compounds as well as how anthropogenic activities affect this chemistry on planet Earth.		
		Content: This course examines the sources, reactions, transport, effects, and fates of chemical species found in air and water as well as the effects of technology thereon. This course is divided into 4 major parts that reflects the most pressing issues in Environmental Chemistry today: (1) Atmospheric Chemistry and Air Pollution; (2) Climate Change and Energy; (3) Water Chemistry and Water Pollution; and (4) Toxic Organic Compounds.		

3rd Semester				
CODE	**COURSES**	**COURSES DESCRIPTION**	**ERASMUS**	
267-190301	**HYDRAULIC OF CLOSED PIPES**		**STUDY/PROJECT**	**5**
	Core (Theory/ Laboratory)	**Aim:** The aim of the course is to provide students an understanding of the subject of the laws of Hydraulic Closed Circuits 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. Preparation of a topic related to a series of exercises - experiments on the above topics addressed in the course.		

267-190302	**SOIL MECHANICS**		**STUDY/PROJECT**	**5**
	Core (Theory/ Laboratory)	**Aim:** This course is intended for introductory in soils anf geotechnical engineering taken by virtually all civil engineering majors.		
		Content: Introduction to soil mechanics. Soil formation classification and mineralogy. Characteristics and engineering properties of soil: density, strength and deformability, water content, Atterberg limits, permeability and seepage. Sub-surface soil investigation. Soil-water movement. Mechanical behavior of a soil element. Description of the state of stress at a point in soil. Effective stress, consolidation, and soil strength, Mohr circle. Stress-strain relationships under different loading conditions. Unconfined and triaxial compression. Simple shear and shear strength of a soil element. Mohr-Coulomb failure criterion. Applications: Slope stability.		
267-190303	**STRUCTURAL ANALYSIS II**		**STUDY/PROJECT**	**5**
		Aim: The aim of the course is to provide the basic principles for the calculation of structures regardless their form and shape		
		Content: Calculation of bending moments, shear forces and axial forces for statically determinate and indeterminate structures, influence lines for statically determinate structures under live loads.		
267-190304	**PROJECT MANAGEMENT I**		**STUDY/PROJECT**	**5**
	Core (Theory/ Laboratory)	**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).		

267-190305	**PROBABILITY AND NUMERICAL METHODS**		**STUDY/PROJECT**	**5**
	Core (Theory/ Laboratory)	**Aim:** The objective of this subject is to expose students to understand the basic notions of probability theory and numerical analysis, and their applications to environmental engineering.		
		Content: Probability theory: Axioms of probability, Conditional probability, Independence, Bayes' theorem). Random variables, mass function & cumulative distribution function, mathematical expectations, 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)		
267-190306	**ENVIRONMENTAL AND PUBLIC WORKS LEGISLATION**		**STUDY/PROJECT**	**5**
	Core (Theory/ Laboratory)	**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				
CODE	**COURSES**	**COURSES DESCRIPTION**	**ERASMUS**	**ECTS**
267-190401	**ANALYTICAL DECISION MAKING METHODS**		**STUDY/PROJECT**	**5**
	Core (Theory/ Laboratory)	**Aim:** The purpose of this course is to provide students with decision-making skills and methodologies in relation to project management dilemmas.		
		Content: Multi Criteria Decision Making Methods (Multi Attribute Utility Theory, Analytical Heirarchy Process, PROMETHEE, TOPSIS). Group Decision Making. Cost Optimization. Investment Evaluation		
267-190402	**FOUNDATIONS AND CONSTRAINTS**		**STUDY/PROJECT**	**5**
	Specialty (Theory/ Laboratory)	**Aim:** This course is intended for introductory in soils anf geotechnical engineering taken by virtually all civil engineering majors.		
		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.		

267-190403	**EARTHQUAKE ENGINEERING**		**STUDY/PROJECT**	**5**
	Core (Theory/ Laboratory)	**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.		
267-190404	**OPEN CHANNEL HYDRAULICS**		**STUDY/PROJECT**	**5**
	Core (Theory/ Laboratory)	**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. Preparation of a topic related to a series of exercises - experiments on the above topics addressed in the course.		

