Course guide
240377 - 240IQU23 - Climatic Change and Environmental Pollution

Last modified: 16/05/2023

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

Degree: MASTER'S DEGREE IN INDUSTRIAL ENGINEERING (Syllabus 2014). (Optional subject).
MASTER'S DEGREE IN AUTOMOTIVE ENGINEERING (Syllabus 2019). (Optional subject).

Academic year: 2023 **ECTS Credits:** 4.5 **Languages:** Catalan, Spanish, English

LECTURER

Coordinating lecturer: Jordi Bou Serra

Others: Albert Soret Miravet
Eva Gallego Piñol

PRIOR SKILLS

Knowledge of environmental technology and physical, chemical and thermodynamic sciences. This subject is within the specialty of Environment and chemistry of the MUEI.

REQUIREMENTS

MUEI or Incoming mobility student

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CEEMQ7. (ENG) Interpretar els resultats d'una investigació o anàlisi ambiental i proposar solucions tècniques per limitar l'impacte ambiental de productes i processos. (Competència específica associada a l'especialitat en Medi Ambient i Química).

CEQUIM4. Manage and carry out the verification, control of facilities processes and products, as well as certificates, audits, verifications, assays and reports.
CEQUIM2. Design, build and implement methods, processes and facilities for the integrated management of suplies and solid, liquid and gaseous waste, in the industries, with the ability to assess its impacts and risks.
CEMEI04. Ability for the analysis and design of chemical processes.
CEEMEC4. Apply the legislation, regulation and current directives and value the environmental, energetic, social and ethical implications of the professional activity.

Generical:
CGMEI01. (ENG) Tenir coneixements adequats dels aspectes científics i tecnològics de: mètodes matemàtics, analítics i numèrics en la ingenieria, ingenieria elèctrica, ingenieria energètica, ingenieria química, ingenieria mecànica, mecànica de medis continus, electrònica industrial, automàtica, fabricació, materials, mètodes quantitatius de gestió, informàtica industrial, urbanisme, infraestructures, etc.
CGMEI02. (ENG) Projectar, calcular i disenyar productes, procesos, instal.lacions i plantes.
CGMEI04. (ENG) Realitzar investigació, desenvolupament i in.novació en productes, processos, i mètodes.
CGMEI06. (ENG) Gestionar tècnica i econòmicament projectes, instal.lacions, plantes, empreses i centres tecnològics.
CGMEI08. (ENG) Aplicar els coneixements adquirits y resoldre problemes en entorns nous o poc coneguts dintre de contextos més amplis i multidisciplinaris.
CGMEI09. (ENG) Coneixement, comprensió i capacitat per a aplicar la legislació necessària en l'exercici de la professió d'Ingenier Industrial.

Transversal:
CT2. SUSTAINABILITY AND SOCIAL COMMITMENT: Being aware of and understanding the complexity of the economic and social phenomena typical of a welfare society, and being able to relate social welfare to globalisation and sustainability and to use technique, technology, economics and sustainability in a balanced and compatible manner.

CT4. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

CT5. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

CT1. (ENG) EMPRENEDORIA I INNOVACIÓ: Conèixer i comprendre l'organització d'una empresa i les ciències que regeixen la seva activitat; tenir capacitat per comprendre les normes laborals i les relacions entre la planificació, les estatègies industrials i comercials, la qualitat i el benefici.
CT3. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

Basic:
CB 6. (ENG) Tenir i comprendre coneixements que aportin una base o oportunitat de ser originals en el desenvolupament i/o aplicació d'idees, sovint en un context d'investigació
CB 9. (ENG) Que els estudiants sàpiguen comunicar les seves conclusions i coneixements (i darrers raonaments que els sostentin), a públics especialitzats i no especialitzats de manera clara i sense ambigüitats.
CB 8. (ENG) Que els estudiants siguin capaços de d'integrar coneixements i enfrentar-se a la complexitat de formular judicis a partir d'una informació que, essent incompleta o limitada, inclogui reflexions sobre les responsabilitats socials i ètiques vinculades a l'aplicació del seus conexicements i judicis.
CB 7. (ENG) Que els estudiants sàpiguen aplicar els coneixements adquirits i la seva capacitat de resolució de problemes en entorns nous o poc coneguts dintre de contextos més amplis (o multidisciplinars) relacionats amb la seva àrea d'estudi.

TEACHING METHODOLOGY

On-site subject. Master classes combined with problems and discussion sessions on current topics or "case studies". The notes for theory, problems and other documents provided for the subject will be in English. The language of the classes will be Catalan, Spanish or English depending on the audience.

