5th Semester

COURSE UNIT DESCRIPTION

Course Title :	Course-No. :	Semester :
Measurement and Control Systems	**TF 5001/TF 5101**	**5th**
Course Type :	Hours/Weeks/WS	Number of credits
Lecture – Laboratory	**4+2**	**7**

Lecturer: Maravelakis Emmanuel, As. Professor

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

Course Description:

This course provides to the students the basic knowledge in order to be able to design and programming a integrated control system for his energy and environmental applications.

Course Outline:

Introduction to basic analog and digital measurements architectures and communication technologies. Introduction of computer use for data recording and elaboration. Smart home sensors and applications. Introduction to automatic control systems (differential equation, Laplace trasformation). Open and closed circuits. Type of errors and sensitivity assess. Optimal control. Introduction to PLC. Digital control systems.

Laboratory Outline:

- Introduction to MatLab.
- Introduction to LabView.
- System simulation with MatLab.
- Data elaboration with LabView.
- Experimental studies of PLC.
- Experimental studies of integrated control system.

Bibliography:

- Sensors, Transducers and LabView, B. E. Paton, Prentice Hall PTR, 1999
- LabView Graphical Programming, G. W. Johnson, McGraw Hill, 1994
- Process Control Instrumentation Technology, C. D. Johnson, John Wiley & Sons, 1982
- Instrumentation Measurement and Analysis, B. C. Nakra, K. K. Chaudhry, Tata McGraw Hill, 1985

- Instumentation, Devices and Systems, C. S. Rangan, G. R. Sarma, V. S. V. Mani, Tata McGraw Hill, 1983

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

Assessment: Theory: final examination (100%).

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

COURSE UNIT DESCRIPTION

Course Title :	Course-No. :	Semester :
Meteorology - Climatology	**TF 5002/TF 5102**	**5th**
Course Type :	Hours/Weeks/WS	Number of credits
Lecture – Laboratory	**2+2**	**5**

Lecturer: Pantelis Soupios, Asc. Professor

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

Course Description:

An introduction to Meteorology – Climatology is designed to meet the needs of students in such a course. It's our hope that the knowledge gained by taking this course will encourage many students to actively participate in bettering the environment and others may be sufficiently stimulated to continue their study to meteorology. Equally important, however, is that a basic understanding of the atmosphere and its processes will greatly enhance appreciation of our planet and thereby enrich the student's life. In general the theory is connected with other lessons such as the hydrogeology.

Course Outline:

- Introduction to the Atmosphere.
- Radiation - Laws, typical characteristics, earth and solar radiation, radiation balance.
- Air Temperature - seasonal changes, daily variation, temperature reversal.
- Ground Temperature - Daily and yearly variation of temperature on the ground and near surface.
- Ocean, Sea water and river, lakes temperature - Basics.
- Form of Condensation, Cloud development and Precipitation.

- The Atmosphere in motion : Air-pressure, Forces and Wind.

Laboratory Outline:

- More than 10 exercises covering the whole theory part

Bibliography:

- Lessons of Meteorology and Climatology, A. Floka, ZHTH, 1997.
- Elements of Meteorology, T. Makrogiannis, X. Sahsamanoglou, ART of TEXT, 1992.
- The Atmosphere, F. Lutgens, E. Tarbuck, Prentice Hall, 1995.
- Essentials of Meteorology, C. D. Ahrens, West Publishing Company, 1993.
- Physics of Climate, J. Peixoto, A. h Oort, Amer. Inst. Of Physics, 1992.
- Applied Climatology, R. Thompson, A. Perry, Rutledge N.Y. , 1997.

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

Assessment: Theory: final examination (100%).

Laboratory: final examination (100%).

COURSE UNIT DESCRIPTION

Course Title :	Course-No. :	Semester :
Renewable Energy I	**TF 5003/TF 5103**	**5th**
Course Type :	Hours/Weeks/WS	Number of credits
Lecture – Laboratory	**2+2 / 10**	**5**

Lecturer: Vourdoubas Ioannis.

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

Course Description:

Introduction to the renewable energy sources. Wind energy in Greece and worldwide. Environmental impact of wind turbines. Case studies. Introduction to solar radiation and solar energy. Solar geometry. Presentation of case studies for solar collectors. Introduction to photovoltaics (PV) technology. PV cells and arrays. Biomass potential. Energy production from biogas and waste. Introduction to geothermal energy. Geothermal potential in Greece and Europe. Case studies of low, medium and high enthalpy sources. Hydropower . Tidal energy and energy from waves. Case studies and recent technological developments.

Course Outline:

- Introduction
- Wind energy potential and case studies
- Solar energy and solar geometry
- Solar collectors.
- Introduction to PV technology
- Biomass potential
- Geothermal resources and case studies in Greece and worldwide.
- Tidal energy & Wave energy.