267-190405	**ENVIRONMENTAL DATA PROCESING AND ANALYSIS**		**STUDY/PROJECT**	**5**
	Core (Theory/ Laboratory)	**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.		
267-190406	**SOIL MECHANICS LABORATORY**		**STUDY/PROJECT**	**5**
	Specialty (Theory/ Laboratory)	**Aim:** This course is an introduction to soils and geotechnical engineering taken by virtually all civil engineering majors.		
		Content: Soil classification methods. Determination of physical and mechanical properties of soils. Laboratory tests: determination of plasticity and liquidity limits, compaction test, sand cone test, measurement of hydraulic conductivity, direct shear test, consolidation test, triaxial compression test.		

5th Semester				
CODE	**COURSES**	**COURSES DESCRIPTION**	**ERASMUS**	**ECTS**
267-190501	**GEOTECHNICAL CONSTRUCTION**		**STUDY/PROJECT**	**5**
	Specialty (Theory/ Laboratory)	**Aim:** This course is an introduction to soils and geotechnical engineering taken by virtually all civil engineering majors.		
		Content: Site exploration and in-situ testing: standard penetration test (SPT), cone penetration test (CPT), pressuremeter test. Critical state theory – advanced topics in soil behavior. The finite element method 16 October 2015 14 in geotechnical engineering. Ground improvement: preloading, drains, compaction, soil replacement, stone columns, grouting. Reinforced earth retaining walls. Slope stabilization – anchors. Selection of special topics in geotechnical engineering. Term project using finite element software.		
267-19502	**SOLID WASTE MANAGEMENT**		**STUDY/PROJECT**	**5**
	Specialty (Theory/ Laboratory)	**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.		

267-190503	**REINFORCED CONCRETE I**		**STUDY/PROJECT**	**5**
	Core (Theory/ Laboratory)	**Aim:** The aim of the course is to transfer to the students the basic knowledge the mechanical properties and applications of reinforced concrete, giving particular emphasis in the design methodology of the buildings core such as slab, beams and columns.		
		Content: Design and analysis of reinforced concrete sections at the ultimate limit state against axial load, flexure and shear. Reinforcement detailing. Design of beams and columns.		
267-190504	**GEODESY**		**STUDY/PROJECT**	**5**
	Core (Theory/ Laboratory)	**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		

267-190505	**RESEARCH METHODS**		**STUDY/PROJECT**	**5**
	Specialty (Theory/ Laboratory)	**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.		
267-190506	**WATER SYSTEMS AND WATER TREATMENT**		**STUDY/PROJECT**	**5**
	Specialty (Theory/ Laboratory)	**Aim:** The aim of the course is to provide students with an understanding of the labor market requirements at the level of study of residential water supply networks (Water abstraction - Interior - Exterior - Aqueduct - Water purification) as well as at the level of construction of relevant projects.		
		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 - The elaboration of a topic related to water supply planning - dimensioning applications, water quality improvement methods - case study in Greece and the technical and economic evaluation of water improvement methods.		

6th Semester				
CODE	**COURSES**	**COURSES DESCRIPTION**	**ERASMUS**	**ECTS**
267-190601	**PROJECT MANAGEMENT II**		**STUDY/PROJECT**	**5**
	Core (Theory/ Laboratory)	**Aim:** The purpose of this course is to familiarize students with the responsibilities of Greek Public Work Client's Superior 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.		
267-190602	**BRIDGE ENGINEERING**		**STUDY/PROJECT**	**5**
	Specialty (Theory/ Laboratory)	**Aim:** The purpose of this course is to familiarize students with the fundamentals of bridge engineering concepts in order to be able participate in the designing, constructing and quantity surveying of several types of bridges.		
		Content: Bridge types, aesthetics, loads, design criteria, bridge components, bearings, expansion joints, preliminary bridge design, construction methods, constructability, estimation of the construction costs, design concepts of green bridges		
267-190603	**GEOGRAPHICAL INFORMATION SYSTEM**		**STUDY/PROJECT**	**5**
	Specialty (Theory/ Laboratory)	**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: Data collection tools, geocoding, data organization, use of related software user-based mapping.		