LEARNING OBJECTIVES OF THE SUBJECT

i) Develop the scientific and technical criteria to define a system of environmental pollution with physical, chemical and thermodynamic data.
ii) Know the scientific bases of climate change to have the appropriate criteria to work, disclosure or research on this topic.
iii) To have the technical tools to solve the problems of environmental pollution with own equipment of the chemical engineering and of other fields of the technology.
iv) Identify the problems, shortcomings and novelties of air pollution and be able to provide engineering solutions.

STUDY LOAD

Type	Hours	Percentage
Hours small group	13,5	12.00
Self study	72,0	64.00
Hours medium group	27,0	24.00

Total learning time: 112.5 h

CONTENTS

Chemical, physical and thermodynamic aspects of the atmosphere

Description:
Description of the atmosphere. Chemical composition. Description of pollutants. Hydrodynamics of the atmosphere. Atmospheric thermodynamics: lapse rate.

Full-or-part-time: 12h
Theory classes: 3h
Guided activities: 3h
Self study : 6h

Climate change and greenhouse effect

Description:
Evidence of climate change. Climate change theories. Greenhouse effect: evolution of the concept. Scientific bases of the greenhouse effect: theories. Future forecasts.

Full-or-part-time: 12h
Theory classes: 3h
Guided activities: 3h
Self study : 6h

New generation air pollutants

Description:
Volatile organic compounds: industrial and natural. New secondary contaminants

Full-or-part-time: 12h
Theory classes: 3h
Guided activities: 3h
Self study : 6h

Particle Pollulants

Description:
Description of the particles and their origin. Effects of particles on pollution. Microplastics

Full-or-part-time: 12h
Theory classes: 3h
Guided activities: 3h
Self study : 6h

Closed environments pollution

Description:
Pollutants characteristic of enclosed spaces. Health effects. Ventilation. Closed air purification technologies.

Full-or-part-time: 12h
Theory classes: 3h
Guided activities: 3h
Self study : 6h

Depuration technologies

Description:
Particle purification techniques: Cyclones, Filters, electrostatic precipitators, wet systems. Gas and vapor purification techniques: liquid gas equilibrium, adsorption, condensation. Catalytic afterburning and other chemical techniques

Full-or-part-time: 24h
Theory classes: 6h
Guided activities: 6h
Self study : 12h

Environmental management

Description:
Management and environmental risk. Indicators and consequences

Full-or-part-time: 12h
Theory classes: 3h
Guided activities: 3h
Self study : 6h

GRADING SYSTEM

NT = 0,5·NAC + 0,5·NDP or NT = 0,5·NDP + 0,5·NEF

NT = Total mark NAC = Mark of continuous evaluation NDP = Mark of debates and presentations NEF = Mark final exam

EXAMINATION RULES.

Exams are done individually and in writing by hand. If the situation suggests they would also be done electronically
The duration of the exams is determined by time availability.
Documentation, such as notes or books, can be brought to the exams.

BIBLIOGRAPHY

Basic:
- Jacobson, Mark Z. Atmospheric pollution : history, science, and regulation. Cambridge, UK ; New York: Cambridge University Press, 2002. ISBN 0521811716.
- Perry, Robert H. [ed.]. Manual del ingeniero químico [on line]. 4a ed. Madrid [etc.]: McGraw-Hill, 2001 [Consultation: 05/02/2021]. Available on: http://www.ingebook.com/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=6572. ISBN 8448130081.
- Seinfeld, John H; Pandis, Spyros N. Atmospheric chemistry and physics : from air pollution to climate change. 3rd ed. Hoboken, N.J.: John Wiley, 2016. ISBN 9781118947401.
- Archer, David. Global warming : understanding the forecast. 2nd ed. Hoboken, N.J : Chichester: Wiley ; [John Wiley [distributor], cop. 2012. ISBN 0470943416.

Complementary:
- Groosse H. [et al.]. Introduction to climate dynamics and climate modeling [on line]. Lovain-la-Neuve, Belgium: Université catholique de Louvaine, 2010 [Consultation: 04/04/2023]. Available on: http://climate.envsci.rutgers.edu/climdyn2019/Goosse.pdf.

RESOURCES

Other resources:
Documents, presentations and problems submited at Atenea Campus

"Intergovernmental Panel on Climate Change" IPPC reports.
Geneve (Suisse) (2000-2020)
https://www.ipcc.ch/reports/