CURRICULUM GUIDE
ACADEMIC YEAR 2016-2017

UNIVERSITY OF WESTERN MACEDONIA
SCHOOL OF ENGINEERING

DEPARTMENT OF ENVIRONMENTAL ENGINEERING

http://www.enveng.uowm.gr/

KOZANI 2016

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Contents

1. THE UNIVERSITY OF WESTERN MACEDONIA

In 2002 the Ministerial Council, chaired by Prime Minister Mr. Kostas Simitis, decided to found the University of Western Macedonia, and published the Presidential decree No. 92/11-4-2003. In June 2003 the Minister of Education and Religious Affairs, Mr Petros Eythymiou, under the decision Φ.120.61/132/61865/Β2/25.6.2003, appoints the members of the Administrative Committee in Kozani.

From 1/1/2004 the Departments of Aristotle University of Thessaloniki (AUTH), that are based in the city of Florina (Primary Education, Preschool and Balkan Studies) and in the city of Kozani (Engineering and Management of Energy Resources) joined the new University. In December 2014 under the provisions of Law 4316 (OG 270/24/12/2014 TX A) Article 121 on "Setting University issues" the University of Western Macedonia becomes autonomous. Finally, the Act 2691/ 03.05.2015 of the Executive Committee of Western Macedonia held the appointment of the first Rector of Western Macedonia, Professor Anthonios Tourlidakis.

Today the University of Western Macedonia, has six (6) Departments, three (3) in the city of Florina and three (3) in the city of Kozani.

1. **School of Engineering (based in Kozani)**
   - Department of Environmental Engineering (www.enveng.uowm.gr)
   - Department of Mechanical Engineering (www.mech.uowm.gr)
   - Department of Engineering Informatics and Telecommunications (www.icte.uowm.gr)
2. **School of Education (based in Florina)**
   - Elementary Education (www.eled.uowm.gr)
   - Nursery Education (www.nured.uowm.gr)
3. **Independent Departments**
   - Department of Applied and Visual Arts (based in Florina) (www.eetf.uowm.gr)

1.1. Facilities

The Departments, Laboratories and Administration of UoWM in Kozani are hosted in facilities ceded by the Municipal Authority of Kozani or are leased until the completion of the University campus.

- Administration and Research Committee of UoWM:

  Agiou Dimitriou Park
  Tel.: 24610 56200
  Fax: 24610 56201
  501 32, Kozani

- The **Department of Environmental Engineering** is hosted in the same building as the Department of Mechanical Engineering in the corner of Bakola and Sialvera Streets. This is the location of the Administration, the faculty offices and classrooms. The Laboratories are located in a separate building at Argirokastrou Street 13.

  Tel.: 24610 56750, 24610 56606
  Fax: 24610 56603
  501 32, Kozani
  web: http://enveng.uowm.gr

- The **Department of Mechanical Engineering** is located in three buildings. The first building is at Bakola Street Sialvera Streets with the Administration, the faculty offices and classrooms. The second building located in Argyirokastrou Street 13 hosting part of the Laboratories. The third building is located in Vermiou Street and also hosts laboratories of the Department.

  Tel.: 24610 56600
  Fax: 24610 56601
  Τ.Κ.: 501 32, Κοζάνη
  web: http://mech.uowm.gr

The **Department of Engineering Informatics and Telecommunications** is housed at 55 Kostantinou Karamanli & Ligeris Street. The library of the Engineering School is also located in the same building.

Telephone Number: +30-24610-56600
Fax: +30-24610- 56501
Postcode: 50100, Kozani

In the city of Florina, the University lies in the suburbs of the city, in the third kilometer of the national road Florinas - Nikis. There are accommodated four Departments, all the Administrative Services, the library and the students' restaurant.

Department of Elementary Education

3 km of National Street Florinas-Nikis
Telephone Number: 23850 55000
Fax: 23850 55003
Postcode: 531 00, Florina

Department of Nurcery Education

3 km of National Street Florinas-Nikis
Telephone Number: 23850 55100
Fax: 23850 55099
Postcode: 531 00, Florina

Department of Applied and Visual Arts

3 km of National Street Florinas-Nikis
Telephone Number: 23850 55250
Fax: 23850 55241
Postcode: 531 00, Florina

1.2. Student Board and Accommodation

Assisting students who face financial difficulties to cope with their studies and based on both ministerial decrees and decisions of the Executive Committee Board of UOWM, the following services are provided:

a. Free board to beneficiary students, in the students restaurant of UOWM located in the city of Kozani (Address: 20 Konstantinoupoleos str.- Kozani, tel.nr. 0030 24611 81039)

b. Rent assistance if not provided by the state.

The preconditions for free boarding and provision of the rent benefit (if the student is entitled to one) as well as the dates for submitting applications, are announced timely by the Administration Office.

1.3. Health Care

All students (undergraduate, postgraduate, expatriates and foreign) are entitled to health, medical and nursing care for a period equal to the years of studies which are considered having a minimum duration of the undergraduate studies incremented by two years.

For this purpose the University provides students with a healthcare booklet that can be used in the region of the university concerned and only in exceptional cases outside it. For obtaining the Healthcare booklet, the students should address to the Administration Office.

2. ADMINISTRATION OF THE DEPARTMENT OF ENVIRONMENTAL ENGINEERING

2.1. Head of the Department

Head of the Department was appointed to the Senate by the Associate Professor of the Department of Mechanical Engineering of Western Macedonia Mr. George Marnellos.

2.2. Interim Governing Board

1.	G. Marnellos	*Associate Professor*	Head of the Department
2.	G. Skodras	*Associate Professor*	Member
3.	R. E. Sotiropoulou	*Lecturer*	Member
4.	G. Panaras	*Lecturer*	Member
5.	G. Malandrakis	*Lecturer*	Member

The General Assembly of the Department's Interim Governing Board is completed by one (1) student representative. The Special Purpose General Assembly of the Department consists of all the Permanent Faculty members of the Department that are a member of the General Assembly.

2.3. Administration Office

Registrar:	Emmanuel Milonas
Administration Office telephone:	24610 56750 FAX: 24610 56603
Address:	Bakola and Sialvera Str, 50 132, Kozani

2.4. Academic Advisors

At the beginning of each academic year the freshmen will be called individually by the Department Faculty members in an introductory meeting and from that time

until the end of their studies, they will be their Academic Advisor. The Academic Advisor provides the student with the necessary guidance and support for the successful completion of studies. Taking into account the needs and interests of the student, it helps him to gradually adapt the scientific and professional expertise, personality and potential.
Each faculty member may be appointed the Academic Advisor of a maximum of 15 students. The Academic Advisor arrange to have frequent contact with the students. The tasks of the Academic Director, including the following:

- Assistance to the composition of the curriculum
- Provision for career guidance information and instructions
- Information and assistance for postgraduate studies, scholarships and study abroad
- Advisory for attending seminars and conferences.

3. AIMS AND ORGANIZATION OF THE DEPARTMENT

3.1. Studies

The Science of Environmental Engineering is related to the restoration, protection and management of the environment, always aiming at sustainable development, i.e. to meet the needs for the continuous improvement of living standards of society, the implementation of the necessary industrial and technical projects and produce the required amounts of energy, ensuring the health and wellbeing of people and the balance of the ecosystem while maintaining the resources offered by our environment (air, water, soil, ecosystems).

The goal and mission of the Department of Environmental Engineering focuses on the following areas:

- The training of Scientists able to contribute to the measurement, monitoring, evaluation and treatment of problems caused by human activity, when it involves alterations and changes in the environment.
- the creation of an interdisciplinary research environment to develop innovative and efficient technologies which will address the current major environmental challenges.
- the provision of environmental services to society, the state and the relevant manufacturing industries with a view to sustainable development.

The students, using scientific processes and related teaching tools, learn to correct the mistakes of the past, to avoid creating or worsening of current environmental problems and to design development paths for a better future, with respect for people and the environment.

To meet these requirements, the curriculum is tailored to provide the student the education and ability to apply the principles of engineering along with basic science (mathematics, physics, chemistry, biology), socio-economic sciences and humanities, ensuring excellent training for scientific, research and professional career.

Issues relating to environmental engineering include minimizing air pollution, the water supply, wastewater treatment, the establishment of an appropriate mechanism for the integrated management and disposal of waste generated by human activity, restoration and remediation of polluted or contaminated sites, protection radiation, public health, environmental law, engineering, energy conservation and the study of the effects of construction projects on the environment.

