

## 820732 - EMAM - Energy and Environment

Coordinating unit:	240 - ETSEIB - Barcelona School of Industrial Engineering
Teaching unit:	713 - EQ - Department of Chemical Engineering
Academic year:	2019
Degree:	MASTER'S DEGREE IN ENERGY ENGINEERING (Syllabus 2013). (Teaching unit Compulsory) ERASMUS MUNDUS MASTER'S DEGREE IN ENVIRONMENTAL PATHWAYS FOR SUSTAINABLE ENERGY SYSTEMS (Syllabus 2013). (Teaching unit Compulsory) ERASMUS MUNDUS MASTER'S DEGREE IN ENVIRONMENTAL PATHWAYS FOR SUSTAINABLE ENERGY SYSTEMS (Syllabus 2012). (Teaching unit Compulsory) MASTER'S DEGREE IN ENERGY ENGINEERING (Syllabus 2013). (Teaching unit Compulsory)
ECTS credits:	5
Teaching languages:	English

### Teaching staff

Coordinator:	Valderrama Angel César A.
Others:	Casas Pons Ignasi Valderrama Angel César A.

### Degree competences to which the subject contributes

#### Specific:

CEMT-3. Assess the economic, social and environmental impact of the production, use and management of energy, with a holistic view of the life cycle of the different systems, and recognise and value the most remarkable developments in the fields of energy efficiency and the rational use of energy.

#### Transversal:

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.

### Teaching methodology

The course is divided into three types of sessions:

- Theoretical classes
- Problem-based learning usually by practical applications
- The project-based learning in which students organized in groups; develop projects based on real situations.

### Learning objectives of the subject

The general objective of the course is to introduce students to the problems associated with energy management in our society and the consequences and effects on the environment in terms of pollution with special emphasis on air pollution. The course aims to identify the effects of energy production and to introduce principles and tools, especially those aimed at preventing and minimizing gas emissions. Familiarize students with the tools to predict the behaviour of contaminants using basic models of transport and dispersion and to determine the air quality at a specific point. Introducing the basic knowledge that allows selecting the most appropriate technology for a treatment according to the type of pollutant, environment, and relevant environmental laws and regulations. The general objective of the course is to introduce students to the problems associated with energy management and the consequences and effects this has on our environment in terms of pollution with special emphasis on air pollution. The course aims to identify the effects of energy production and to introduce principles and tools, especially those aimed at preventing and minimizing gas emissions. Familiarize students with the tools to predict the behaviour of contaminants using basic models of transport and dispersion and to determine the air quality at a specific point. Introducing the basic knowledge that allows selecting the most appropriate technology for a treatment according to the type of pollutant, environment, and relevant environmental



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### Study load

Total learning time: 125h	Hours large group:	30h	24.00%
	Guided activities:	15h	12.00%
	Self study:	80h	64.00%

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### Content

<p>Sustainability, Energy and Environment</p>	<p>Learning time: 10h Theory classes: 4h Guided activities: 2h Self study : 4h</p>
<p>Description: Sustainable development Sustainable use of resources Energy efficiency</p> <p>Specific objectives: At the end of this topic, students will be able to: Identify the elements of the sustainable development and the social, economic and environmental challenges related to the energy management Distinguish between the concepts of the use of energy resources and energy efficiency in terms of sustainable development</p>	
<p>Air Pollution</p>	<p>Learning time: 13h Theory classes: 2h Practical classes: 3h Guided activities: 4h Self study : 4h</p>
<p>Description: Air pollutants resulting from energy generation processes Primary and secondary pollutants Overview of environmental policy and legislation relevant to air pollution</p> <p>Specific objectives: At the end of this topic, students will be able to: Identify the most important constituents of the atmosphere and their importance for living organisms, climate, etc. Classify the most representative pollutants and their emission sources arising from energy production Identify the types of pollutants and distinguish the maximum permitted levels of emissions and air quality legislation</p>	

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<p>Effects of air pollution</p>	<p>Learning time: 14h Theory classes: 4h Practical classes: 2h Guided activities: 4h Self study : 4h</p>
<p>Description: Global effects: ozone layer depletion Local and regional effects: acid rain, photochemical smog, Climate change. Global energy balance and radiative forcing, International agreements, commitments within the EU. Prevention measures and international emissions trading system</p> <p>Specific objectives: At the end of this topic, students will be able to: Distinguish between local and global effects of air pollution Recognize the implications of air pollution on climate change and identify the principles that determine the emissions trading</p>	
<p>Emission inventories and Carbon Footprint</p>	<p>Learning time: 14h Theory classes: 2h Practical classes: 2h Guided activities: 4h Self study : 6h</p>
<p>Description: Emissions inventory. European regulation of air emissions inventories. International regulations. General methodology. Specific methodologies for different types of sources Carbon Footprint Methodology</p> <p>Specific objectives: At the end of this topic, students will be able to: Identify standards and methodologies for emissions inventories Develop a basic inventory from an industrial process, from a natural or urban system.</p>	

