7th Semester

COURSE UNIT DESCRIPTION

Course Title :	Course-No. :	Semester :
Quality Control of Energy and Environmental Systems	**TF7001/TF7101**	**7th**
Course Type :	Hours/Weeks/WS	Number of credits
Lecture - Laboratory	**4 lec. – 2 lab. hours/week**	**8**

Lecturer: Vourdoubas Ioannis

Institute/Department: TEI-Technological Educational Institute of Crete, Department of Enviromental and Natural Resources Engineering.

Course Description:

The aim of the course is to give students the necessary theoretical and technical knowledge that is required for the Quality Control of Energy and Environmental Systems. This knowledge is focused on Environmental management systems and in various applications of them in organizations and enterprises . During the course the students are working on a case study concerning the design of an EMS for an enterprise that they choose.

Course Outline:

- Introduction to quality
- Introduction to environmental management systems

1. EMAS
2. ISO 14001
3. Various stages of an EMS

- Preparing and organizing an EMS
- Applications of Environmental Management Systems

Laboratory Outline:

During the course each student with the support of the lecturer is obliged to design and prepare an EMS for an organization or an enterprise that he will choose.This case study in the end is presented by the student as ppt in the class.

-

Bibliography:

Arvanitoyiannis, I.S. (2000). ISO 9000 - ISO 14000 presentation, analysis of quality assurance and environmental management standards, adaptation in the food and drink industry (in *Greek*), University Studio Press, Thessaloniki, Greece.

J.G.Martin , G.J.Edgley " Environmental management systems – A guide for planning , development and innovation " Governmental Institutes press

-

Teaching method: Lectures and case studies preparation.

Assessment: *Theory***:** Final exams (100%).

Laboratory: Group homework (40%) , Final exams (100 %)

COURSE UNIT DESCRIPTION

Course Title :	Course-No. :	Semester :
Energy System Conjunction Technology	**TF7002/TF7102**	**7th**
Course Type :	Hours/Weeks/WS	Number of credits
Lecture - Laboratory	**3 lec. – 2 lab. hours/week**	**6**

Lecturer: Dr Emmanuel Karapidakis, Asc. Professor

Course Description:

Introduction to power electronics fundamentals. More precisely, the course focuses on basic analysis of power converters, voltage rectification circuits and devises. Additional, operation and control of electric motors and power quality issues are within the main learning objectives. Concluding, the course reveal the crucial role and the significant power electronics' contribution in the field of contemporary energy system interconnections.

Course Outline:

Introduction to power electronics fundamentals. Voltage rectification circuit and devises. Operation analysis of several converters and inverters models. Frequency and motor control. Presentation of Power electronics application in the field of energy and environment.

Laboratory Outline:

- Exercises following the theory

Bibliography:

- Power Electronics, Stefanos Manias, Ekd. Symeon, 1999 (in Greek)

Teaching method: Lectures (1 per week), experimental exercises (2 per week).

Assessment: Theory: final examination (100%).

Laboratory: homework (40%), final examination (60%).

COURSE UNIT DESCRIPTION

Course Title :	Course-No. :	Semester :
Management and Control of Renewable Energy Sources	**TF 7003/TF 7103**	**7th**
Course Type :	Hours/Weeks/WS	Number of credits
Lecture – Laboratory	**3+2 / 10**	**6**

Lecturer: Dr. Emmanuel Karapidakis, Asc. Professor

Course Description:

Introduction to main development stages of a contemporary renewable energy project. More precisely, effect of the terrain and obstacles in the energy production in case of wind parks. Wind turbines siting methods and techniques, wake losses and final estimation of the power generation of a wind farm. Solar energy potential and photovoltaic installations efficiency have also been examined. Investigation of all the interconnection issues of a RES plant to the grid, in parallel of a basic techno-economic assessment are within the course objectives. Finally, the main steps of a feasibility study for projects regarding RES are presented.

Course Outline:

- Introduction

- Wind in a complex terrain.
- Wind turbines
- Wake losses
- Energy production of a wind farm
- Techno-economic assessment
- Feasibility study
- International standards for renewable energy products certification.

