



Course guide

240772 - 240772 - Environmental Engineering

Last modified: 16/05/2023

Unit in charge: Barcelona School of Industrial Engineering
Teaching unit: 713 - EQ - Department of Chemical Engineering.

Degree: BACHELOR'S DEGREE IN INDUSTRIAL TECHNOLOGIES AND ECONOMIC ANALYSIS (Syllabus 2018).
(Compulsory subject).

Academic year: 2023 **ECTS Credits:** 4.5 **Languages:** English

LECTURER

Coordinating lecturer: Juan Jesus Perez

Others:

PRIOR SKILLS

Initial phase

REQUIREMENTS

Initial phase

TEACHING METHODOLOGY

The subject is taught by means of an expository methodology (master class) using as slides as support to teach the theoretical part (20%), an expository / participatory methodology to teach problem solving skills related to the theory (16%), active and collaborative learning to carry out different practical work throughout the course (4%) and autonomous learning (60%).

Lab sessions, which are mandatory in person, will be done in groups of two people during the dedicated class hours. Depending on the type of lab session it might be requires the students to submit a individual report following specific instructions thjat will be evaluated. At the end of the class, students will submit, in groups, a report with the resolution of the problem posed to the lab session.

LEARNING OBJECTIVES OF THE SUBJECT

The course aims to provide students with a range of knowledge to analyze and solve environmental problems, as well as having the ability to propose sustainable alternatives, especially in those aspects related to industrial activity. Therefore, at the end of the course the student must be able to:

1. Assess the environmental impact of an activity.
2. Calculate and design equipment to reduce the environmental impact of an activity.
3. Identify and formulate alternatives to minimize the environmental impact of an activity.
4. Describe and evaluate proposals that make an activity more sustainable.

STUDY LOAD

Type	Hours	Percentage
Hours large group	38,7	28.67
Self study	90,0	66.67
Hours small group	6,3	4.67

Total learning time: 135 h

CONTENTS

INTRODUCTION

Description:

Sustainability: load capacity, concept, variables and definitions; sustainable development; sustainability triangle; technological role; sustainability indicators. Environmental Management: response to the principles of sustainability; principles and evolution of environmental management; critical points of environmental management; product impact; environmental management tools. ACV. Ecodesign; environmental impact indicators. Balances of matter and energy.

Specific objectives:

Objectives 1-4

Related activities:

Lectures
Problem solving sessions
Autonomous learning

Full-or-part-time: 23h

Theory classes: 5h
Practical classes: 4h
Self study : 14h

ENVIRONMENTAL ISSUES OF SURFACE WATERS

Description:

The hydrological cycle of water: water use. Water quality: physical, chemical and biological parameters; water quality indicators. Natural mechanisms of water purification: classification of the different mechanisms; BOD and COD; kinetics of aerobic degradation of organic matter; effect of organic matter on rivers; eutrophication. Supply water treatments: drinking and water conditioning. Wastewater treatment: characteristics of wastewater; pretreatments; primary treatments; secondary treatments; tertiary treatments; reuse. Sludge management. The sanitation plan and its financing.

Specific objectives:

Objectives 1-4

Related activities:

Lectures
Problem solving sessions
Lab session
Autonomous learning

Full-or-part-time: 27h

Theory classes: 4h
Practical classes: 5h
Laboratory classes: 2h
Self study : 16h



AIR ENVIROMENTAL ISSUES

Description:

Air pollution: types of pollutants; air quality (ICQA). Air pollutants: origin, characteristics and effects. Natural mechanisms of air purification: meteorological factors; pollutant dispersion mechanisms; pollutant dispersion models. Mechanisms for pollution prevention, control and correction: type of equipment and selection; particulate emission control equipment; equipment for the control of the emission of gases.