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<p>Treatment and control systems for particles and dust</p>	<p>Learning time: 5h Theory classes: 1h Practical classes: 1h Guided activities: 1h Self study : 2h</p>
<p>Description: Treatment types Dry treatments Wet treatments Filtration treatments</p> <p>Specific objectives: At the end of this topic, students will be able to: Classify technologies according to process parameters (flowrate, particle size distribution) Calculate treatment system efficiencies from design parameters and working conditions.</p>	
<p>Gas cleaning systems</p>	<p>Learning time: 8h Theory classes: 2h Practical classes: 0h Guided activities: 2h Self study : 4h</p>
<p>Description: Prevention systems: low emission burners, chemical reduction methods Absorption, adsorption, condensation, biofiltration. Thermal oxidation. Catalytic and non-catalytic combustion CO2 capture and sequestration technologies</p> <p>Specific objectives: At the end of this topic, students will be able to: Distinguish among different treatment and cleaning technologies, and to identify the most suitable technology for each pollutant in a given regulation environment. Identify the design parameters for each technology, and to apply them to real air pollution cases.</p>	

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<p>Atmospheric dispersion</p>	<p>Learning time: 20h Theory classes: 4h Practical classes: 2h Guided activities: 4h Self study : 10h</p>
<p>Description: Emission, transport and receptor point concepts Meteorological factors influencing the dispersion. Point and linear sources of pollution. Characteristics of a contaminant plume. Inversion. Overview of dispersion models and reaction of pollutants in the atmosphere The Gaussian dispersion model</p> <p>Specific objectives: At the end of this topic, students will be able to: Identify concepts, dispersion, transport and the effects of meteorological parameters on the dilution of pollutants Identify the different levels of complexity in modelling the dispersion of pollutants Apply mathematical representations (Gaussian model) to describe the process of dispersion of pollutants under different situations (Inversion, linear source pollution, etc. .) Interpret the results obtained from the point of view of air pollution reduction and also of air quality control</p>	
<p>Management of radioactive waste</p>	<p>Learning time: 6h Theory classes: 2h Practical classes: 0h Guided activities: 0h Self study : 4h</p>
<p>Description: Management of low and intermediate level radioactive waste Management of high level radioactive waste Multi-barriers system description Long-term performance assessment analysis</p> <p>Specific objectives: At the end of this topic, students will be able to: Identify the management criteria for safe disposal of low, intermediate and high level radioactive wastes Recognize the technological challenges associated to the management of this type of waste</p>	

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### Qualification system

Written test control of knowledge: 50%  
Work done individually or in groups during the course: 25%  
Attendance and participation in practical activities: 15%  
Quality and performance of group work: 10%

### Bibliography

#### Basic:

Vallero, Daniel A. Fundamentals of air pollution [on line]. 4th ed. Oxford: Academic, 2007 [Consultation: 03/10/2016]. Available on: <<http://www.sciencedirect.com/science/book/9780123736154>>. ISBN 9780123736154.

Sioshansi, F.P. Energy, sustainability and the environment: technology, incentives, behaviour. Amsterdam: Elsevier/Butterworth-Heinemann, cop. 2011. ISBN 9780128103760.

Colls, Jeremy ; Tiwary, Abhishek. Air pollution: measurement, modelling and mitigation [on line]. 3rd ed. London: CRC Press, 2009 [Consultation: 03/10/2016]. Available on: <<http://site.ebrary.com/lib/upcatalunya/docDetail.action?docID=10330877>>. ISBN 9780203871966.

Fay, James A. ; Golomb, D. Energy and the environment. New York: Oxford University Press, 2002. ISBN 0195150929.

#### Complementary:

Hill, Marquita K. Understanding environmental pollution. Cambridge: Cambridge University Press, 2004. ISBN 0521527260.

Arons, Jakob de Swaan; Kooi, Hedzer van der; Sankaranarayanan, Krishnan. Efficiency and sustainability in the Efficiency and sustainability in the energy and chemical industries [on line]. New York: Taylor & Francis, 2014 [Consultation: 03/10/2016]. Available on: <<http://lib.myilibrary.com?id=9681>>. ISBN 9781280096815.

Schnelle, Karl B. ; Brown, Charles A. Air pollution control technology handbook [on line]. Boca Raton [etc.]: CRC Press, 2014 [Consultation: 12/09/2017]. Available on: <<http://lib.myilibrary.com/Open.aspx?id=50378>>. ISBN 9781280503788.