267-190604	**HYDROLOGY – GROUND WATER**		**STUDY/PROJECT**	**5**
	Core (Theory/ Laboratory)	**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. Assignment related to a series of exercises in the above topics that the course deals with.		
267-190605	**SEWAGE SYSTEMS AND CALCULATION**		**STUDY/PROJECT**	**5**
	Specialty (Theory/ Laboratory)	**Aim:** The aim of the course is to provide students with the ability to design studies and supervise the construction of rainwater and wastewater networks.		
		Content: 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. Elaboration of a topic related to a series of exercises in the above topics		

267-190606	ENVIRONMENTAL INFORMATICS		STUDY/PROJECT	5
	Core (Theory/ Laboratory)	**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.		

7th Semester				
CODE	**COURSES**	**COURSES DESCRIPTION**	**ERASMUS**	**ECTS**
267-190701	**SMART CITIES**		**STUDY/PROJECT**	**5**
	Specialty (Theory/ Laboratory)	**Aim:** The aim of this course is to introduce to the students the ideas about how computers, computation, and electronic communications are being rapidly introduced into the fabric, operation and design of the contemporary western 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.		

267-190702	**COASTAL ENGINEERING**		**STUDY/PROJECT**	**5**
	Core (Theory/ Laboratory)	**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.		
267-190703	**POLLUTION AND POLLUTION CONTROL TECHNOLOGIES I**		**STUDY/PROJECT**	**5**
	Specialty (Theory/ Laboratory)	**Aim:** The aim of the course is to provide students an introduction to issues related to environmental pollution, with emphasis on causes, pathways, risks, mitigation, prevention and pollution control.		
		Content: Introduction to pollution and the sources of pollution. Standards and legalization. Health and environmental effects of pollution. Air pollutants; particulate, SOx, NOx, and organic vapors. Air pollution control. Treatment of industrial wastewater. Handling of solid waste. Monitoring of pollutants.		

267-190704	WASTE PROCESSING AND MANAGEMENT		STUDY/PROJECT	5
	Specialty (Theory/ Laboratory)	**Aim:** The aim of the course is to give students an understanding and the ability to write the technical description and calculations of the design of the sewage treatment plant design, as well as their familiarity with the management issues of urban sewage disinfection - sludge management.		
		Content: Water Pollution (water quality - forms of pollution - pollution of rivers, lakes, groundwater - pollution control - sewage decomposition. Installations - Wastewater treatment. Mechanical cleaning (gravel - cultivator - sand collector - sedimentation). (biological filters, chillers, biological towers and trays). Active sludge method, ventilation, oxidation ditches. Nitrogen and phosphorus control and removal. Sludge treatment. Digestion tank. once the operation of waste water treatment (Primary - Secondary - Tertiary treated sewage) and disinfecting sewage additional the sludge management.		

8th Semester				
CODE	**COURSES**	**COURSES DESCRIPTION**	**ERASMUS**	**ECTS**
267-190801	**PHYSICAL OCEANOGRAPHY**		**STUDY/PROJECT**	
	Core (Theory/ Laboratory)	**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. Preparation of exercises on the above issues as well as presentation and application of measuring instruments in the field.		

267-190802	ENVIRONMENTAL IMPACT PROJECTS		STUDY/PROJECT	5
	Specialty (Theory/ Laboratory)	**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. Students will become familiar with the European and Greek institutional framework for environmental protection, will be able to assess the environmental impacts of infrastructure construction, know the legislation, stages and content of Environmental Impact Assessment (EIA) and to carry out EIAs.		
		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. Preparation of an environmental impact study on an infrastructure project		

267-190803	POLLUTION AND POLLUTION CONTROL TECHNOLOGIES II		STUDY/PROJECT	5
	Specialty (Theory/ Laboratory)	**Aim: T**he purpose of this course is to give the students an overview of air, noise, solid, waste, hazardous waste, and also radioactive pollution including methods for, prevention, control, measures and management of the pollution.		
		Content: Classification and characterization of air pollutants, effects of air pollution, meteorology, factors to be considered in industrial plant, location and planning, noise pollution – sources, measurement units, effects and control, sampling and analysis control. Classification and characterization of water pollutants, water chemistry, water microbiology, water quality and control, water distribution and water treatment, wastewater flows, characteristics and treatment. Solid and hazardous wastes, municipal solid waste management, hazardous waste treatment and disposal, special waste management, legal requirements.		

