

Centre	University College of Engineering of Vitoria-Gasteiz
Name of subject	25988 – Environmental Technologies
Qualification	Degree in Industrial Chemical Engineering
Type	Compulsory
Credits	6 ECTS
Year	4
Term(s)	1st
Department	Chemical and Environmental Engineering
Language	Spanish and Basque

Outcomes / Objectives

OUTCOMES

- C1. Ability to write and develop projects aimed at the construction, conservation, installation, assembly or operation of industrial facilities, equipment and plants in the area of the environment applying knowledge of Industrial Engineering.
- C2. Ability to direct activities in the area of environmental technology focused on the industry framework.
- C3. Knowledge of environmental issues, in particular in relation to pollution and pollution prevention in the three large areas of air, water and waste, providing students with sufficient knowledge to perform environmental audits in industry.
- C4. Develop problem solving and decision making skills, as well as critical thinking skills and the ability to transmit knowledge, in the field of industrial technology.
- C5. Knowledge required to perform calculations, carry out studies and write reports in the environmental sector.
- C7. Ability to analyse and assess the environmental impact of technical solutions.
- C10. Ability to work in a multidisciplinary environment.
- C11. Be able to use relevant bibliographic sources correctly to obtain, understand and interpret scientific-technical information regarding environmental technology.
- C12. Adopt a responsible, orderly attitude at work, and be willing to learn.

BRIEF DESCRIPTION OF THE CONTENT

1. Introduction to Environmental Technology.
2. Air quality management. Quality criteria and standards. Monitoring networks. Diagnosis and prediction. Technology for reducing emissions at the source. Process analysis. Separation technologies. Capture systems. Urban sources. Stacks.
3. Water pollution, pollutant sources. The water cycle. Water quality management. Technologies for reducing emissions at the source. Separation technologies. Biological processes. Reuse.
4. Waste management. Collection, storage and containment. Treatment technologies: recovery, reuse, recycling. Waste minimisation. Landfills.
5. Corporate environmental management. Risk analysis. Audits.
6. Environmental legislation.

OBJECTIVES

To achieve a minimum level of training in environmental issues, in particular in relation to pollution and pollution prevention in the three large areas of air, water and waste, providing students with sufficient knowledge to perform environmental audits in industry.

Syllabus

1. INTRODUCTION

- 1.1. Sustainability
- 1.2. Ecological concepts and natural resources
- 1.3. Definitions of human impact and pollution.
- 1.4. Introduction to environmental audit and industry

2. ATMOSPHERIC POLLUTANTS I: BASIC CONCEPTS, TYPES AND SOURCES

- 2.1. Classification of atmospheric pollutants
- 2.2. Sources of atmospheric pollution
- 2.3. Atmospheric pollutants

3. ATMOSPHERIC POLLUTANTS II: EFFECTS AND MEASUREMENT

- 3.1. Effects of atmospheric pollution
- 3.2. Measurement of atmospheric pollution

4. DISPERSION OF POLLUTANTS IN THE ATMOSPHERE

- 4.1. Dynamics of the atmosphere
- 4.2. Factors affecting the dispersion of pollutants

5. GASEOUS EFFLUENT TREATMENT PROCESSES I: REMOVAL OF PARTICLES BY MECHANICAL METHODS

- 5.1. Separation by gravity: sedimentation chambers
- 5.2. Separation by centrifugal force: cyclones
- 5.3. Separation by filtration

6. GASEOUS EFFLUENT TREATMENT PROCESSES II: REMOVAL OF PARTICLES BY WASHING MACHINES AND ELECTROSTATIC PRECIPITATORS

- 6.1. Wet separators
- 6.2. Electrostatic precipitators
- 6.3. Comparison of PARTICLE REMOVAL equipment

7. GASEOUS EFFLUENT TREATMENT PROCESSES III: REMOVAL OF GASEOUS POLLUTANTS BY TRANSFER

- 7.1. Absorption
- 7.2. Adsorption
- 7.3. Condensation

8. GASEOUS EFFLUENT TREATMENT PROCESSES IV: REMOVAL OF GASEOUS POLLUTANTS BY TRANSFORMATION

- 8.1. Chemical transformation
- 8.2. Biological transformation. Biofilters
- 8.3. Control technique selection criteria

9. POLLUTION CONTROL SYSTEMS FOR SOME SPECIFIC POLLUTANTS

- 9.1. Sulphur oxides
- 9.2. Nitrogen oxides
- 9.3. Volatile organic compounds

10. WATER POLLUTION

- 10.1. Quality criteria and measurement of water pollution
- 10.1. Water pollutants and their effects
- 10.2. Discharge regulations

11. LIQUID EFFLUENT TREATMENT PROCESSES I: PHYSICAL TREATMENTS

- 11.1. Grilles
- 11.2. Screens
- 11.3. Sedimentation
- 11.4. Filtration
- 11.5. Flotation

12. LIQUID EFFLUENT TREATMENT PROCESSES II: CHEMICAL AND PHYSICAL-CHEMICAL TREATMENTS

- 12.1. Neutralisation
- 12.2. Coagulation/flocculation
- 12.3. Chemical precipitation
- 12.4. Adsorption
- 12.5. Ionic exchange
- 12.6. Membrane processes
- 12.7. Stripping
- 12.8. Oxidation processes

13. LIQUID EFFLUENT TREATMENT PROCESSES III: AEROBIC BIOLOGICAL TREATMENTS

- 13.1. Aerobic metabolism
- 13.2. Aerobic treatment systems with suspended biomass
- 13.3. Aerobic treatment systems with fixed biomass