Specific objectives:

Objectives 1-4

Related activities:

Lectures
Problem solving sessions
Lab session
autonomous learning

Full-or-part-time: 26h

Theory classes: 4h
Practical classes: 5h
Laboratory classes: 2h
Self study : 15h

SOIL AND GROUNDWAERS

Description:

Soil and Groundwater: Groundwater Flow, Darcy's Law. Soil degradation: degradation mechanisms; heavy metals; hydrocarbons; other toxic compounds. Natural mechanisms that affect pollutants in soil: transport by advection, dispersion and diffusion, retention and attenuation. Soil recovery treatments: classification and selection; landfill removal and disposal; stabilization and confinement; physicochemical, biological and thermal treatments. Groundwater recovery treatments

Specific objectives:

Goals 1-4

Related activities:

Lectures
Problem seminars
Autonomous learning

Full-or-part-time: 21h

Theory classes: 7h 30m
Practical classes: 6h 50m
Self study : 6h 40m



WASTE AND ENVIRONMENT

Description:

Definition of waste: the problem of solid waste. Waste classification. Waste management: minimization, recovery, reuse and recycling, energy use. Municipal solid waste treatment (MSW): characteristics of MSW; selective collection; biological treatment: composting; thermic treatment; landfills. Industrial waste and its treatment: characteristics; the waste catalog; physicochemical and biological treatments; heat treatments; landfills.

Specific objectives:

Objectives 1-4

Related activities:

Lectures
Problem solving sessions
Autonomous learning

Full-or-part-time: 11h

Theory classes: 2h
Practical classes: 3h
Self study : 6h

INDUSTRIAL RISK ASSESSMENT

Description:

Introduction: definition of risk, types and measurement parameters. Serious risks: legislation. Risk analysis: methods of risk identification. Types of accidents: fires; explosions; BLEVE-fireball; dispersal of toxic clouds; the danger of inert gases. Consequence assessment: models of vulnerability (Prohibition).

Specific objectives:

Objectives 1-4

Related activities:

Lectures
Problem solving sessions
Lab Session
Autonomous learning

Full-or-part-time: 12h

Theory classes: 2h
Practical classes: 3h
Laboratory classes: 2h
Self study : 5h

GRADING SYSTEM

The final mark will be the mark obtained according to the following formula, taking into account that the final exam is for the whole subject and that the partial exam does not release material for the final exam.

FINAL MARK: $\text{MAX}((0,2 \cdot \text{NAC} + 0,3 \cdot \text{NEP} + 0,5 \cdot \text{NEF}), (0,2 \cdot \text{NAC} + 0,8 \cdot \text{NEF}))$

NAC: Continuous assessment note (deliverables + exercises). Exercises will taken during class time without previous notice.

NEP: partial exam grade

NEF: final exam note

If at the beginning of the course the academic activity is normalized, the grading method will be: $\text{NF} = 0.1 \cdot \text{NP} + 0.3 \cdot \text{NEP} + 0.6 \cdot \text{NEF}$.

In case of realizing the examination of re-evaluation, the note obtained in the same will constitute 80% of the final note, keeping the 10% corresponding to the note of practices (NP) obtained during the course or validated d 'any previous year and 10% of the NAC obtained during the course or any previous year. In the event that the re-evaluation is carried out on the basis of a normal situation, this exam will be worth 90% and the internship grade 10%.



EXAMINATION RULES.

The tests, both the partial exam and the final exam, can be done using all kinds of bibliographic material available: class notes, reference books, problem collection, etc. The partial exam is a test type of 1 hour and 15 minutes. The final exam consists of a test-type part with an assessment of 30% on the final mark of the exam and lasting 1 hour, and a part of problems with an assessment of 70% on the mark end of the exam and 2 hours long

BIBLIOGRAPHY

Basic:

- Henry, J. Glynn ; Gary W. Heinke. Ingeniería ambiental. 2a ed. México [etc.]: Prentice-Hall, 1999. ISBN 9701702662.
- Arnaldos, Josep. Tecnologia del medi ambient : fonaments, problemes i qüestions. Barcelona: Kit-book, 2016. ISBN 9788494576225.
- Davis, Mackenzie Leo ; David A.Cornwell. Introduction to environmental engineering. 5th ed. New York: McGraw-Hill, cop.2013 [distribuit el 2012]. ISBN 9780071326247.
- Kiely, Gerard. Environmental engineering. Special Indian ed. Boston, Massachusetts [etc.]: McGraw-Hill, 2007. ISBN 0070634297.
- Peavy, Howard S [et al.]. Environmental engineering. New York: McGraw-Hill, cop. 1985. ISBN 0070491348.