3.2. Alumni Profile – Carrier Path

Graduates in Environmental Engineering from our Department can be employed in:

- the administration and staffing of public, private or International organizations, related to design and implement protection programs, development and overall management of the natural and human environment and the production of public and private technical and industrial projects on the environment.
- the development and / or study of audit management and environmental protection and environmental impact studies for engineering or other projects, in accordance with current legislation,
- training and consulting on environmental issues in primary and secondary education in public or private sector.

The profession of Environmental Engineering is related the following key areas:

- Environmental Impact Assessment and environmental management Studies (public works, emissions, waste, buildings, industrial plants)
- Management and protection studies of environmentally sensitive or of particular ecological interest and aesthetic beauty areas
- Design, Construction and Installation Design:
    - Processing wastewater
    - Processing & Management municipal waste and agricultural or livestock waste.
    - treatment and Management of toxic and hazardous waste
    - waste processing of agricultural industries and food industries
- Design, Construction and Management:
    - Surface and Groundwater
    - Gaseous emissions
    - Hydraulic works
    - air pollution control systems, water and soil
- Remediation of contaminated areas and restore groundwater
- Controlling noise and radiation
- Renewables
- Studies environmentally friendly thermodynamic cycles and installations of alternative and renewable fuels
- Studies on energy flows in the urban heat island
- Safety Engineers to companies of A, B or C grade
- Environmental policy Consultants (local and regional government, public sector, public sector organizations, armed forces, church, environmental etc.)

- Environmental inspection of Industrial products
- Supervision of the implementation of environmental legislation and standards of environmental compatibility in projects and facilities

The environmental Engineer can work either as an employee or as an independent professional consultant to public entities (e.g., Ministries, Municipalities, Universities, Research Centers, etc.) and private (e.g. Industrial facilities, construction companies, companies providing consulting services, etc.) sector as well as international organizations.

In addition, the Environmental Engineer may also be employed in teaching environmental education courses in primary of secondary education (ΦΕΚ 204, τ.Β΄/2.3.2001 και ΦΕΚ 328, τ.Β΄/28.2.2008).

The Environmental Engineers can become members of the Technical Chamber of Greece (TCG-TEE) either in the area of expertise of Civil Engineering or Chemical Engineering and have the comprehensive medical insurance and pension plan as all Engineers (ΤΣΜΕΔΕ). According to the legislation, the Environmental Engineer can either register as a student at Research Group (27): Environmental Studies and (13): Hydraulic Works, or may be registered as a contractor in the Register of Experience Contractors in the following categories:

- Industrial -Energy Projects (only if enrolled in basic specialty of Chemical Engineering)
- Hydraulic Projects (only if enrolled in basic specialty of Civil Engineering)
- Cleaning and Water Treatment, Wastewater, Solid and Gaseous Waste Contractors
- Landscaping Contractors

4. ORGANIZATION OF STUDIES AND REGULATIONS

4.1. Duration of Studies

The exact dates of start and finish of each Semester are set by the Senate of UoWM. Enrollment dates for each year are set and announced by the Ministry of Education. The **minimum possible duration** of studies is **10 semesters**

Every semester consists of at least 13 full teaching weeks

4.2. Curriculum Guide

The curriculum is finalized for each academic year at the end of the Summer Semester of the previous academic year.

The courses are divided into two categories: (a) mandatory courses and (b) elective compulsory courses. The first category comprises core courses that provide the basic and necessary knowledge to students and must all without exception be completed successfully. The second category includes a large number of specialized courses that are student-selected and of which a sufficient amount of credits must be accrued to obtain the diploma.

To obtain the Diploma of Environmental Engineering requires 10 Semesters. The first nine (9) are devoted to teaching courses, and during the 10th Semester is prepared the thesis. The curriculum is divided into two Cycles: The First Cycle (1st-3rd year) only includes mandatory courses, providing the necessary general background. The Second Cycle (4th-5th year) includes mandatory courses and electives. In total there are 49 mandatory courses and 23 electives. The succession of courses in Semesters is indicative and not compulsory for students except for the sequence of prerequisite and dependent prerequisites.

In every Semester of the Second Cycle it is allowed the registration of up to 8 courses, with the exception of the last six months in which the student can register up to 10 courses. The choice of mandatory elective courses can be made of for all available Winter Semester elective courses during the Winter Semester and respectively the same applies for the Summer Semester.

To facilitate students, follows a summary table with the number of courses that must be completed to obtain the Diploma

STUDENTS OBLIGATIONS FOR OBTAINING THE DIPLOMA

CAUTION: In completing the statement make sure to cover the following number of courses per category i.e. (M), (E), (FL).

Admission year	Number of Courses in 1st Cycle of Studies (1st-2nd -3rd year)	Number of Courses in 2nd Cycle of Studies (4th – 5th year)	Total Number of Courses, inc. Design Project	Overview
2015-2016	38 Mandatory (M) + 2 Foreign Language (FL)	10 Mandatory (M) 8 Electives (E)	58 + Diploma Thesis	**48 M** **2 FL** **8E**

4.3. Statement of attendance of semester courses

At the beginning of each semester and on specified dates, each student **must** submit to the Administration Office of the Department a statement including those courses he decides to attend in the specific semester. This can be accomplished through a special application form, available from the Administration Office. **The course statement is essentially equivalent to the student`s enrollment per semester in the Department.**

After the deadline no statement will be accepted as any course change will not be allowed.

4.4. Educational Material

The educational procedure is complemented by the use of textbooks and other educational aids which are provided to students for free, as well as by ensuring their information and access to the relevant Greek and foreign bibliography (Art. 23 § 2 Law 1268/82). Moreover, for each course exists a special website via the web-based e-class system of UoWM, with the instructor notes, lecture presentations as well as any of the teacher announcement to students who have declared the course (e.g. exam announcements, evaluation of the course in modip.uowm.gr, make-up teaching, organizing educational excursions and making special lectures by visiting scientists and business executives).

4.5. Student evaluation and Exams

The grade mark in all courses is expressed on the scale 0-10, including the use of the fractional part. The pass mark is grade 5 (five). Student performance evaluation in each course takes place during the whole academic year. The final grade in each course consists of two parts. The first part, which forms 30% of the final grade assesses the student's performance during the semester and the grade results from grading exercises, questions, or at least one mid-semester written test, lying to the discretion of the tutor. The second part, which forms 70% of the final grade evaluates the student's performance in the final exams of the course.

There are **two (2) examination periods** for the courses taught in each semester. The first period is set immediately after the end of that semester, Fall or Spring. The second is set in September, before the beginning of the next Winter Semester.

Each student is entitled **to participate in the exams, only of those semester courses, that he/she alone has determined through the courses statement, which he/she submitted at the beginning of this semester**.

4.6. Internship

The internship is an excellent opportunity for students of Environmental Engineering Department to become acquainted with activities directly or indirectly related to their field of study and gain experience related to their future careers.

Specifically, students of 4th and 5th year, who have successfully completed a reasonable number of courses of the first three years, have the option via a scholarship fund (ΕΠΕΑΕΚ) and bilateral agreements to carry out funded internships in public and private actors (industry, construction companies) in Greece. The duration of the internship the student is three (3) months, especially during the summer (June, July, August).

The students are selected following the evaluation of applications after a call. Although it is not mandatory take part to complete their studies, the Department encourages students to apply for internships and at the end to deliver a final activity report.

4.7. ERASMUS+ Program

Students can participate in the European student exchange program ERASMUS+.

The ERASMUS + is the European Commission's new program for education, training, youth and sport, which came into effect on January 1, 2014.

It integrates previous EU programs for education, training and youth including, inter alia, the integrated Lifelong Learning Programme (LLP) (Erasmus, Leonardo da Vinci, Comenius, Grundtvig), the program "Youth in Action" and five international cooperation programs (Erasmus Mundus , Tempus, Alfa, Edulink and cooperation programs with industrialized countries).

Specifically, the ERASMUS student exchange + program enables students who have successfully completed the first year of study and meet specific requirements to do part of their study program in a related department of a European academic institutions from a minimum of 6 (1 semester) up to 12 months (2 semesters) course. The UoWM is actively involved since 2004 in the ERASMUS+ student exchange program and for this purpose there are bilateral agreements with recognized academic institutions abroad, in which the Department of Environmental Engineering students are eligible to do part of their studies in the academic year 2016- 2017. Following a call for expressions of interest, students apply, are evaluated by the Director of the program and are selected to participate. Moreover, the ERASMUS + program evolves and expands its operations, it now enables the employment of students under internships in organizations and companies abroad for up to 12 months. Indeed, this feature is also given to graduates of the Department until the end of the academic year in which they were awarded the Diploma in Environmental Engineering.

