PERSONA CIÈNCIA EMPRESA
UNIVERSITAT RAMON LLULL

COURSE: ENERGY AND ENVIRONTMENT

SUBJECT: Energy and environtment
MODULE: Process and product engineering
STUDIES: Master in Chemical Engineering

GENERAL FEATURES*

Type: ☐ Basic training, ☑ Mandatory, ☐ Elective

☐ Master thesis, ☐ Internship

Duration: Semestral **Semester/s**: 2
Number of credits ECTS: 3
Language/s: Spanish, Catalan, English

DESCRIPTION

BRIEF DESCRIPTION AND JUSTIFICATION (the meaning of the subject in relation to the studies. Between 100 and 200 words.)

This course is intended to give the student a general overview of the different technical and economic aspects that are related to the energy use and supply in industry and to give him the tools for a correct management of the energy. It also wants to explain the different types of energy that exist and the tools that can be used for its conversion.

COMPETENCIES (of the subject according to the competencies pre-assigned in the subject.)

- To be able of integrate knowledge and confront the complexity of solving problems with a limited amount of information. Including reflex ions about social and ethical responsibilities (**CB8**).
- To have capability to understant the inpact of Chemical engineering in the sustainable development of society (**CT5**).
- To manage and supervise any type of processm system and services of the different types of industries related to Chemical Engineering (**CE5**).
- To design, built and implement methods, processes and instalaations for the integral management of solid, liquid and gaseous suplies and residues of the industry with capacity to evaluate its impacts and risks (**CE6**).

PREREQUISITES* (modules, subjects, courses or knowledge needed to monitor the course. It can be noted courses, which must have been completed.)

Those related to the Basic Module.

* These features should not be modified without the approval of organs responsible for the high-level academic structures (subject, module and/or study plan).

CONTENTS (according to sections, which constitute the list of contents of the course to the second level detail.)

1. Resources consumption and structure of the energy system.
2. Energy conversion and storage.
3. Coal and derivate.
4. Liquid fuels.
5. Gaseous fuels.
6. Nuclear energy.
7. Renewable energy.
    - Solar.
    - Hydroelectric.
    - Wind.
    - Oceanic.
    - Geothermal.
    - Biomass.
    - Solid waste.
8. Cogeneration
9. Energy and sustainable development.

METODOLOGY

TRAINING ACTIVITIES* (complete the table relating activities and workload to ECTS credits and competencies.)

Training activities	**ECTS Credits**	**Competencies**
Concept Sessions	0.5	CB8, CT5, CE5, CE6
Sessions solving exercises, problems and cases	0.5	CB8, CT5, CE5, CE6
Seminars	-	
Compulsory activities at the teacher's office	-	
Practical work / laboratory	-	
Presentations	-	
Personal study activities of students	1.8	CB8, CT5, CE5, CE6
Evaluation activities (testing, monitoring controls…)	0.2	CB8, CT5, CE5, CE6
TOTAL	**3**	

EXPLANATION OF TEACHING METHODOLOGY (justifying the teaching methods used related to competencies and course contents. Between 100 and 200 words)

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The subject is taught using theory sessions. At the end of each chapter, an hour is dedicated to solve some of the exercises of that topic which the students have prepared at home.

A total of 2 hour of class are destined to the solution of exercises that will compute directly to the final mark. For this exercises, the students will use the work done at home. Apart from assisting to class, there are two laboratory activities and a final presentation of the conclusions obtained from the practical work.

EVALUATION

METHODS OF EVALUATION* (Complete the table relating assessment methods, competencies and the weight in the rating of the course)

Methods of evaluation	Weight	Competencies
Final exam	40%	CB8, CT5, CE5, CE6
Partial exams	-	
Following up activities	40%	CB8, CT5, CE5, CE6
Homework and presentations	20%	CB8, CT5, CE5, CE6
Experimental work or fieldwork	-	
Projects	-	
Evaluation of the company or institution	-	
Participation	-	

LEARNING OUTCOMES (Explanation of the achievements of students that allow competency assessment, relating to competencies and assessment methods.)

Objetive 1:

- The student must show its own criteria to identify the best method to be applied in each situation.

Objetive 2:

- The student must show that possesses capacity to criticize the numerical solution obtained.
- The student must show criteria to identify the best energy source according to economical, technical and environmental points of view.

EVALUATION (Explanation of the evaluation method of the subject.)

The final mark is calculated with the mean value between the final exam (40%) the exercises and the homework (40%) and the practices (20%) but only if the mark of the exam is equal or bigger than 4. If this mark is lower than 4, the final mark will be the exam mark.

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EVALUATION OF COMPETENCIES (Define calculation expressions for each competency in terms of the corresponding evaluation activities.)

To evaluate competence CB8, the indicator is the final exam mark.
To evaluate competence CE5 and CB6, the indicator used is the overall subject final mark.
To evaluate competence CT5 the indicator used is practices mark.

BIBLIOGRAPHY (recommended and student accessible.)

BIBLIOGRAFÍA BÁSICA:

- Larry C. Witte, Philip S. Schmidt, David R. Brown. "Industrial Energy Management and Utilization". Edit.: Hemispher Publishing Corporation. ISBN: 0-89116-322 o Springer-Verlag; ISBN: 3–540-18533.
- CENTRO DE ESTUDIOS DE LA ENERGÍA.- "Técnicas de conservación Energética en la Industria". 2tomos. Servicio de Publicaciones del Ministerio de Industria y Energía. 1982.
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BIBLIOGRAFÍA o MATERIAL COMPLEMENTARIO:

- MOLINA,L.A., MOLINA,G., MERINO,J.Mª., GOZÁLEZ,R. "Manual de Eficiencia Energética Eléctrica en la Industria".2 tomos. CADEM. Bilbao.1985.
- Sala Lizarraga, José Mª. "Cogeneración".- Universidad del País Vasco. 1999.
- EDF."Le calcul économique et le système électrique". Editorial Eyrolles. 1979.
- Orille Fernández, A. L. "Centrales Eléctricas". Tres tomos. ETSEIB- CPDA, Barcelona. 1993.
- "Enciclopedia de la Energía". Editorial Marcombo, Barcelona, 1982.
- Emilio Menéndez Pérez. 2001. "Energías renovables. "Sustentabilidad y creación de empleo".- Edit. Catarata.- ISBN: 84-8319-115-6. 2001.
- Josep Enric Llebot. "El canvi climàtic".- Edit.: Rubes Editorial, S.L. ISBN: 84-393-4453-8.- 1998.

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