267-190804	BUSINESS ADMINISTRATION AND ENTREPRENEURSHIP		STUDY/PROJECT	5
	Specialty (Theory/ Laboratory)	**Aim:** The aim of this course is for the student to understand the basic principles of business administration and operation, the role of human resources for the successful running of a business, to understand the difference between a simple executive and a leader, to recognize the competitive advantage of innovation, to develop a systematic approach to identifying business opportunities and to combine sources and information from a more internationalized environment and to explain the relative application of innovative products and services in the scientific field of environmental engineering.		
		Content: Business Organization and Management: Introduction to the concept of business organization and management, contemporary forms of organization, organizational structures, the role and mission of management and the evolution of management function and theories of management, the nature of administrative work and the roles of executives, administrative structures, the culture and style of administration - management and leadership, management and entrepreneurship. Business principles: The nature, evolution and growth of the business, business types, the theory of business, business functions, business environment - evaluation of economic conditions, business and market - the business and industry of environmental engineers. Business and innovation development: definitions of sources and types of innovation, innovation and creativity processes, methods and tools for enhancing innovation and creativity, innovation in Greece, business concept and business model, business plan (Development – Evaluation). Analyzing and Studying examples of Innovative Businesses: examples, good practices of planning and organizing innovative businesses. Laboratory Exercises study and evaluate an example of business organization and management, business plan development and evaluation applications and implementation and evaluation of innovative business.		

267-190805	RENEWABLE ENERGY SOURCES			
	Specialty (Theory/ Laboratory)	**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. Basic principles of energy saving. 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.		

9th Semester				
CODE	**COURSES**	**COURSES DESCRIPTION**	**ERASMUS**	**ECTS**
267-190901	**WATER HYDRAULICS AND HYDROGEOLOGY**		**STUDY/PROJECT**	**5**
	Specialty (Theory/ Laboratory)	**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.		
267-190902	**AQUATIC ECOSYSTEMS**		**STUDY/PROJECT**	**5**
	Specialty (Theory/ Laboratory)	**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.		
267-190903	**REINFORCED CONCRETE II**		**STUDY/PROJECT**	**5**
	Core (Theory/ Laboratory)	**Aim:** The purpose of this course is to familiarize students with the production, design and construction of advanced building materials like high performance concrete		
		Content: 2. High performance concrete (production, applications, design, quality assurance). Design of reinforced concrete structural elements against flexure, shear, torsion. structural control. Reinforcement detailing		

ELECTIVE COURSES			
SECTOR OF STRUCTURED ENVIRONMENT AND MANAGEMENT			
CODE	**COURSES DESCRIPTION**	**ERASMUS**	**ECTS**
267-191001	**RISK MANAGEMENT**	**STUDY/PROJECT**	**5**
	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).		
267-191002	**NATURAL DISASTER MANAGEMENT**	**STUDY/PROJECT**	**5**
	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.		