The following countries can participate fully in all actions of the program ERASMUS+:

Member States of the European Union (EU): Belgium, Bulgaria, Czech Republic, Denmark, Germany, Estonia, Ireland, Greece, Spain, France, Croatia, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Hungary, Malta, Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland, Sweden, United Kingdom.

Countries outside the European Union (EU): Former Yugoslav Republic of Macedonia, Iceland, Liechtenstein, Norway and Turkey.

4.8. Diploma Thesis

The Environmental Engineering studies are concluded with a diploma thesis. The thesis is an extensive, in-depth study of a scientific area of expertise in Environmental Engineering. It aims to demonstrate that the student is able to work and to expand the knowledge in a specific scientific field. Each student can

choose at the end of the 8th semester the topic to develop the thesis and the supervising Professor. Titles and brief descriptions of the topics are available on the website of the department.

Membership of the tripartite exam committee

Right to participate in the tripartite Thesis Exam Committee have all faculty members of the Department of Environmental Engineering and other departments of the University of Western Macedonia or another recognized higher education institution either national of international or a Researcher from a recognized Research Institution / Agency or an esteemed scholar (with a Ph.D.) working in the private sector.

The Supervisor can be only a faculty member of the Department of Environmental Engineering, who chairs the Exam Committee. All members are required to be present for the defense of the Diploma Thesis. The subject of the thesis and the membership of the Exam Committee are approved by the General Assembly. The progress of the thesis is monitored at regular intervals in collaboration with the student, the Supervisor and the other members of the committee.

Timeframe for the completion of the Thesis

The minimum time for completion is one academic semester. In the case of group work (up to 2 people) it is required to present a single written report, regardless of the number of team members.

Thesis Grading

The Thesis is graded separately by each of the three members of the Examination Committee. The average of the three grades is the final Thesis grade. The weighting factor of the thesis shall be 10% of the total grade, so that it corresponds to one (1) full semester.

4.9. Diploma

All graduates of the Department of Environmental Engineering of Western Macedonia are awarded without discrimination the Diploma of Environmental Engineer.

To obtain the Diploma it is required to have successfully completed at least 56 courses, two foreign language courses, the defense of the Diploma Thesis and the accumulation of 300 credits, of which 270 resulting from the successful completion

of mandatory and elective courses (180 in the First Cycle of studies and 90 from the Second Cycle) plus 30 from the Diploma Thesis.

The Diploma certifies the successful completion of studies and reports the final grade-average to the second decimal point. This degree classification is in order of achievement: Excellent from 8.50 until 10.00, Very Well from 6.5 to 8.49, well up from 5.00 6.49.

4.10. Degree grade calculation

To calculate the Diploma grade, the grade of each course is multiplied by a weighting factor for the course and the sum of the each product is divided by the sum of the weighting factors of all subjects.

Each course is characterized by a number of credits. One teaching unit corresponds to 1 hour lecture and 1 to 3 hours tutoring or laboratory per week. Course weighting varies from 1,0 to 2,0 and is calculated as follows:

- Coursed with 1 or 2 credits are weighted 1,0.
- Coursed with 3 or 4 credits are weighted 1,5.
- Coursed with 5 or more credits are weighted 2,0.

If a student is graded in more courses than they correspond to in the required minimum number of courses and credits to be awarded the Diploma a number of mandatory elective courses only are the ones that can be chosen by the student to be excluded from the calculation of the final Degree grade-average.

For the calculation of the diploma degree, the degree of each course is multiplied by the weighting of the course. The sum of the individual products is divided by the sum of the weighting factors of all subjects and shows the average grade of the course. The diploma grade is calculated from the average grade of the course with weighting 90% plus the grade of the Diploma Thesis weighted at 10% so to correspond to a Semester. The degree grade formula is:

$$\text{B.}\Delta\text{.} = 10\%\,\text{B}_{\delta} + 90\%\,\frac{\sum_{i=1}^{M} W_i B_i}{\sum_{i=1}^{M} W_i}$$

where M is the number of courses passed successfully in exams, B_i is the successful examination grade of course i W_i is the weighting for grade i and B_δ is the Diploma Thesis grade.

5. DETAILED CURRICULUM GUIDE

All Semester mandatory courses are can be found In the summary tables that follow. Also listed are the mandatory elective courses available for the student. For each course are reported:

- The course code
- The weekly lecture and lab hours (H)
- The course Weighting Coefficient (W.C.).
- The number of course credits according to European Credit Transfer and Accumulation System - ECTS.
- A detailed course description.

The selection of courses for each semester is indicative and not mandatory for students. It represents though the typical path of a student following the degree course to completion with the minimum number of examinations required for obtaining the Diploma while respecting the order of interdependent prerequisites. Generally, it is recommended to follow the chronological order of mandatory courses, as the order of courses was set having taken into account a specific logical sequence of incremental knowledge-building steps. Failing in the examination of a mandatory course, the student can repeat it in the next six months. In addition, it is recommended for students to attend all lectures and participation in the educational process as this will help them assimilate the course contents and have an interactive way to have answers in difficult topics.

1st SEMESTER

Mandatory Course	Hr	W.C.	ECTS
Mathematics	4	1,5	5
Physics I	4	1,5	5
General Chemistry	4	1,5	5
Mechanical Drawing	5	2	5
Environmental Engineering Principles	4	1,5	5
Programming for Engineers	4	1,5	5
English I	2	1	2

2nd SEMESTER

Mandatory Course	Hr	W.C.	ECTS
Differential and Integral Calculus	4	1,5	5
Physics II	4	1,5	5
Instrumental Environmental Analysis	4	1,5	4
Organic Chemistry	4	1,5	4
Technology and Innovation, Introduction to Economics	3	1,5	3
Engineering Statics	5	2	5
English II	2	1	2

3rd SEMESTER

Mandatory Course	Hr	W.C.	ECTS
Probability - Statistics	5	2	5
Atmospheric Dynamics	4	1,5	5
Strength of Materials	5	2	5
Aquatic Chemistry	4	1,5	6
Biology Principles	3	1,5	3
Thermodynamics	5	2	6

4th SEMESTER

Mandatory Course	Hr	W.C.	ECTS
Numerical Analysis and Simulation	5	2	6
Mass and Energy Balances	4	1,5	5
Ecology	4	1,5	4
Fluid Mechanics	5	2	6
Environmental Microbiology	3	1,5	4
Geodesy (Surveying and GIS)	5	2	5

5th SEMESTER

Mandatory Course	Hr	W.C.	ECTS
Hydraulics	4	1,5	4
Remote Sensing	4	1,5	5
Environmental Geology	3	1,5	3
Mass - Heat Transfer Phenomena	5	2	5
Soil Mechanics	4	1,5	4
Atmospheric Pollution	4	1,5	5
Chemical & Biochemical Processes Engineering	5	2	5

6th SEMESTER

Mandatory Course	Hr	W.C.	ECTS
Wastewater Engineering	5	2	5
Solid Waste Management	5	2	5
Hydrology	3	1,5	3
Coastal Engineering	4	1,5	4
Air Quality Engineering	4	1,5	4
Renewable & Alternative Energy Sources	4	1,5	4
Risk Management and Safety of Large Industrial Systems	4	1,5	4

7th SEMESTER

Mandatory Course	Hr	W.C.	ECTS
Mechanisms and Control of Water Pollution	4	1,5	5
Remediation and Restoration of Contaminated Sites	5	2	5
Environmental Economics	3	1,5	3
Process Control	5	2	5

8th SEMESTER

Mandatory Course	Hr	W.C.	ECTS
Design and Optimization of Environmental Systems I	5	2	6
Life Cycle Analysis of Environmental Systems	4	1,5	4
Water Treatment Plants	5	2	5
Toxic and Hazardous Waste Management	4	1,5	4

9th SEMESTER

Mandatory Course	Hr	W.C.	ECTS
Design and Optimization of Environmental Systems II	5	2	15
Environmental Impact Studies	5	2	6