Laboratory Outline:

- Exercises following the theory

Bibliography:

- Kaldelis I., Wind Energy Management, 2007 (in Greek).
- Frangiadakis I., Photovoltaics Systems, 2006 (in Greek).

Teaching method: Lectures (1 per week), experimental exercises (2 per week).

Assessment: Theory: midterm test (optional, 40%), final examination (100%).

Laboratory: homework (40%), final examination (60%).

COURSE UNIT DESCRIPTION

Course Title :	Course-No. :	Semester :
Air Quality Control Technologies	**TF 7004/TF 7104**	**7th**
Course Type :	Hours/Weeks/WS	Number of credits
Lectures and **Laboratory experiments**	**2 /15/WS** **2 /15/WS**	**5**

Lecturer: Dr. Eleftheria Katsivela, Associate Professor

Institute/Department: TEI-Technological Educational Institute of Crete, Department of Enviromental and Natural Resources Engineering.

Course Description:

The aim of this course is to introduce students i) into the different methods, techniques and technologies of sampling, measurement and determination of gaseous and particulate pollutants of the atmospheric air as well as of exhaust emission sources, and ii) into several pollution control technologies of gaseous and particulate pollutants originated from static and mobile emission sources. This course in combination with the course of the 6th semester "Air Pollution" gives integrated knowledge in the field of air pollution and its control technologies.

Course Outline:

- Introduction into Quality Control Technologies of gaseous and particulate pollutants:

Definitions, Units of measurements, Air Pollution, Legal Limits

- Methods of sampling of gaseous and particulate pollutants into the atmosphere:

Conditions, Parameters, Isokinetic sampling, Sampling devices, Instrumentation.

- Methods of sampling of gaseous and particulate pollutants in exhaust emission sources:

Conditions, Parameters, Sampling devices, Instrumentation

- Sampling of gaseous air pollutants :

Pre-concentration of air pollutants, Adsorption, Absorption, Condensation, Identical air sample

- Sampling of particulate air pollutants:

Diffusion, Impinger, Impaction, Filtration, Filters, Sampling pumps

- Analytical techniques for the determination of air pollutants:

Lidar, NOx Analyzer, NDIR, Gas Chromatography, etc.

- Air Pollution Control Technologies
- Control of Pollutant Emissions from Road Traffic:

Road transport emissions, fuel choice and emissions, petrol and diesel, alternative fuels, three-way catalysts

- Technology of air pollution removal from static sources:

Cyclones, Electrostatic Precipitators, Catalytic Filters, etc.

- Emissions from industrial operations and their control pollution technologies in Greece

Laboratory outline

A) Determination of gaseous and particulate pollutants in air samples

- Determination of bacterial and fungal concentration in air samples. Bioaerosol determination
- Microscopic measurements of aerosols (particulate matter and bioaerosols)
- Sampling of particulate matter using an high volume sampler and acid digestion of filters
- Determination of heavy metals by Atomic Adsorption Spectroscopy (AAS)
- Determination of volatile organic compounds by Gas Chromatography equipped with a Flame Ionization Detector (GC-FID)
- Determination of Total Organic Carbon, Inorganic Carbon and Total Carbon in rain water samples by Total Organic Carbon Analyzer (TOC Analyzer)

B) Air Pollution Control Technologies

- Removal of sulphur dioxide from exhaust emissions of an electrical generator
- Removal of carbon dioxide from exhaust emissions of an electrical generator
- Determination of carbon dioxide, shoot, temperature, pressure from exhaust emissions of a boiler and calculation of the yield of the boiler
- Operation of three-way catalysts and calculation of their yield

Bibliography:

Course:

1. Ι. Β. Γεντεκάκης (1999). Ατμοσφαιρική ρύπανση, Εκδόσεις Τζιόλας, Θεσσαλονίκη, ISBN 960-8050-01-4 (accomplishes 50% of syllabus)
2. Κουϊμτζής, Κ. Σαμαρά-Κωνσταντίνου, Κ.Φυτιάνος, Δ. Βουτσά (2004). Έλεγχος Ρύπανσης Περιβάλλοντος. Εκδόσεις University Studio Press, Θεσσαλονίκη, ISBN 960-12-1350-3 (accomplishes 50% of syllabus).
3. **6.** Noel de Nevers (1995) Air Pollution control engineering, Mc Graw- Hill. Inc.
4. **7.** R. M. Harrison (2001). Pollution: Causes, Effects and Control, Royal Society of Chemistry – ISBN: 0-85404-621-6, Chapter 13 (accomplishes 10% of syllabus).