267-191003	**NATURAL HAZARDS**	**STUDY/PROJECT**	**5**
	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 al the related hazards.		
	Content: Introduction to hazards and their direct or indirect relevance to human and nonhuman communities. Extraterrestrial hazards: asteroids, bolides, radiation events, and solar storms. Geological hazards: those that arise mainly from processes in the solid earth. Hydro-meteorological hazards: associated with processes in the coupled hydrosphere-atmosphere system. Biological hazards: pandemics, rodents, insects, algae-bloom, extinction. Chemical hazards: changes in major flows of the ELSS leading to changes in the composition of atmosphere, ocean, soil, water (including pollution, acid rain, ocean acidification, change of greenhouse gases). Technological hazards: accidents, malfunction, artificial Intelligence, nanotechnology. Social hazards: involuntary migration, unrest, racism, genocide, wars, imperialism, failed governance. Economic hazards: depression, bubbles, speculations, peak-oil, etc.		
267-191004	**ARCHITECTURE OF PHYSICAL AND STRUCTURED ENVIRONMENT**	**STUDY/PROJECT**	**5**
	Aim: The aim of this course is to impart knowledge of contemporary theories and trends in architecture through the examples of emerging building typologies.		
	Content: Overview of world architecture since 1970 with the study of Late Modernism, Post Modernism and Deconstructivism. Theories governing contemporary architecture through case studies, evolving architectural trends andtheir impact on urban built environment. Emerging building typologies with emphasis on residential developments, offices, skyscrapers, institutional and public buildings. Evolving building materials and technologies, contemporary approach towards disaster mitigation in the built environment. Energy efficient and built environment with emphasis on the use of energy simulation modelingembodied energy estimation and application of governing codes, viz., LEED and ECBC in contemporary buildings.		

267-191005	**ENERGY DESIGN OF BUILDINGS**	**STUDY/PROJECT**	**5**
	Aim: The aim of this course is for the student to gain the ability to independently and creatively identify and evaluate different energy conservation measures for a building through systematic analysis and simulation of the building's energy performance**.** **Content:** The course covers energy conservation measures for buildings. General energy efficiency and environmentally friendly measures in different parts of a house. The course continues with students obtaining general knowledge of approximating energy consumption in buildings depending on their design and equipment, outdoor climate, indoor conditions, HVAC systems, etc. Afterwards, energy performance simulations are conducted using computer software to investigate the current situation of the building and the effects of implementing energy efficiency measures. Up to date energy efficient building concepts, such as Near Zero Energy buildings and Passive houses, are finally introduced.		
267-191006	**BUILDING MATERIALS AND INDOOR ENVIRONMENTAL QUALITY**	**STUDY/PROJECT**	**5**
	Aim: The aim of this course is to provide fundamental knowledge on indoor environmental quality (IEQ) investigations, to be able to make recommendations for solutions for IEQ problems in residential buildings. **Content:** Introduction to IEQ: Discuss the History of IEQ, recognition of the related associations and agencies, definition of indoor environmental quality; the concept of permissible exposure limits, identification of what Bioaerosols are and their importance to IEQ. Introduction to the essentials for healthy homes: Recognition of the link between housing and health, that certain groups are at greater risk for adverse health effects, identification of the basic public health and housing principles, recognition of that the "Healthy Homes" movement is a holistic approach to promote health through better housing, recognition of the codes and regulations as tools that can help to achieve healthier housing in a community. Introduction to Health Effects - Start with People: comparing methods for interviewing occupants, identify routes of exposure, recognition of health effects, recognition of the signs and symptoms of housing related disease, determination of how to identify housing conditions that may affect health. The house as a System: recognition of the many different types of houses, identification of the different types of systems in homes, recognition of the factors that affect the health of home. The seven principals of healthy housing.		

267-191007	**MATHEMATICS III**	**STUDY/PROJECT**	**5**
	Aim: The course aims to introduce the basic ideas and techniques of linear algebra and differential equations, and their applications to environmental engineering.		
	Content: Linear Algebra: Matrices and vectors. Systems of linear equations. Determinants. Vector spaces and subspaces. Eigenvectors, eigenvalues. Differential equations: 1st and 2nd order differential equations. Newton's differential equations and their applications. Linear differential equations and 1 st order systems, with constant coefficients.		
267-191008	**QUALITY MANAGEMENT AND ASSURANCE**	**STUDY/PROJECT**	**5**
	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 Systems, Quality Control, Certification, Accreditation, Total Quality Management.		