10th SEMESTER

Mandatory Course	Hr	W.C.	ECTS
Diploma Thesis		2	30

WINTER SEMESTER ELECTIVES

Courses	Hr.	W.C.	ECTS
Environmental Models for Pollutants Transport	4	1,5	4
Water Resources Sanitation - Ecological Engineering	4	1,5	4
Agro-industrial Waste Management	4	1,5	4
Health and Safety at Work	4	1,5	4
Climate Change: Impacts - Adaptation	4	1,5	4
Quality Control	4	1,5	4
Operations Research	4	1,5	4
Environmental and Technical Legislation	4	1,5	4
Technology, Research, Innovation Policies and Entrepreneurship	4	1,5	4
Environmental Management	4	1,5	4

SUMMER SEMESTER ELECTIVES

Courses	Hr.	W.C.	ECTS
Design and Management of Protected Areas	4	1,5	4
Special Topics in Environmental Engineering	4	1,5	4
Economics of Natural Resources	4	1,5	4
Design of Water and Sewerage Networks	4	1,5	4
Environmental Geotechnics	4	1,5	4
Energy Building Design - Energy Audit	4	1,5	4
Solar Technique / Photovoltaic Systems	4	1,5	4
Physical Processes Engineering	4	1,5	4
Systems Reliability, Maintenance and Safety	4	1,5	4
Inventory and Supply Chain Management	4	1,5	4
Renewable & Alternative Energy Sources Lab	4	1,5	4
Processes Simulation and Dynamics	4	1,5	4

6. COURSES DESCRIPTION

Below you will find the analytical description of the courses taught.

Abreviations:

S. : Semester

Hr. : Teaching hours per week

W.C. : Impact points of the course

W.S. : Winter Semester

S.S. : Summer Semester

Courses are taught in Greek

Mathematics I	S.	Hr.	W.C.
	1	4	1,5

Course Content: Vector calculus, algebra matrices, determinants, systems of linear equations, vector spaces and subspaces, basis and dimension of vector spaces, linear representations of finite dimension linear imaging tables, diagonalization of matrices: eigenvalues and eigenvectors, quadratic forms, differential functions of one variable and applications, inverse trigonometric functions, hyperbolic functions, some vaguely integrals, techniques of integration, Improper integral, Sequences, Series of real numbers.

Physics I	S.	Hr.	W.C.
	1	4	1,5

Course Content: Basic engineering theory, Newton's Laws, Forces, Energy Conservation, Principles of Momentum and Angular Momentum, Kinematics and Dynamics of Material Point, Kinematic of Rigid Body Level and Area, Relative Motion, Dynamic of Rigid Body Level and Area, Electrostatic, Electrical Loads, Law Coulomb, Electric Fields and Electric Resources, Gauss Laws, Potential Difference, Capacitors, Conductors and Insulators, Electrical currents and Current Density, Fields of Moving Load, Magnetic Field, Electromagnetic Induction and Equations of Maxwell, Electric and Magnetic Fields of the Matter

General Chemistry	S.	Hr.	W.C.
	1	4	1,5

Course Content: Introduction to the basic principles of the structure of atoms, Quantum mechanical approach of atoms, Electronic configuration of atoms, Periodic system of

elements, Ionic and co-valent bonds, Molecular geometry, Hybridization, Molecular orbital theory, Metallic bonds, Intermolecular forces, Chemical kinetics, Chemical equilibrium, Chemical solutions, Acids – Bases - Salts, Redox processes & electrochemistry, Spectroscopic techniques.

Mechanical Drawing	S.	Hr.	W.C.
	1	5	2

Course Content: Fundamental ISO rules for drawing (types of technical drawings, drawing tools and sheets, title block, parts list, drawing scales, types of lines and line widths, lettering), Introduction to Computer-Aided Design/Drafting (CAD), Views and representation of mechanical components (types of views, technical sketch, construction drawing, assembly drawing, rules and basic conventions for views), Dimensions (ISO rules and principles for dimensioning, special symbols for dimensioning, basic methods and paradigms for dimensioning, dimensions for CNC processing), Sections (general principles and rules for drawing sections, special types of sections, sections in multiple cutting planes), Drawing of connection elements (geometric features and categories of threads, standard threads, drawing of thread holes, dimensions and types of screws, standardization of bolts, nuts and tools, bolted joints and related components, rivets, welding methods and drawing of welds).

Environmental Engineering Principles	S.	Hr.	W.C.
	1	4	1,5

Course Content: Introduction - Mass balances (application to fixed and non-fixed systems), Energy Balances (1^{st} – 2^{nd} law of thermodynamics), Use of natural resources (exponential growth, Gauss curve), Air Quality, Climate change, Water quality management (water supply sources, categories of pollutants, Streeter-Phelps equation), Drinking water treatment (flocculation-coagulation, filtration, sedimentation, disinfection), Wastewater treatment (primary and secondary treatment), Sludge treatment - Reuse of wastewater and sludge, Solid municipal and hazardous waste management

Programming for Engineers	S.	Hr.	W.C.
	1	4	1,5

Course Content: General computing literacy, hardware design and operation, basic problem solving techniques. Basic principles of programming using the MATLAB environment and language: the command prompt, scripts, tables, graphics and data visualization, flowcharts, selection and repetition structures, data input-output.

English I	S.	Hr.	W.C.
	1	2	1

Course Content: Familiarize students with the specific language of their science, to acquire the linguistic skills that will allow them to understand extensive English-language texts on the subject of their studies .

Differential and Integral Calculus	S.	Hr.	W.C.
	2	4	1,5

Course Content: Lines, surfaces and curves in space, Real functions of several variables, partial derivatives of functions of several variables, div, grad, Curl, Chain differentiation, Directional Derivative, Extremes, Taylor series, Double integrals, Triple integrals, Vector functions, curves, Linear integrals, Differentiation of scalar and vector fields, preservatives fields, Theorem of Green, surface integrals, theorems of Gauss and Stokes.

Physics II	S.	Hr.	W.C.
	2	4	1,5

Course Content: Vibrations and wave theory, linear wave equation, Flat and spherical waves, Contribution and coordination, Sound waves, Optical Linear Elements (reflection, refraction, diffraction), Heat, Elements of Heat Transfer, Laws of thermodynamics, Atomic Physics (modern atomic theory, model of Bohr, Millikan experiment), Elements of Quantum theory, Nuclear Physics, Nuclear fission, Fusion, Radiation

Instrumental Environmental Analysis	S.	Hr.	W.C.
	2	4	1,5

Course Content: Methodology, Statistical Data Analysis-Bugs, Absorption of Electromagnetic Radiation, Instrumental spectrophotometry, Chromatographic Methods, Instrumentation of Mass Spectrometry, Atomic Spectroscopy, X-ray Methods, Techniques for the Study of Solid Samples, Ionizing Radiation-Radiation, Noise & Environmental Technology Laboratory exercises.

Organic chemistry	S.	Hr.	W.C.
	2	4	1,5

Course Content: Introduction to Organic Chemistry, Structure and bonds, Organic Reactions-nomenclature, Saturated hydrocarbons, Unsaturated hydrocarbons, stereochemistry, aromatic hydrocarbons, structure identification, alkyl halides, alcohols, ethers, alkyl halides, Carbonyl Compounds, Biomolecules

Technology and Innovation, Introduction to Economics	S.	Hr.	W.C.
	2	3	1,5

Course Content: Size and business development – the overall financial budget of enterprises – investment and financing – financing and capital composition Styles – Foreign and Credit Capital – Developmental regimes – Other forms of finance – balance sheet and income statement – Indicators of profitability on invested capital – Balanced Scorecard.

Engineering Statics	S.	Hr.	W.C.
	2	5	2

Course Content: Force and moment. Addition and resolution of forces. Free body diagram. Equilibrium conditions. Elementary structures: rods, beams, cables. Advanced structures: frames, trusses. N-Q-M diagrams. Friction: brakes, clutches, couplings, belts. Center of mass. Moments of Inertia.

English II	S.	Hr.	W.C.
	2	2	1

Course Content: Familiarize students with the specific language of their science, to acquire the linguistic skills that will allow them to understand extensive English-language texts on the subject of their studies .

Probability - Statistics	S.	Hr.	W.C.
	3	5	2

Course Content: Descriptive statistics: data summary and presentation, frequency distribution, histogram, characteristic values (mean, median, mode, range, variance, standard deviation). Probability theory: basic concepts, events, conditional probability, addition and multiplication law of probabilities, Bayes theorem. Probability distributions, discrete and continuous random variables, expected value, variance and standard deviation. Important distributions: Bernoulli, binomial, geometric, Poisson, uniform, exponential, gamma, normal distribution and the central limit theorem, Student, X2 and F distributions. Statistical estimation: sampling distributions, point estimation, properties of estimators,

confidence intervals. Statistical hypotheses: hypothesis testing, type I and type II errors, required sample size, goodness of fit tests.