Laboratory Outline:

10 Exercises following the theory

- Solar energy (Solarthermal and photovoltaics)
- Wind energy
- Hydropower
- Biomass (solid biomass and biogas)
- Geothermal energy
- fuel cells and cogeneration of heat and power

Bibliography:

- Kaldelis I. Kavvadias K., Applications of Renewable Energy Sources, 2001 (in Greek).
- Boyle Godfrey, Renewable Energy: Power for a Sustainable Future , The Open University/Oxford University Press,

Teaching method: Lectures (2 hours per week), experimental exercises (2 hours 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 :
Environment Legislation	**TF 5004**	**5th**
Course Type :	Hours/Weeks/WS	Number of credits
Lecture	**2**	**3**

Lecturer: Dr. D. Kalderis, Lecturer

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

Course Description:

Aim of the course is to make the students familiar to the general system of law and especially the principles of Environmental Law. The course gives information about actual issues of Environmental Law and deals with the Environmental Law on International, European and National level.

Course Outline:

- Introduction
- Basic law definitions
- The "Environmental Constitution" and the definition of "forest"
- European Law definitions (Directions-Regulations e.t.c)
- The principles of European Environmental Law: the principle of preventing action and the precautionary principle
- The polluter pays principle
- The environmental information
- The principle of sustainability
- Law Nr. 1650/86 for the protection of the environment
- Production of Electricity through Renewable Sources of Energy-The Market of electricity
- National and European Case Law

Bibliography:

Environmental Law, Glikeria P. Siouti. Ant. N. Sakkoula Editions

Environment and Law, I. K. Karakostas, Ant. N. Sakkoula Editions

European Environmental Law, The case law of the European Court of Justice, **Kramer Ludwig, Ant. N. Sakkoula Editions**

Teaching method: Lectures (1 per week)

Assessment:

Final examination: 100%

COURSE UNIT DESCRIPTION

Course Title :	Course-No.:	Semester:
Wasterwater Treatment and Management Technologies	**TF 5005/TF 5105**	**5th**
Course Type:	Hours/Weeks/WS/SS	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 Environmental and Natural Resources Engineering.

Course Description:

Scope of the course is to provide all necessary knowledge related to the Municipal Wastewater Treatment and management Technologies. This course aims to give all necessary knowledge related to the working protocols at the Laboratories of Wastewater Treatment Plants. An important part of the course handles with the biological treatment of municipal wastewater. This particular part is analyzed from the microbiological point of view in the course of "Environmental Microbiology", in which is obtained a better understanding of the microbial metabolism. The topics covered by Wastewater Treatment and Management Technologies are linked to the laboratory experiments, which include all necessary determinations for the characterization of wastewaters.

Course Outline:

- Introduction to Water Pollution:

History of Water Pollution, Problem Identification, Definitions, Legal Limits (European and Greek Legislation)

- Characterisation of Wastewaters:

Techniques, Flows, Total Solids, Organic and Inorganic Constituents, Pathogenic Microorganisms, Nitrogen and Phosphorus

- Overview of Wastewater and Waste Sludge Treatment Processes
- Preliminary Treatment:

Screening, Flow Equalization, Grit Removal, Oil Removal

- Primary Treatment
- Secondary Treatment (Biological treatment of wastewaters):

Aeration Systems, Role of Microorganisms

- Microbial Metabolism and Kinetics of Bacterial Growth Systems
- Secondary treatment (Physical Treatment of Wastewaters):

Sedimentation

- Tertiary and advanced waste water treatment
- Processes for Biological Nitrogen Removal
- Processes for Biological Phosphorus Removal
- Disinfection Processes
- Sludge treatment and disposal: incineration, composting, digestion, and land disposal

Laboratory Outline

- Field trip to the Sewage Treatment Plant of Chania – Collection of samples. Determination of pH and Electrical Conductivity
- Determination of Total Suspended Solids (TSS)
- Determination of Biochemical Oxygen Demand (BOD_5)
- Determination of Chemical Oxygen Demand (COD)
- Determination of Total Coliforms Counts
- Determination of Faecal Coliforms Counts
- Determination of Sludge Volume Index
- Determination of oils and greases
- Determination of anionic detergents in sewage effluent
- Determination of Germination Index in anaerobic digested waste sludge

Bibliography:

Course:

1. Metcalf & Eddy (2002): *Wastewater Engineering*, (4^{th} ed.), McGraw-Hill. ISBN 0-07-112250-8.
2. Gray, N. F. (1992): *Biology of Wastewater Treatment*, Oxford Science Publications.
3. McGhee, T. J. (1991): *Water Supply and Sewerage*, (6^{th} ed.), McGraw-Hill International, Edition.
4. Horan, N. J. (1990): *Biological Wastewater Treatment Systems -Theory and Operation*, John Wiley & Sons.

Laboratory:

1. American Public Health Association, American Water Works Association, Water Environment Federation (1998). Standard Methods for Examination of Water and Wastewater, 20th Edition, American Public Health Association, New York, USA

Teaching method: Lectures supported by transparencies, video and PowerPoint presentations. Laboratory experiments.