267-191009	INSPECTION, MAINTENANCE AND REHABILITATION OF STRUCURES	STUDY/PROJECT	5
	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: Maintenance and repair strategies: Maintenance, repair and rehabilitation, Facets of Maintenance, importance of Maintenance various aspects of Inspection, Assessment procedure for evaluating a damaged structure, causes of distress and deterioration of concrete- Evaluation of existing buildings through field investigations, Seismic evaluation of existing buildings. Serviceability and durability of concrete: Quality assurance for concrete construction concrete properties – strength, permeability, thermal properties and cracking. – Effects due to climate, temperature, chemicals, corrosion – design and construction errors – Effects of cover thickness and cracking. Materials and techniques for repair: Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, ferro cement, Fibre reinforced concrete. Rust eliminators and polymers coating for rebars during repair, foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shotcrete, Epoxy injection, Mortar repair for cracks, shoring and underpinning - Methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coating and cathodic protection. Repairs, rehabilitation and retrofitting of structures: Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering corrosion, wear, fire, leakage and marine exposure - Special techniques for structural Retrofitting (Bracing, Shear walls, Base isolation etc). Demolition techniques: Engineered demolition techniques for Dilapidated structures – case studies - Case Studies on Restoration of fire damaged buildings, Case study on repairs and strengthening corrosion damaged buildings; Case study on use of composite fibre wraps for strengthening of building components.		

267-191010	**HEALTH AND SAFETY AT WORK**	**STUDY/PROJECT**	**5**
	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. The noise. The lighting. The chemical agents. The asbestos. The fire. Electricity. The heat. The radiation. The mice. Stagnant waters. Paints and solvents. The 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.		
267-191011	**ART AND TECHNOLOGY**	**STUDY/PROJECT**	**5**
	Aim: the aim of this course ia for the students to interpret the relationship between Technology and Art, Technology and to understand the influence of technology in various art forms. **Content: Introduction to the h**istorical approach between Technology and Art. The development of digital technologies and the presentation of new forms of art. Reviewing the development of various technologies and their impact on development in the arts, and examining socio-cultural considerations and their impact on the uses of technologies, aesthetics, pedagogy and curriculum in New Media contexts. The role of virtual reality in art. Technology and art as forms of creative activity in the structure and development of society.		

267-191012	**PROJECT PLANING AND MANAGEMENT SOFTWARE APPLICATIONS**	**STUDY/PROJECT**	**5**
	Aim: The aim of this course is to present the theory, methods and quantitative tools used to effectively plan, organize, and control projects.		
	Content: Introduction to Project Management, What is a project, What is project management, Required project management skills, Project management phases, Templates in environmental engineering project management, environmental engineering software development process models, Software project management templates, software development process models and software life cycle. Basics of MS-Project software, simple project examples, Introduction to the arched network method, Introduction to the node networks method, Resolving / Finding the critical path, Time Limits - minimum and slower times, Introduction to the PERT method and examples, Combined exercises of the previous methods with the introduction of uncertainties in project implementation (eg over time implementation). Introduction of human resources, working hours,Introduction of human resources costs, fixed costs of activities, Analysis of useful metric costs per activity / project, project evaluation, Project optimization - cost / time, cost / resource combinations, Real-time project analysis, complexity analysis - example of a realistic IT project.		
267-191013	**SUSTAINABLE DEVELOPMENT**	**STUDY/PROJECT**	**5**
	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. Laboratory: Development of a short projects on a subject of the Sustainability.		

267-191014	ENVIRONMENTAL ROAD CONSTRUCTION	STUDY/PROJECT	5
	Aim: The aim of the course is to introduce students to the fundamentals of urban transportation planning, to familiarize students with contemporary transportation planning issues and methods of analysis, to present the relationships between transportation and urban land use systems and new tools to address environmental and quality of life impacts of transportation and to show the role of investment decisions (or lack thereof) have been held accountable for increased economic prosperity or spiraling economic decline.		
	Content: Introduction: Role of transportation in the Economic development of Nations, Overview of transport modes, growth trends, National Transport Policy, Transportation planning in the developing world; Fundamentals of transportation , Principles of planning, evaluation, selection, adoption, financing, and implementation of alternative urban transportation systems; formulation of community goals and objectives, inventory of existing conditions; transportation modeling trip generation, distribution, modal choice, assignment. Data Collection And Inventories: Collection of data – Organization of surveys and Analysis. Demand and Supply planning : Planning for sustainable urban mobility, positive and negative externalities in urban transport, congestion pricing, parking policy, demand management, Urban travel and transportation system characteristics - a systems perspective, Data management and use in decision making , Demand analysis , Urban activity analysis, Supply analysis; Plan Preparation And Evaluation: Travel Forecasts to Evaluate Alternative Improvements, Impacts of New development on Transportation Facilities. Master plans, Selection of Corridor, Corridor Identification, Corridor deficiency Analysis. Metropolitan Cities: Design issues in urban mobility, integrating land use and transport planning; Overview of urbanization process, city structure and urban activity and infrastructure systems, Economic and social significance of urban infrastructure systems; Transport's Role in tackling Social Inclusion, Economic Impacts of Transport Policy.		