14. LIQUID EFFLUENT TREATMENT PROCESSES IV: ANAEROBIC BIOLOGICAL TREATMENTS AND REMOVAL OF NUTRIENTS

- 14.1. Anaerobic metabolism and process parameters
- 14.2. Anaerobic treatment systems with suspended biomass
- 14.3. Anaerobic treatment systems with fixed biomass
- 14.4. Comparison of biological treatment systems
- 14.5. Biological nutrient removal

15. SLUDGE TREATMENT AND MANAGEMENT PROCESSES

- 15.1. Characterisation of water treatment plant sludge
- 15.2. Treatment processes
- 15.3. Sludge evacuation

16. GENERAL DIAGRAM OF AN URBAN WASTEWATER TREATMENT PLANT

- 16.1. Pre-treatment
- 16.2. Primary treatment
- 16.3. Secondary treatment
- 16.4. Sludge line

17. URBAN SOLID WASTE I: CHARACTERISTICS, MANAGEMENT AND RECYCLING

- 17.1. Definition, origin and production of urban solid waste
- 17.2. Properties of urban solid waste
- 17.3. Principles of waste management
- 17.4. Storage, collection and transport of urban solid waste
- 17.5. Recovery and recycling of urban solid waste

18. URBAN SOLID WASTE II: TREATMENTS AND DISPOSAL

- 18.1. Biological treatments
- 18.2. Heat treatments
- 18.3. Controlled disposal

19. INDUSTRIAL AND HAZARDOUS WASTE

- 19.1. Definition and generation of hazardous waste
- 19.2. Labelling and transport of hazardous waste
- 19.3. Recovery and recycling
- 19.4. Treatments
- 19.5. Stabilisation and solidification
- 19.6. Secure landfill

20. OTHER WASTE

- 20.1. Agricultural and forestry waste
- 20.2. Livestock farming waste
- 20.3. Construction and demolition waste
- 20.4. Mines and quarries
- 20.5. Fly ash from thermal power stations
- 20.6. Disused tyres
- 20.7. Disused vehicles
- 20.8. Hospital waste
- 20.9. Radioactive waste

Methodology

Teaching Method

Face-to-Face Teaching Hours

Lectures	Seminars	Classroom practice	Lab. practice	Computer sessions	Clinical practice	Workshops	Industrial workshops	Field practice
48		12						

Student Hours of Non Face-To-Face Activities

Lectures	Seminars	Classroom practice	Lab. practice	Computer sessions	Clinical practice	Workshops	Industrial workshops	Field practice
72		18						

Assessment System

General criteria

- Written essay exam
- Practical tasks (exercises, case studies or problems)
- Group assignments
- Presentation of assignments, reading...

Clarification regarding assessment

The subject can be passed by either sitting an essay exam in the official examination sessions, or partially as follows:

- Essay theory exam with a value of up to 6.0 points
- Academically supervised assignment with a value of up to 2.5 points
- Practical exercises or problems with a value of up to 0.5 points
- Visits to companies in relation to the subject matter of the course, or alternatively, oral presentation of the submitted report, with a value of up to 1.0 point

Bibliography

Basic Bibliography

- Baird, C. "Química ambiental" (2001) Barcelona
- Bueno, J.L., Sastre, H., Lavín, A.G. "Contaminación e ingeniería ambiental. Vol. II. Contaminación atmosférica", Ficyt (1997) Oviedo
- De Nevers, N. "Ingeniería de control de la contaminación del aire", McGraw-Hill Interamericana Editores (1998) México
- Hontoria, E., Zamorano, M. "Fundamentos del manejo de los residuos urbanos". Colegio de Ingenieros de Caminos, Canales y Puertos (2000) Madrid
- Kiely, G. "Ingeniería ambiental". McGraw-Hill, 1999, Madrid
- Lagrega, M.D., Buckingham, Ph. L., Evans, J.C. "Gestión de residuos tóxicos. Tratamientos, eliminación y recuperación de suelos". Mc Graw Hill (1996) Madrid
- Masters, G.M. "Introducción a la ingeniería medioambiental". Pearson Educación. 2008, Madrid.
- Metcalf & Eddy "Ingeniería de las aguas residuales. Tratamiento, vertido y reutilización" (2001) Madrid
- Ramalho, R.S. "Tratamiento de aguas residuales" (1996) Barcelona
- Rodríguez, J.J., Irabien, A. "Los residuos peligrosos. Caracterización, tratamientos y gestión". Editorial Síntesis. (1999) Madrid
- Spiro, T.G., Stigliani, W.M. "Química medioambiental", Pearson Educación, (2004) Madrid
- Wark, W. "Contaminación de aire. Origen y control", Editorial Limusa, (2001) México

In-depth Bibliography

- Botkin, D.B., Keller, E.A. "Environmental science. Earth as a living planet". John Wiley & Sons, Inc. 2005, Estados Unidos
- Droste, R.L. "Theory and practice of water and wastewater treatment". John Wiley & Sons, Inc. (1997) Estados Unidos
- Nazaroff, W.W., Álvarez-Cohen, L. "Environmental engineering science" John Wiley & Sons, Inc. 2001, Estados Unidos
- Tchobanoglous, G., Kreith, F. "Handbook of solid waste management" McGraw-Hill (2002) EEUU.
- Williams, P.T. "Waste treatment and disposal". Wiley (2005) Gran Bretaña

Magazines

- Ingeniería del Agua, Tecnología del Agua, Química Industrial ,Biomass and Bioenergy, Enviromental Engineering Science.