Laboratory:

1. Κουϊμτζής, Κ. Σαμαρά-Κωνσταντίνου, Κ.Φυτιάνος, Δ. Βουτσά (2004). Έλεγχος Ρύπανσης Περιβάλλοντος. Εκδόσεις University Studio Press, Θεσσαλονίκη, ISBN 960-12-1350-3 (accomplishes 50% of syllabus).
2. J. P. Lodge, Jr. (1989). Methods of Air Sampling and Analysis, Lewis Publishers Inc., Michigan, USA (Καλύπτει 30% της διδακτέας ύλης)

Teaching method: Lectures, supported by transparencies. Laboratory experiments.

Assessment: Theory: midterm test (optional, 40%), final examination.

Laboratory: homework (20%), final examination (80%).

COURSE UNIT DESCRIPTION

Course Title :	Course-No. :	Semester :
Water Ressources Management	**TF 7005/TF 7105**	**7th**
Course Type :	Hours/Weeks/WS	Number of credits
Lecture / Practical	**2 +2**	**5**

Lecturer: Dr. Dimitris Kalderis, Lecturer

Institute/Department: TEI-Technological Educational Institute of Crete, Department of Enviromental and Natural Resources Engineering.

Course Description:

The aim of the course is to provide theoretical and practical knowledge about water resources management.

Course Outline:

Introduction (Definitions, Objectives of Water Resources Management, Current management conditions, Water use, Water quality and hydrological cycle, Water resources and environment in Greece, Sustainability of water resources, Pollution of water resources, Water industry) - Exploitation of surface Water Resources (River bed constructions, Dams, Artificial reservoirs, Social and environmental impacts of water resources constructions, Water supply) - Seawater Intrusion In Coastal Aquifers (Definitions, Seawater intrusion problems in Greece, Physical and Mathematical description of the phenomenon, Confrontation of the sea water intrusion) - Irrigation (Definition and purpose of irrigation, Irrigation systems, Irrigation water quality, The problem of salinity, Crop irrigation requirements, Calculation of Reference Evaportraspiration, Irrigation scheduling).

Practical exercises:

1. Exercises of techno-economic analysis (part 1)

2. Exercises of techno-economic analysis (part 2)

3. Exercises of techno-economic analysis (part 3)

4. Calculation of water supply requirements

5. Calculation of BOD5

6. Soil physics- Soil- water relationships (part 1)

7. Soil physics- Soil- water relationships (part 2)

8. Salinity- Calculation of leaching fraction in soil

9. Calculation of water flow, geometrical characteristics (Part 1, Part 2).

Teaching method:

Lectures, supported by transparencies and computer demonstrations. In the practical part student participate in laboratory exercises

Assessment:

Coursework (40%) and final examination (60%).

Bibliography:

1. Water Resources Management- Aggelidis S. Agricultural University of Athens (2000)
2. Irrigation Water Quality- Aggelidis S. Agricultural University of Athens (1998)
3. Irrigation II- Irrigation distribution systems,-Valiantzas I. Agricultural University of Athens (1998)
4. Hydraulic constructions- Dams,- Kalkani E. Athens (1992)
5. Water Resources Management- Katsifarakis K. Thessaloniki (1999).
6. Water Resources Management- Petalas Ch. Xanthi (2000).
7. Mechanics I- Water Resources Management, Lekkas Th. (1996)
8. Water Resources I. Technical Hydrology Tsakiris G. (1995)

Exercises:

1. Exercises in Water Resources Management- Mimidis Th. Agricultural University of Athens (2000)
2. Exercises in Hydroualics and Irrigation – Boubouka A. Agricultural University of Athens (2004)

COURSE UNIT DESCRIPTION

Course Title :	Course-No. :	Semester :
Water quality control technology	**TF 7006/TF 7106**	**7th**
Course Type :	Hours/Weeks/WS	Number of credits
Lecture – Practical	2 + 2	**5**

Lecturer: Professor George Stavroulakis

Institute/Department: TEI-Technological Educational Institute of Crete, Department of Enviromental and Natural Resources Engineering.