167-191015	SPATIAL AND URBAN PLANNING	STUDY/PROJECT	5
	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.		

SECTOR OF HYDRAULIC AND GEO-ENVIRONMENTAL ENGINEERING				
CODE		**COURSES DESCRIPTION**	**ERASMUS**	**ECTS**
267-192001	**NUMERICAL METHODS AND MATHEMATICAL MODELS IN HYDRAULIC PROJECTS**		**STUDY/PROJECT**	**5**
		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.		
267-192002	**ENVIRONMENTAL GEOTECHNICAL ENGINEERING**		**STUDY/PROJECT**	**5**
		Aim: This course is intended for introductory in soils and geotechnical engineering taken by virtually all civil engineering majors.		
		Content: Fundamentals of pollutant transport mechanisms (advection, diffusion, dispersion) related to air, water and ground media. Gaussian plume dispersion models, Lagrangian		

267-192003	**RIVER TRAINING**	**STUDY/PROJECT**	**5**
	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.		
267-192004	**ENVIRONMENTAL MICROBIOLOGY AND BIOTECHNOLOGY**	**STUDY/PROJECT**	**5**
	Aim: The aim of this course to provide to the students the microbial processes in the environment, microbial communities and microbial interactions and the development, use and regulation of biological systems for remediation of contaminated environments and for environment-friendly processes.		
	Content: Introduction to environmental microbiology and biotechnology. Microbiology: Structure and activities of microbial communities, Microbial interactions and interactions with macroorganisms, Population biology of microorganisms, Microbes and surfaces, microbial community genetics and evolutionary processes, Global) element cycles and biogeochemical processes, microbial life in extreme and unusual little-explored environments. Biotechnology: biotechnology and waste, pollution control, bioremediation, environment and energy.		
267-192005	**ENVIRONMENTAL MANAGEMENT OF PORTS AND COASTAL AREAS**	**STUDY/PROJECT**	**5**
	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. Assignments-exercises on the abovementioned topics.		

267-192006	**ECOTOXICOLOGY**	**STUDY/PROJECT**	**5**
	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 organisations		
	Content: Environmental chemistry: This part comprises an overview of different chemical groups of anthropogenic origin present in the environment. Focus is on their sources and fates in the environment. Effects of anthropogenic chemicals: This part comprises negative effects of chemicals on different biological organisation levels (cell, organ, organism, population, ecosystem) with focus on mechanisms. An experimental study is carried out. Hazard assessment: This part comprises retrieval and critical evaluation of toxicological information from different sources (internet-based databases, hand books, scientific articles etc.) for classification and labelling of chemicals. The students perform an individual project on classification and labelling of chemicals dangerous for the environment according to EU guidelines. Environmental risk assessment: This part comprises environmental risk assessments of chemicals and is done as projects.		
267-192007	**HYDRODYNAMIC PROJECTS**	**STUDY/PROJECT**	**5**
	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.		

267-192008	LAND RECLAMATION	STUDY/PROJECT	5
	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.		