Atmospheric Dynamics	S.	Hr.	W.C.
	3	4	1,5

Course Content: The atmosphere: Origins - Structure – Composition, Atmospheric properties - Boundary layer. Physics of the Atmosphere, Radiation Laws, Dissemination of radiation, Energy balance, Changes in pressure and density of the atmosphere, Climatology, Meteorology, Atmospheric Static.

Strength of Materials	S.	Hr.	W.C.
	3	5	2

Course Content: Axial Loading, Centric & Eccentric Loading, Shearing Stress, Bearing Stress in Connections, Stress Under General Loadings, Rod & Boom Normal Stresses, State of Stress, Factor of Safety, Normal Strain, Hooke's Law: Modulus of Elasticity, Elastic vs. Plastic Behavior, Fatigue, Deformations Under Axial Loading, Static Indeterminacy, Thermal Stresses, Poisson's Ratio, Relation Among E, v, and G, Composite Materials, Generalized Hooke's Law, Shearing Strain, Saint-Venant's Principle, Stress Concentration, Plastic Deformations, Residual Stresses

Torsion: Torsional Loads on Circular Shafts, Axial Shear Components, Shaft Deformations, Shearing Strain, Stresses in Elastic Range, Angle of Twist in Elastic Range, Statically Indeterminate Shafts, Design of Transmission Shafts, Stress Concentrations, Plastic Deformations, Residual Stresses, Torsion of Noncircular Members, Thin-Walled Hollow Shafts.

Pure Bending: Symmetric Member in Pure Bending, Bending Deformations, Strain Due to Bending, Deformations in a Transverse Cross Section, Bending of Members Made of Several Materials, Stress Concentrations, Eccentric Axial Loading in a Plane of Symmetry, Asymmetric Bending, General Case of Eccentric Axial Loading.

Transverse Loading: Basic distributional assumption of normal stresses, Determination of the Shearing Stress in Common Types of Beams, Further Discussion of the Distribution of Stresses in a Narrow Rectangular Beam, Longitudinal Shear on a Beam Element of Arbitrary Shape, Shearing Stresses in Thin-Walled Members, Plastic Deformations, Multi Loading stresses, Asymmetric Loading of Thin-Walled Members.

Transformations of Stress and Strain: Transformation of Plane Stress, Principal Stresses, Maximum Shearing Stress, Mohr's Circle for Plane Stress, Application of Mohr's Circle to the Three-Dimensional Analysis of Stress, Yield Criteria for Ductile Materials and Fracture Criteria for Brittle Materials Under Plane Stress, Stresses in Thin-Walled Pressure Vessels, Transformation of Plane Strain, Mohr's Circle for Plane Strain, Three-Dimensional Analysis of Strain, Measurements of Strain.

Aquatic Chemistry	S.	Hr.	W.C.
	3	4	1,5

Course Content: Structure and properties of water. Simulations of aqueous systems, aqueous solutions, ionic strength and activity, Mathematical modeling of water systems, Setting Up Equilibrium Problems - Tableau Method, monoprotic acids, diprotic and triprotic acids. Solving Problems by Approximation - Log C vs. pH Diagrams, Acids and bases, acid-base neutralization buffer. Water systems - gas, acidity and alkalinity, The Carbonate System and Alkalinity, water systems - Solid-Solution Interface and Kinetic, introduction to complex formation equation

Biology Principles	S.	Hr.	W.C.
	3	3	1,5

Course Content: Characteristics of living organisms, chemical composition of organisms, structure and function of the cell, cell functions, Breathing - Photosynthesis, Mendel and heredity types, molecular genetics, genetic engineering, biotechnology, microorganisms, animal breeding and plant organisms.

Thermodynamics	S.	Hr.	W.C.
	3	5	1,5

Course Content: Basic principles of Thermodynamics. The First Law of Thermodynamics in closed systems, properties of pure substances, Phase diagrams for gases and liquids, equations of State, the First Law of Thermodynamics for open flowing systems, The Second Law of Thermodynamics, Entropy and the third Law, Power, refridgeration and heating cycles, Gas and vapor cycles: Carnot, Otto, Diesel, Brayton, Rankine. Thermodynamic calculations of chemical reactions, chemical equilibrium and kinetics. Thermochemistry, the heat of chemical reactions.

Numerical Analysis and Simulation	S.	Hr.	W.C.
	4	5	2

Course Content: Introduction to the use of MATLAB for solving numerical analysis problems, Basic concepts and analysis. Representation of numbers and numerical errors solutions. Linear systems. Roots of equations. Nonlinear Equations. Optimization. Curve fitting. Numerical interpolation and polynomial approximation. Numerical Differentiation and Integration. Ordinary Differential Equations

Mass and Energy Balances	S.	Hr.	W.C.
	4	4	1,5

Course Content: Material balances and definitions. Simple flow sheets. Combustion and excess air. Elements of phase equilibria. Equations of state. Critical and reduced T and P. Compressibility factor (Z). Pure gases and gas mixtures. Partial pressure. Humidity; steam tables; drying and humidification processes. Energy balances. Definitions (work, heat, energy, enthalpy, specific heat). Enthalpy calculations. Phase change and ΔH calculations. Generalized energy balance. Enthalpy of reaction. Reactions at T, P other than standard. Enthalpy of dilution and of mixing. Combined mass and energy balances. Distillation. Degrees of freedom. Enthalpy – concentration diagrams. Humidification – dehumidification – cooling diagrams. Applications. Non-steady state mass and energy balances. Simple non-steady state mass balances, mixing, distillation, reaction. Simple non-steady state energy balances, heat transfer. Simple applications and examples. Students are required to attend a computer lab on the use of Aspen Plus

Ecology	S.	Hr.	W.C.
	4	4	1,5

Course Content: Systems and ecosystems. Meaning and use of models. Succession and stability. Mathematical models of ecosystems. Organizations and environmental factors. Categories of organisms and their interaction with the environment. The organization in population levels. Models of population size change. Population interactions. Organization at ecosystem level. energy flow. Limiting factors. Movement of chemicals on ecosystems. Ecological succession. Ecological quality and degradation of the natural environment. Habitats - biodiversity. Introductory information on toxic pollution, pollution of water and air. Environmental indicators.

Fluid Mechanics	S.	Hr.	W.C.
	4	5	2

Course Content: Basic definitions. Properties of fluids. Fluid Statics: Measurement of pressure, hydrostatic forces, buoyancy and Archimedes's law. Introduction to Fluid Dynamics: Bernoulli's equation and its applications. Kinematics of fluids, Eulerian and Lagrancian description of flow. Reynolds transport theorem. Control volume formulation and application in mass, momentum and energy conservation. Differential analysis of flow fields: stream function, vorticity and potential; elementary ideal, potential, flows and their combinations, examples and applications. Continuity equation, Euler and Navier Stokes equations of motion, Energy equation and their applications. Viscous flows and their application in simple geometries: Poiseuille flow in a slit channel and a cylinder, Quette flow. Dimensional analysis, similarity and dimensionless numbers. Π- Buckingham's

theorem. Flow in tubes: Fully developed flow, introduction to turbulence and the concept of the boundary layer. Dimensional analysis and the use of Moody's charts to determine the pressure drop in smooth and rough tubes.

Environmental Microbiology	S.	Hr.	W.C.
	4	3	1,5

Course Content: Introduction to Environmental Microbiology. Chemical composition of the cell. Classification of cells/organisms (eubacteria, archaea, fungi, protozoa, algae, viruses). Elements of key categories pathogenic microorganisms. Systematic classification of organisms -Nomenclature - Classification. Nutrition and physiology of microorganisms. Metabolism of heterotrophic microorganisms. Microorganisms as biogeochemical agents. Microbial growth (batch culture, continuous culture). Measurement of microbial growth. Microbiology of aquatic environment (water - wastewater). Drainage problems faecal contamination of water - protecting the environment. Biological Treatment of Urban Waste. Removal of pathogenic microorganisms in wastewater treatment. Enteric viruses in wastewater. Fate of pathogenic microorganisms in soil. Applications of microorganisms

Geodesy (Surveying and GIS)	S.	Hr.	W.C.
	4	5	2

Course Content: Fundamentals of digital cartography. Categories and structuring data. Grid (raster) and vector (vector) data. Spatial databases. The importance of scale. The data collection range. The generalization. Collecting data from maps. data collection by remote sensing. The Global Positioning System (GPS). coordinate systems. Methods Data georeferencing. Working with multiple levels of information. Topology: relations between geographical objects. The descriptive attributes of map objects. Geocoding. Revealing information: Thematic maps, visual analysis, spatial search. Network analysis: in-car navigation, travel time analysis, analysis of the optimal path. Portable GIS: Find Location, Location Based Services (LBS), telematics. Applications GIS MCA: manufacturing grid files, analysis of variables.

