

## Course guide

### 240IEN31 - 240IEN31 - Management and Energy Efficiency

Last modified: 16/05/2023

**Unit in charge:** Barcelona School of Industrial Engineering  
**Teaching unit:** 724 - MMT - Department of Heat Engines.

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

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

#### LECTURER

**Coordinating lecturer:** José Luis Martín Godoy

**Others:** Fernandez Francos, Xavier

#### REQUIREMENTS

thermodynamics, Thermal Engineering and Fluid Mechanics.

#### DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

**Specific:**

CEEENE2. Manage the energetic chain (generation, transformation and use) to obtain the highest energetic efficiency in a process or product.

#### TEACHING METHODOLOGY

- B. Students will not face different activities scheduled throughout the year chronologically
1. Study the documentation provided on each topic
  2. It promotes continuous work throughout the year with the proposal and collection problems.
  3. Resolution of the Digital Campus exercises on the subject you are trying to classe (weekly)

#### LEARNING OBJECTIVES OF THE SUBJECT

Understanding and interpreting energy as a vector consisting of several components: thermodynamic, economic, environmental, affecting some thermal energy transformation processes. Students will learn to analyze and determine opportunities for energy savings in different scenarios (industrial, residential and tertiary), propose solutions and study their technical and economic viability, taking into account the current regulatory framework. As a practical case, they will carry out an audit and energy certification of a residential or tertiary building.

#### STUDY LOAD

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

**Total learning time:** 112.5 h

## CONTENTS

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### Introduction: Energy efficiency and energy management systems. ISO50001 standard

**Description:**

The overall concept of energy. Historical evolution of the use of energy. Different classifications of energy. Energy consumptions. Energy intensity. Energy efficiency and management systems.

**Full-or-part-time:** 1h 30m

Theory classes: 1h 30m

### Energy balances and Thermoeconomics

**Description:**

Energy costs. Case study: Analysis of the electricity bill and the Spanish electricity market. Energy and exergetic evaluation. Thermoeconomics: a case study.

**Full-or-part-time:** 3h

Theory classes: 3h

### Energy audit and certification

**Description:**

Energy audits: objective, legal framework and procedure. Analysis of the energy efficiency of buildings through energy certification: control of energy demand and consumption. Economics analysis and environmental impact.

**Full-or-part-time:** 4h 30m

Theory classes: 4h 30m

### Production, distribution and use of heat

**Description:**

Efficiency in heat production in boilers and ovens. Distribution, recovery and internal use of heat. Centralized heating and cooling production: District Heating and Cooling

**Full-or-part-time:** 6h

Theory classes: 6h

### Cogeneration and Polygeneration systems

**Description:**

Concepts and definitions. Cogeneration technology and applications: industry, hotels, hospitals, supercomputing center and agricultural sector. Economic and exergetic analysis of cogeneration. Environmental impact. Legal framework.

**Full-or-part-time:** 3h

Theory classes: 3h



### Heat pumps

**Description:**

Heat pumps: type. Instant and seasonal COP. Energy and exergetic efficiency. Geothermal heat pump. Aerothermal for residential use. Heat pumps for industry.

**Full-or-part-time:** 3h

Theory classes: 3h

### Energy storage systems

**Description:**

We describe some electrical energy storage systems such as compressed air tanks, liquid air, reversible hydroelectric power stations, hydrogen production and fuel cells, batteries, ...

**Full-or-part-time:** 1h 30m

Theory classes: 1h 30m

### Project

**Description:**

In the development of the subject, active learning methodologies based on projects (PBL) and cooperative work will be employed. It will consist of an energy audit and certification of a tertiary or residential building.

**Full-or-part-time:** 12h

Theory classes: 12h

## GRADING SYSTEM

The qualification of the student will be

$$N_{\text{final}} = 0,50 N_{\text{ef}} + 0,15 N_{\text{prof}} + 0,35 N_{\text{proj}}$$

RETAKE: the retake exam replace the final exam + Nprof

Nfinal: Final note

Nef: Note final exam

Nproj: Note the project or course work

Nprof: Note teacher's continuous assessment

## EXAMINATION RULES.

The final exam, about 3h approximately consist of short questions and problems are.

During the short questions will not be allowed to consult any material, whereas the resolution of the problems must be take notes because occasionally conducting an exercise could be allowed to consult additional material which communicates the same

## BIBLIOGRAPHY

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### Basic:

- Eastop T.D. ; D.R. Croft. Energy Efficiency : For Engineers and Technologists. Harlow, Essex: Longman Scientific & Technical, 1990. ISBN 047021645X.
- Doty, Steve ; Turner; Wayne C. Energy Management Handbook. 8th ed. Lilburn, GA: CRC Press, 2013. ISBN 9781466578289.

### Complementary:

- Rey Martínez, Francisco Javier ; Eloy Velasco Gómez ; Javier M. Rey Hernández. Eficiencia energética de los edificios : certificación energética. Madrid: Paraninfo, 2018. ISBN 9788428339940.
- Redondo Rivera, Óscar. Eficiencia energética : Manual práctico de cálculos térmicos de edificios. Madrid: Fundación laboral de la construcción, 2013. ISBN 9788415205692.
- Sancho García, José ; Miró, Rafael ; Gallardo, Sergio. Gestión de la energía. Valencia: UPV, 2006. ISBN 8483630036.
- Dincer, Ibrahim ; Marc Rosen. Exergy analysis of heating, refrigerating, and air conditioning : methods and applications [on line]. Amsterdam: Elsevier, 2015 [ Consultation: 14/09/2022]. Available on: <https://www.sciencedirect-com.recursos.biblioteca.upc.edu/book/9780124172036/exergy-analysis-of-heating-refrigerating-and-air-conditioning>. ISBN 9780124172036.
- Vicente Quiles, Pedro. DTIE 18.03 : integración de energías renovables en la rehabilitación energética de los edificios. Madrid: ATECYR, 2013. ISBN 9788495010520.
- Amidpour, Majid ; Mohammad Hasan. Cogeneration and Polygeneration Systems [on line]. Amsterdam: London [et al.], 2021 [ Consultation: 14/09/2022]. Available on: <https://www.sciencedirect-com.recursos.biblioteca.upc.edu/book/9780128172490/cogeneration-and-polygeneration-systems>. ISBN 978012817249.