267-192009	**CLIMATE CHANGE AND IMPACT**	**STUDY/PROJECT**	**5**
	Aim: The aim of this course is to enhance awareness of climate change security implications through acquisition of basic knowledge related to global warming as a phenomenon and a security threat multiplier, the main factors which affect the environment, and the impact of climate change on international peace and security in short, mid and long term period.		
	Content: Point main climate change characteristics – causes, impacts, scenarios, direct and indirect impacts; State the main international strategies, policies and actors in the field of Climate Change; Summarize the nexus between Climate Change and Security considering the impact of climate change on international peace and security, and implications on the military activities; Point the main EU strategies, policies and actors in Climate Change mitigation and adaptation; Explain the impact of climate-driven, man-made and natural disasters on security;Links the main direct and indirect impacts with CSDP/CFSP; Describe the EU organizational structures, mechanisms and instruments for international cooperation in disaster response, including Union Civil Protection Mechanism (UCPM), the Integrated Political Crisis Response Arrangements of the Council of the EU and the European External Action Service (EEAS) structures; Outline the EU integrated approach in early warning and building resilience; Explain the relevance of co-operation and networking with the various actors in the field.		
267-192010	**MANAGEMENT OF MARINE PROTECTED AREAS**	**STUDY/PROJECT**	**5**
	Aim: The main purpose of the course is to give an overview of marine processes, emphasizing the Mediterranean marine ecosystem. Based on the categories of marine ecosystems as defined by European and international legislations, the pressures and measures proposed are analyzed.		
	Content: Types of marine ecosystems, protected Mediterranean ecosystems threats and pressures, mild anthropogenic actions farms, protection measures environmental awareness, ecosystem-friendly actions and exploitation.		

267-192011	**HEAT AND MASS TRANSFER**	**STUDY/PROJECT**	**5**
	Aim: The aim of the course is for the students to understand the mechanisms of heat transfer under steady and transient conditions, the concepts of heat transfer through extended surfaces and to learn the thermal analysis and sizing of heat exchangers and to understand the basic concepts of mass transfer.		
	Content: Free and Forced Convection – Hydrodynamic and Thermal Boundary Layer. Free and Forced Convection during external flow over Plates and Cylinders and Internal flow through tubes. Nusselts theory of condensation – Regimes of Pool boiling and Flow boiling. Correlations in boiling and condensation. Heat Exchanger Types – Overall Heat Transfer Coefficient – Fouling Factors -Analysis – LMTD method – NTU method. Basic Concepts – Diffusion Mass Transfer – Ficks Law of Diffusion – Steady state Molecular Diffusion – Convective Mass Transfer – Momentum, Heat and Mass Transfer Analogy -Convective Mass Transfer Correlations.		
267-192012	**PHOTOGRAMMETRY - REMOTE SENSING**	**STUDY/PROJECT**	**5**
	Aim: The aim of the couese is for the studenta to understand basic photogrammetric & remote sensing techniques, to be able to perform basic photogrammetric office computations, to apply photogrammetry information to professional surveying services and to demonstrate an appropriate mastery of the knowledge, techniques, skillls and modern tools of photogrammetry.		
	Content: Procedures and methods used for deriving metric information from photographs, analog processes for using aerial photographs in production of topographic maps, flight planning, and cost estimation in aerial mapping work. Introduction to photocoordinate measurement devices and their calibration. Mathematics of modern photogrammetry. introduction, photos vs. maps, aerial photography and cameras. Scale and relief displacement. Parallax, stereo viewing. Coordinate transformations. Collinearity, relative orientation, strip/block adjustment. Aerotriangulation, bundle adjustment. Absolute orientation, mapping. Stereoplotter evolution, Digital Terrain Models, GPS-IMU, LIDAR. Soft copy photogrammetry, digital image products. Aerial Digital cameras, project planning, remote sensing.		

267-192013	**EXPERIMANTAL FLUID MECHANICS**	**STUDY/PROJECT**	**5**
	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.		
267-192014	**UNSTEADY FLOWS**	**STUDY/PROJECT**	**5**
	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-hummer. 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.		

267-192015	**ROCK MECHANICS LABORATORY**	**STUDY/PROJECT**	**5**
	Aim: This course is intended for introductory in soils anf geotechnical engineering taken by virtually all civil engineering majors.		
	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.		
267-192016	**NATURAL ARTIFICIAL ECOSYSTEMS**	**STUDY/PROJECT**	**5**
	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.		