Hydraulics	S.	Hr.	W.C.
	5	4	1,5

Course Content: Engineering of incompressible fluids, flow meters, flow in closed conduits and open channels, hydraulic machine elements. Technical irrigation network projects (closed and open lines, network equipment, pumps and pumping stations). Land reclamation. Leveling soil, draining soils and saline soils. Technical abstraction works (e.g., floating docks).

Remote Sensing	S.	Hr.	W.C.
	5	4	1,5

Course Content: Scientific methods and technology for the collection and processing of information with remote sensing methods such as satellite images and their use in environmental applications.

Environmental Geology	S.	Hr.	W.C.
	5	3	1,5

Course Content: Materials and Earth processes, energy and heat, geothermal gradient, internal and external structure of the earth, tectonic plates, earthquakes and their results, minerals and rocks, volcanoes and igneous rocks, sedimentary rocks and sedimentary processes, transformation and other processes, geologic time scale, topography, geological maps, geological sections, geological evolution

Mass - Heat Transfer Phenomena	S.	Hr.	W.C.
	5	5	2

Course Content: Introduction to transport phenomena - Basic concepts. Mass transfer mechanisms. Collection, transport and diffusion rate. diffusion coefficient. mass balance. Diffusion in permanent and non-permanent situation. Diffusion by chemical reaction. Similarities in the transfer of momentum, heat and mass. Dimensional analysis. Analytical solutions of simple mass and heat transfer systems. applications

Soil Mechanics	S.	Hr.	W.C.
	5	4	1,5

Course Content: Nature and properties of soil. Classification and characterization of soils. Gradation. Relative density. Atterberg Limits. Permeability soils. Role of water in the mechanical behavior of soils. Behavior soils under drained and undrained conditions. Solidification. Mechanical behavior of soils. Trends in soils. Soil deformations. Durability and soil subsidence. Shear strength of soils. fracture criteria. Mohr-Coulomb theory. Lateral earth pressures. Methods of calculation of active and passive thrusts. Slope stability. Landslides. Methods of analysis. Countermeasures. Retaining walls. Improving soil. Condensation. Shallow foundations. Types of surface foundation. Calculation ground bearing capacity. Deep foundations and excavations. Piling & Shafts. Limit failure and functional statements. safety factors.

Atmospheric Pollution	S.	Hr.	W.C.
	5	4	1,5

Course Content: Structure, Composition and Characteristics of the Atmosphere. Atmospheric Pollutants and Sources. Physicochemical processes in the atmosphere, Atmospheric Boundary layer, Acid Rain theory, Aerosols, Effective Height of Emissions, The Phenomenon of Diffusion. Transport of Pollutants in the Atmosphere. Atmospheric Dispersion Modeling. Atmospheric dynamics. Instrumentation - Measurement of Meteorological Parameters.

Chemical and Biochemical Processes Engineering	S.	Hr.	W.C.
	5	5	2

Course Content: Kinetics of chemical reactions: reactions of 0th, 1st, 2nd order, one-way and equilibrium reactions, complex reaction systems (parallel and successive reactions). Kinetics of enzymatic and microbial reactions with the main Michaelis-Menten and Monod kinetics, kinetic inhibition. Design of ideal reactors (through mass and energy balances) batch reactors, continuous-stirred tank reactors and plug flow reactors. Reactor systems (in series, parallel). Optimization of performance. Deviation from the non-ideal state.

Wastewater Engineering	S.	Hr.	W.C.
	6	5	2

Course Content: Origin, qualitative and quantitative characteristics of Urban Wastewater (SAH), Analysis & Selection of wastewater provision and the Cargo, pretreatment Projects (scab, precipitation, sedimentation of individual particles, sand collectors agglomerating precipitation), Primary SAH treatment, Kinetics of microorganisms growth, Biological Edit SAH (suspended / adherent biomass systems, activated sludge: remove BOD, nitrification, denitrification, biological removal of P, presence of toxic substances, effects, fortune, heavy metals and organic micropollutants) biological filters, processing Ponds - Artificial wetlands, Tertiary treatment AR, sludge treatment (characteristics, thickening, digestion, dehydration, composting), SAH Disinfection (chlorination, ozonation), SAH Reuse, Reuse and Disposal of Solid & biosolids, issues relating to performance of the Processing Unit.

Solid Waste Management	S.	Hr.	W.C.
	6	5	2

Course Content: Solid waste classification and characterization, properties and characteristics, integrated waste management principles based on their characteristics, basic waste management phases: collection, transportation, storage, recycling, treatment, final disposal. Available solid waste treatment methods based on their characteristics (composting, heat treatment, landfilling), advantages and disadvantages of available methods of selection criteria. Energy from waste. Analysis of solid waste collection systems: cache system design factors (bins, total capacity selection bins and garbage) collection and transmission system (planning collection routes, evaluation and selection of waste collection, capacity, design parameters, equivalent annual cost for collection and transport examples design), transfer station (WTS) municipal solid waste (structure and operation of systems, dimensioning, selection criteria and compatibility technology, location, annual costs, economic evaluation garbage with STD). Methods for calculating the required number Services Sanitary Landfill (CHYT) or Integrated Waste Management Facility (OEDA) in a study area. Selection CHYT positions, position selection of alternative candidates. Biological and chemical waste degradation processes. Quantitative and qualitative characterization of degradation products (leachate, biogas). Design CHYT: phases of development and capacities, earthworks and sealing, collection and treatment of leachate and biogas, technical infrastructure (fencing, gates, weighing, access roads, etc.), mechanical equipment, operating organization, control and monitoring, final restoration and future monitoring .

Hydrology	S.	Hr.	W.C.
	6	3	1,5

Course Content: Hydrological cycle, Hydrometeorology, precipitation, evaporation and transpiration, Losses, Snow Hydrology, Filtration, Hydrologic measurements and Flood runoff hydrographs, flood routing, Hydrology and watershed models, computers applications.

Coastal Engineering	S.	Hr.	W.C.
	6	4	1,5

Course Content: Introduction to coastal engineering processes and problems. Topics include: mechanical waves, coastal hydrodynamics, methodologies examination ripple (mathematical wave theories, linear wave theory, spectral wave description), wave shaping the coastal area (shoaling, refraction diffraction, breakage, reflection), tides, sediment transport and coastal structures . streams (wave, wind-), environmental control projects in the coastal zone

Air Quality Engineering	S.	Hr.	W.C.

	S.	Hr.	W.C.
	6	4	1,5

Course Content: Analysis and design of the particulate emission control and removal techniques: settling chambers, cyclones, electrostatic precipitators, bag filters, scrubbers. Basics accessories emission gas treatment facilities. Air emissions control technologies: combustion (thermal oxidation), adsorption, absorption, biological control, concentration, chemical treatment of sulfur oxides and nitrogen oxides and organic compounds. emission gas treatment technologies from mobile sources. Catalytic converters.

Renewable & Alternative Energy Sources	S.	Hr.	W.C.
	6	4	1,5

Course Content: Introduction to energy policy issues. Energy in the European Union. The EU Green Bible for the security of the energy supply. The EU White Bible for the Renewable Energy Sources. Energy reserves and resources. The Greek energy system. Solar energy-basic principles. Solar collectors and photovoltaics. Wind energy and wind parks. Energy from biomass. Energy utilization of biomass. Hydropower and power plants – Advantages and disadvantages. Geothermal energy and geothermal fields. Tidal and wave energy. Ocean thermal energy. Energy conservation. Thermodynamic analysis of the renewable energy systems. Environmental analysis of the renewable energy systems. Social and economic impacts.