Course Description:

The course aims to provide the theoretical knowledge on water quality management and develop the student's analytical skills with laboratory exercises.

Course Outline:

Source and use of water. Significance of the water characteristic. Physical, chemical and microbiological parameters of water quality. Water sampling. Analytical methods for water quality control. Official qualitative parameters of potable water. Surface water, underground water, bathing water, water for agricultural use. Water pollutants.

Bibliography:

Water quality parameters and water technology. Mansis Mitrakas

Water Quality. Tchobanoglous G and E Schtoeder

Handbook of drinking water quality. Dezuane J

Teaching method:

Lectures, supported by transparencies and computer demonstrations. In the practical part student participate in laboratory exercises

Assessment:

Coursework (40%) and final examination (60%). In the practical part student participate in laboratory exercises

COURSE UNIT DESCRIPTION

Course Title :	Course-No. :	Semester :
Water Treatment Technology	**TF 7007/TF 7107**	**7th**
Course Type :	Hours/Weeks/SS	Number of credits
Lecture **Laboratory**	**2** **2**	**5**

Lecturer: Dr. Kotti Melina, Lecturer.

Institute/Department: TEI-Technological Educational Institute of Crete, Department of Enviromental and Natural Resources Engineering.

Course Description:

The target of this course is to give the students the neseccary knoweldge of the water treatment methods. The most studied methods are coagulation-flocculation, sedimentation, filtration, adsorption, ionexchange, disinfection. The students will be in position to decide on what methods are necessary to apply into the untreated water and how to apply them.

Course Outline:

- Introduction to water cycle, physicochemical properties, organic constituents, inorganic constituents, biological constituents.
- Pretreatment methods, screens, grinders, mixing methods.
- Coagulation-Flocculation, electric double layer, coagulating agents, coagulating mechanisms.
- Sedimentation-Flotation, sedimentation types, sedimentation tanks, flotation types.
- Filtration, Filtration media, Filtration types, Filtration mechanisms.
- Adsorption, Activated carbon, Adsorption isotherms, adsorption beds.
- Ionexchange, resins, selectivity.
- Disinfection, mechanisms, disinfection agents, chlorination, UV radiation, ozonation.
- Selective membranes, microfiltration, ultrafiltration, nanofiltration, reverse osmosis, membrane manifolds

Laboratory Outline:

- Coagulation with different doses of ferric chloride at stable pH.
- Coagulation with stable dose of ferric chloride at different pH.
- Designing a rectangular sedimentation tank.
- Filtration with sand for turbidity removal.
- Adsorption with activated carbon for oxalic acid removal.
- Chemical precipitation for hardness removal.
- Ionexhange with strong acidic and strong basic resins.
- Study of the removal efficiency of aluminium by ion exchange and adsorption.
- Chlorination and dechlorination.
- Filtration with selective membranes.

Bibliography:

Course

1. AWWA (American Water Works Association), Principles and Practices of Water Supply Operations. Water Treatment, 3rd ed., USA, 2003.
2. Baker, R. W., Membrane Technology and Application, John Wiley & Sons, NY, 2004.
3. Cheremisinoff, P. N., Handbook of water and wastewater technology, Marcel Dekker, Inc., NY, 1995.
4. Perry, R. H., Green, D. W.,eds. Perry's Chemical Engineers' Handbook, 7th ed., Mc Graw-Hill, NY, 1997.

Laboratory

1. Water Treatment Technology Laboratory Notes, 2007, Aivalioti, M., Manousaki, E., Kotti, M., Xekoukoulotakis, N., Chania.

Teaching method: Lectures, supported by transparencies, Laboratory experiments.

Assessment: Theory: Final examination (100%).

Laboratory: Homework (20%), final examination (80%).