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

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

COURSE UNIT DESCRIPTION

Course Title :	Course-No. :	Semester :
Drilling operations	**TF 5006/TF 5106**	**5th**
Course Type :	Hours/Weeks/WS	Number of credits
Lecture – Laboratory	**2-4**	**5**

Lecturer: Dr. Pantelis Soupios, Associate Professor.

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

Course Description:

The primary aim of the course is to describe the different types of wells, its hazards, cost, and planning the operation rig. At the end of the course students should be familiar with the whole range of drilling procedures and able to suggest solutions in case of a technical problem.

Course Outline:

- Water wells
- Engineering wells
- Exploration and production wells for minerals and hydrocarbons
- Geothermic wells
- Logging procedures and its usefulness during drilling

Laboratory Outline:

- *Theory:*

Type of drilling operations

- *Experiments:*

Logging operations

Exploration and critical estimation of how to detect possible well locations

Bibliography:

1. Τεχνική Γεωτρήσεων, Φυτίκας, 166 pp, 1998
2. Αβαθείς και ειδικές γωετρήσεις, Β. Κελεσίδης, Εκδόσεις Τζιόλα, 2012
3. Britain's offshore oil and gas, UK offshore Operators Association & the Natural History Museum, 57 pp, 1997

Teaching method: Lectures (1 per week), experimental exercises (1 (4 hours) per week).

Assessment: Theory: final examination

Laboratory: final examination

COURSE UNIT DESCRIPTION

Course Title :	Course-No. :	Semester :
Groundwater Hydrogeology	**TF 5007/TF 5107**	**5th**
Course Type :	Hours/Weeks/WS	Number of credits
Lecture – Laboratory	**2+4 / 10**	**5**

Lecturer: Dr. Pantelis Soupios, Associate Professor

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

Course Description:

Physical properties of ground water. Darcy flow; Porosity, hydraulic conductivity and intrinsic permeability. Principles of ground water flow. Storage and transmissivity. Ground water in the hydrological cycle: flow nets; local and regional flow systems – springs; interactions with surface water; the hyporheic zone. Introduction to ground water modeling. Unsaturated zone flow and calculation of infiltration. Ground-water recharge mechanisms and water balance calculations.

Course Outline:

- Introduction. What is hydrogeology, Hydrogeological Cycle.
- Units and Terminology
- Precipitation
- Infiltration
- Runoff water
- Evapotraspiration
- Comments and discussion on hydrogeological cycle
- Physical Properties of Soil - Aquifer
- Porosity - Transmissivity - Hydraulic properties
- Vertical and Horizontal distribution of groundwater
- Introduction to Darcy's Law
- Limitations of the Darcian Approach
- Flow in Fractured Rocks
- Grain-Size Analysis

Laboratory Outline:

- Exercises following the theory

Bibliography:

1. Soulios, G., University Studio Press, 1996, Thessaloniki (in greek).
2. Groundwater Hydrology, Course Notes, School of Civil and Environmental Engineering, University of New South Wales.
3. Investigation and Management of Salinity, Course Notes, School of Civil and Environmental Engineering, University of New South Wales.
4. Γ. Στουρνάρας, Θεματα Υδατικής και Οικολογικής Πολιτικής, Δίαυλος, 2013

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

Assessment: Theory: final examination.

Laboratory: homework (30%), final examination.

COURSE UNIT DESCRIPTION

Course Title :	Course-No. :	Semester :
Applied Techniques of Water-Resources Investigations	**TF 5008/TF 5108**	**5th**
Course Type :	Hours/Weeks/WS	Number of credits
Lecture – Laboratory	**2-2**	**5**

Lecturer: Dr. Pantelis Soupios, Associate Professor.

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

Course Description:

This course describes procedures for planning and executing specialized work in water resources investigations. It is also provides an introduction to geological, geophysical and remote sensing techniques for engineering, geological, hydrogeological and environmental (to include Hazardous, Toxic and Radioactive waste) investigations. Descriptions and guidance are provided for all methods typically used in these investigations.

Course Outline:

- Introduction
- Geology
- Remote Sensing
- Drilling operations
- Geophysical Methods

1. Seismic Procedures
2. Electrical and Electromagnetic Methods

- Logging

Laboratory Outline:

- Exercises with data from real projects operated in Greece including information about geological maps, remote sensing images, geophysical logging and borehole and surface geophysics.

Bibliography:

1. Geophysical Exploration for Engineering and Environmental Investigations, U.S Army Corps of Engineering, 1995.
2. Application of Surface Geophysics to Ground-Water Investigations, USGS publications, 1990.
3. Borehole Geophysics Applied to Ground-Water Investigations, USGS publications, 1990.
4. Innovations in Site Characterization: Geophysical Investigation at Hazardous Waste Sites, Environmental Protection Agency (EPA) U.S.A, 2000.
5. Geophysical Techniques in Ground Water Studies, Course Notes, School of Civil and Environmental Engineering, University of New South Wales, 2000.

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

Assessment: Theory: final examination.

Laboratory: homework (30%), final examination.

- Students
  - Erasmus
- Department of Music Technology and Acoustics (Rethimno)