Risk Management and Safety of Large Industrial Systems	S.	Hr.	W.C.
	6	4	1,5

Course Content: This course covers the scientific area of Risk Management and Safety of Large Industrial Systems with emphasis to Petroleum Industry. The following subjects are covered In details: Safety and loss prevention, definition of hazard, risk and risk assessment, scope and outline of risk management, frequency and severity, intrinsic and extrinsic safety, risk balance, Pareto principle, epidemiological approach, hazard warning. Identification of hazards and basic definitions: toxicity, flammability, sources of ignition, fires, explosions, ionizing radiation, noise pollution, temperature and pressure deviations. Fire protection: classification of fires, fundamentals of fire suppression, fire protection systems and facilities, thermal radiation. Hazard and operability studies (HAZOP): basic principles, explanation of guide, procedures, critical examination of flow sheets. Risk analysis; acceptable risks and safety priorities, frequency of accidents, safety checklists and fault trees, assessment of risks from complex plants. Strengths and limitations of quantitative risk assessment, modeling, a systematic approach to risk reduction, human factors, and management of process safety, insurance. Industrial hygiene, identification MSDS, evaluating exposure to volatile toxicants. Flow of fluids through a pipe, liquids through pipes Toxic release and dispersion models, parameters affecting dispersion.

Mechanisms and Control of Water Pollution	S.	Hr.	W.C.
	7	4	1,5

Course Content: Organoleptic characteristics of water. Physical characteristics of the water. Inorganic water features. Organic water features (COD, BOD, TOC). Sampling. Fundamentals spectrometry. Spectrophotometers. Atomic spectroscopy. Introduction to analytical separations. Gas and Liquid Chromatography. Automated analysis and remote monitoring Fundamentals Chemometrics. Limits water quality and waste treatment requirements.

Remediation and Restoration of Contaminated Sites	S.	Hr.	W.C.
	7	5	2

Course Content: Design of in-situ and ex-situ remediation of contaminated soils and groundwater systems from operators (or non-chlorinated) organic compounds. Planning biological subsurface dams. bioreactors of SBR type operation. Peculiarities restoring marine ecosystems by oil spills. environmental self-healing forms. Design and analysis of phytoremediation soil / groundwater from organic compounds or heavy metals. Design of air biofilter for odor control and hazardous and toxic gases. Transport and fate of pollutants in the soil. Hydrodynamic (co-transport, dispersion, diffusion), abiotic (adsorption, evaporation, ion exchange, hydrolysis, etc.) and biotic processes that take place underground. soil remediation technologies (physicochemical, biological and thermal methods) - basic characteristics, system design, performance and suitability, advantages and disadvantages. Technologies rehabilitation of contaminated aquifers (in-situ, ex-situ and on-site technologies) - basic characteristics, system design, performance and suitability, advantages and disadvantages.

Environmental Economics	S.	Hr.	W.C.
	7	3	1,5

Course Content: Economic system and environment. Sustainability and growth. Income. Effect of growth. development and country classification. Determinants of growth. Development with and without technological progress. Productivity. Natural resources. Value for economic and biosphere. economic development models. Unbalanced development. Agricultural, industrial, postindustrial development. International financial transactions and technology transfer. Financial ecology. The LFAT equation. Economics of Climate Change. cost - benefit analysis. Environmental Management Systems -EMAS.

European sustainability policies. The European Framework Programmes for sustainable development. Environmental taxes.

Process Control	S.	Hr.	W.C.
	7	5	2

Course Content: Introduction to Automatic Control Systems (ACS). Mathematical Models Systems. M / S Laplace and Transfer Functions. Models Variable Status. Key Figures and Performance Systems Closed Loop. Analysis Stability Ruth-Hurwitz. Root locus method. Methods of Systems Analysis in Frequency Field. Stability in the Frequency Field. Design Systems Closed Loop with root locus, Bode diagrams (lead-lag, three terms (proportional - integral - differential, PID)).

Design and Optimization of Environmental Systems I	S.	Hr.	W.C.
	8	5	**2**

Course Content: Theory and environmental systems design methodology. Familiarize students with current research practices and illustrating the steps of the research process. Quantitative and Qualitative Research Methods. Literature review, paper-writing methods. Process Design Development, Flow Chart Design and Synthesis, Indicators evaluating investments, Optimal Design and Planning Strategy.

Life Cycle Analysis of Environmental Systems	S.	Hr.	W.C.
	8	4	1.5

Course Content: The Life Cycle Analysis (LCA) is the dominant framework for assessing the environmental impact of products, services and energy systems. LCA enables consistent comparison of alternative designs of the system with respect to their environmental performance. This includes assessing the multiple categories of environmental impact. Methodological fundamentals of LCA. Mathematical LCA structure modeling of systems and processes for the assessment of environmental impact.

Water Treatment Plants	S.	Hr.	W.C.
	8	5	2

Course Content: Drinking water objectives- Unit Design, Physico-chemical characteristics of the water - Requirements for drinking water – Features, sizes and components according to EC Directives - Principles of system balance "Calcium - Carbonic acid' - "calcium carbonate - carbonic acid" - deacidification methods - Technical adjustment

of pH - Methods for the removal of carbonic acid - Natural processes, Flocculation - Coagulation: Theory - experimental design flocculation - practice of chemical sedimentation - stirring and power dissipation – hardness, disinfection: chlorine and chlorine compounds - part disinfecting practice of water supply - ozone and peroxides - ultraviolet radiation - speed disinfection - Concentration of disinfectant, filtration: classification of filters - elements of a filter - filter materials - characterization and operation - backwashing - problems when flushing.

Toxic and Hazardous Waste Management	S.	Hr.	W.C.
	8	4	1,5

Course Content: Definition of toxic and hazardous wastes, basic features, technical aspects of the management of hazardous waste, including legislation, risk assessment, reduction – minimization of waste at source, reuse and recovery, recycling, assess recycling performance, storage, use and management of containers, tank management, waste compatibility, transport, treatment, disposal, life cycle analysis (LCA), landfill of toxic waste, physicochemical, thermal and biological treatment processes, specific classes of toxic waste, the basic concepts in toxicology, acute and chronic toxicity, the basic principles of analyzing hazard, hazard identification, exposure and toxicity assessment, risk characterization, remediation technologies.

Design and Optimization of Environmental Systems II	S.	Hr.	W.C.
	9	5	2

Course Content: Application of the theoretical and methodological environmental systems design framework. Students work in teams to design an environmental installation based on data juvenilia. The work includes the search / calculation of design parameters, design and costing of the plant, and the drafting of the related Environmental Impact Study. At the end of the semester, students present the results of their work in a faculty committee.

Environmental Impact Studies	S.	Hr.	W.C.
	9	5	2

Course Content: Key political, design and methodological issues in the assessment of environmental impacts including the regulatory framework and analytical techniques.

Environmental Models for Pollutants Transport	S.	Hr.	W.C.

W.S. 4 1,5

Course Content: Transport Phenomena, Chemical Reaction Kinetics, Equilibrium Chemical Modeling, Eutrophication of lakes, Conventional pollutant in rivers, Toxic Organic Chemicals, Modeling Trace Metals, Groundwater Contamination, Atmospheric Deposition and Biogeochemistry, Deposition of Metals, Global Climate Change and Global Cycles, Air Quality Models

Water Resources Sanitation - Ecological Engineering	S.	Hr.	W.C.

W.S. 4 1,5

Course Content: Treatment of contaminated water using natural processes to improve water quality. On combining basic science and technology with a view to understanding the fundamental processes governing the efficiency of complex systems in physics processing. Applications include artificial wetlands, waste stabilization ponds, bioaccumulation of rainwater, decentralized wastewater management, ecological sanitation.

Agro-industrial Waste Management	S.	Hr.	W.C.

W.S. 4 1,5

Course Content: Agricultural systems and environmental pollution. Definition, Properties, Pollution load of agrochemical activities and food industries. Strategies in the treatment of agro-industrial waste. The specificity of anaerobic treatment in agro-industrial waste. Recovery of valuable components from agro-industrial waste. Modern methods. Solar detoxification. membrane bioreactors

Health and Safety at Work	S.	Hr.	W.C.

W.S. 4 1,5

Course Content: Assessment, Methodology, Professional Risk and Security Studies (production units, storage or handling of hazardous substances (toxic, flammable, dangerous for the environment). Safety Management System: Risk Analysis, Impact Assessment, Prevention and Containment impact of labor and industrial accident and Risk Management . methodologies, standards and legislative requirements.

Climate Change: Impacts - Adaptation	S.	Hr.	W.C.

W.S. 4 1,5

Course Content: Natural pathways and semi periodic oscillation (ENSO, NAO. Chaotic behavior), cycles and global carbon balance, greenhouse gases and solar radiation as agents, sources and sinks of greenhouse gases, aerosols and climate. Direct and indirect

effects of radiation, Models and estimates for the future, Evaluation of model performance. Adjustment methods.

Quality Control	S.	Hr.	W.C.
	W.S.	4	1,5

Course Content: Introduction, basic statistical concepts. Basic quality concepts. acceptance quality control by screening. acceptance quality control by measurement. production process capability analysis. General principles of control charts. sorting feature control charts. measuring characteristics control charts. Special control charts. control chart design methods. Basic concepts of Quality Management Systems.

Operations Research	S.	Hr.	W.C.
	W.S.	4	1,5

Course Content: Introduction to optimization, mathematical programming models, variables, objective function parameters, constraints. Linear programming theory, graphical solution, Simplex method, sensitivity analysis. Linear programming problem solving using computer software (lindo, lingo, EXCEL solver). Integer programming. Branch and Bound algorithm. Binary programming. Applications to real-world problems.

Environmental and Technical Legislation	S.	Hr.	W.C.
	W.S.	4	1,5

Course Content: Introduction to the legal system. EU legislation. Introduction to technical legislation. Procedures for the enterprise, the construction of public works and contractual liability.

Technology, Research, Innovation Policies and Entrepreneurship	S.	Hr.	W.C.
	S.S.	4	1,5

Course Content: National Policies of research and technological growth –National policies of innovation –European map of research and technological growth –Models of policies of research and growth –Models of policies of innovation –Analysis of case studies. Study and Development of Business Plan.

Environmental Management	S.	Hr.	W.C.
	S.S.	4	1,5

Course Content: Design of polluting processes (e.g., industrial activities) in a manner so as to minimize waste. Regulations and the corporate organization of current pollution prevention efforts. Current research on the prevention of pollution. Analysis of the product life cycle and the design of more efficient procedures

Design and Management of Protected Areas	S.	Hr.	W.C.
	S.S.	4	1,5

Course Content: Abundance Population, Population Growth Rate, Dietary Habits, Protection of Endangered Species, Hunted Species, Unwanted Items Control, Anthropogenic Effects on Wild Fauna. NATURA areas.

Special Topics in Environmental Engineering	S.	Hr.	W.C.
	S.S.	4	1,5

Course Content: The course emphasizes the environmental management system and operation of the Steam-Electric Station (SES) for the area of Kozani, Ptolemaida, Amyntaio, Florina. Visits will be conducted in the Power Generation Units, the mines of West Macedonia Lignite Center, and the Hydroelectric Power Stations in the area.

Economics of Natural Resources	S.	Hr.	W.C.
	S.S.	4	1,5

Course Content: Theory of renewable and non-renewable use of natural resources, with applications in forests, fisheries, energy and climate change. Resources - development - sustainability. The economic theory of environmental policy, externalities, tax impact and bumps, indirect taxes, environmental standards, environmental regulations, effect of uncertainty about taxes and standards, monitoring, penalties and regulatory strategy, emissions market.

Design of Water and Sewerage Networks	S.	Hr.	W.C.
	S.S.	4	1,5

Course Content: Projects Water Supply: Population and planning period, water needs, benefits and consumption variation, external aqueduct, making authorities, network

components, materials and line protection, setting tanks, interior aqueduct scenarios, mathematical simulation and network analysis, Hardy-Cross method. Design of drainage works: purpose, systems and device networks, wastewater facilities and stormwater, rational method, recovery period, IDF curves, design and analysis of networks, permitted speeds and minimum slopes, filling pipes, materials and accessories.

Environmental Geotechnics	S.	Hr.	W.C.
	S.S.	4	1,5

Course Content: Principles of environmental geotechnics applied to waste boxing and rehabilitation of contaminated sites. Characterization of soils and waste, engineering and geosynthetic properties of soils and their use in typical applications. Fate and transport of pollutants. Fundamental principles and practices in groundwater remediation. Implementation of environmental geotechnical design and construction of waste containment systems. Soil remediation. Emerging technologies.

Energy Building Design - Energy Audit	S.	Hr.	W.C.
	S.S.	4	1,5

Course Content: Objectives and Course Content energy building design. building uses. building comfort requirements: thermal comfort, ventilation, visual comfort. Assessment of heating and cooling loads. Sizing Systems. Green building. Passive solar systems for heating buildings. Natural cooling buildings: Sun protection, passive and hybrid natural cooling techniques. Natural and artificial ventilation of buildings. Conventional active systems. Solar thermal systems. solar cooling systems. RES systems in the building. energy building Behavior Analysis: Modelling energy loads, degree-days methods, typical meteorological year modeling systems. Application to the optimum design of the building. Input for energy regulation. The inspection of the building envelope of the electrical installation and central heating, cooling, air conditioning. Authorities and inspection bodies boilers and heating systems. Calibration and energy certification of different types of buildings. Proposals for building energy upgrades.

Solar Technique / Photovoltaic Systems	S.	Hr.	W.C.
	S.S.	4	1,5

Course Content: Solar Radiation. Parameters and Calculation of the Incoming Solar Radiation on horizontal and Inclined Surface. Calculation of the Energy Needs in Space Heating and Domestic Water Heating. Flat Plate Solar Thermal Collectors. Concentrating Solar Thermal Collectors. Storage of Solar Energy in Heating Processes. Integrated Solar Energy Systems for Heating Processes. F-Chart Method. Technology of the Photovoltaics. Photovoltaic Panels. Photovoltaic Systems. Dimension Process in Photovoltaic Systems.

Physical Processes Engineering	S.	Hr.	W.C.
	S.S.	4	1,5

Course Content: Introduction to basic engineering principles. Transfer of momentum, heat, mass-principles and applications. Absorption processes. Equilibrium phases and the Henry's Law. Absorption towers with steps and filler. Resistances to mass transfer between two phases. Design for sparse and dense mixtures. Analytical and Graphical Methods. Distillation processes. Equilibrium phases in binary mixtures. Raoult's Law. Using composition-chart methods McCabe Thiele and Lewis. Extraction of complex mixtures with the simplified method (Shortcut). Extraction. Cooling towers. Design with simplified methods. Adsorption processes. Mechanisms and adsorption isotherms with one or more components-Langmuir isotherm. Discontinuous separation process at adsorption-adsorption bed design bed from laboratory data. Processes membranes for gas separation and fluid. flow models. The complete mixing model-analytical design equations. Complex flow models. Reverse osmosis processes, ultra-filtration and micro-filtration. mechanical separation processes

Systems Reliability, Maintenance and Safety	S.	Hr.	W.C.
	S.S.	4	1,5

Course Content: Reliability theory, reliability distributions, exponential distribution, distribution gamma, Weibull distribution, normal distribution. Systems reliability, reliability estimation, Markov reliability chains, estimation of reliability using generic parts, fault tree analysis, Monte-Carlo Simulation, Duane model. Reliability data collection, cost estimation, maintenance policies, maintenance indices, economic implications of idle time. The theory of replacement, deterministic and stochastic replacement policies. Preventive maintenance, total productive maintenance TPM, Use of simulation in maintenance

Inventory and Supply Chain Management	S.	Hr.	W.C.
	S.S.	4	1,5

Course Content: Introduction: The significant role of Inventory management and Logistics. Introduction to Supply Chain Management. Forecasting Methods. Deterministic systems of inventory management: (a) the case of known and constant demand (EOQ methods) and (b) the case of known and inconstant. Stochastic systems of inventory management: sQ, RS, sS, RsS systems. Seasonable and innovative products (Newsvendor problem). Supply Chain Management and multi-echelon inventory optimization.

Renewable & Alternative Energy Sources Lab	S.	Hr.	W.C.

	S.	Hr.	W.C.
	S.S.	4	1,5

Course Content: Introduction: RES technologies, renewable energy technologies in buildings involved sizes and gauges. Exercise: measurement, quality measurement and uncertainty. Exercise: Instruments Calibration. Application to liquid flowmeter. Exercise: Weather station. Measuring ambient temperature, wind speed, solar radiation, moisture. Exercise: Photovoltaics. Measurement of V-I curve. Design of F / V system. Exercise: solar thermal energy technologies. Solar thermal collector. Solar thermal systems.

Process Simulation and Dynamics	S.	Hr.	W.C.
	S.S.	4	1,5

Course Content: Design, analysis and development of simulations, random numbers, random numbers generators and simulation sampling, statistical analysis of simulation results. Applications in industrial management and operations research. Practice on specialized simulation software. Fundamental system concepts, the object of a system dynamics analysis

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