220577 - Energy Technology

Coordinating unit: 205 - ESEIAAT - Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 724 - MMT - Department of Heat Engines
Academic year: 2017
Degree: MASTER'S DEGREE IN MANAGEMENT ENGINEERING (Syllabus 2012). (Teaching unit Optional)
MASTER'S DEGREE IN MANAGEMENT ENGINEERING (Syllabus 2012). (Teaching unit Optional)
ECTS credits: 3  Teaching languages: Catalan

Teaching staff
Coordinator: Yolanda Calventus Solé
Others: Assensi Oliva Llena; Ivette Rodriguez Pérez

Opening hours
Timetable: It will be available at the beginning of the course

Prior skills
Elementary knowledge in Thermodynamics

Requirements
Nothing

Degree competences to which the subject contributes

Specific:
4. Apply theories and principles related to technology and information systems in order to analyze uncertainty complex situations and make decisions using engineering tools.

Generical:
1. Ability to apply knowledge to solve problems in new environments or unfamiliar environments within broader contexts (or multidisciplinary) related to engineering.
2. Self-learning capacity to independent continuous training.
3. Ability to understand the impact of engineering solutions in a global and social context.
220577 - Energy Technology

Teaching methodology

The course is divided into three parts:

a) Theory classes
b) Guided activity
c) Self-study

In the theory classes, teachers will solve relevant examples in order to remark important concepts. On the other hand, teachers guide students in applying theoretical concepts to solve problems, always using critical reasoning. We propose that students solve exercises in and outside the classroom, to promote contact and use the basic tools needed to solve problems.

In the guided activity class, teachers propose, by means of the ATENEA platform, to solve exercises and to visualize videos and to read divulgative articles in order to promote the achievement of the objective of the subject.

Students, independently, need to work on the materials provided by teachers and the outcomes of the sessions of exercises/problems, in order to fix and assimilate the concepts.

Learning objectives of the subject

The course Energy Technology allows students to acquire an enlarged vision of the energy in its sources, transformations and technological applications. At the end of the course students must know several energy sources, alternatives and conventional: solar energy, internal combustion engines, gas turbines, vapor power plants and cogeneration systems.

Study load

<table>
<thead>
<tr>
<th>Total learning time: 75h</th>
<th>Hours large group: 8h</th>
<th>10.67%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group:</td>
<td>3h</td>
</tr>
<tr>
<td></td>
<td>Guided activities:</td>
<td>16h</td>
</tr>
<tr>
<td></td>
<td>Self study:</td>
<td>48h</td>
</tr>
</tbody>
</table>
## Content

### Module 1: INTRODUCTION TO ENERGY SOURCES. GAS TURBINES POWER PLANTS

**Learning time:** 13h
- Theory classes: 1h
- Guided activities: 2h
- Self study: 10h

**Description:**
1.1 Primary energy sources. Interconversions of energy
1.2 Combustibles: main sources. Fossil fuels. Pollutant emissions
1.3 Gas turbines: Application fields. Main parts: compressor, burning chamber and turbine. Parametric analyses of the variables that affect to efficiency and to specific work. Gas turbine modified cycles

**Related activities:**
- Activity 1: Large/Theory and exercises group sessions
- Activity 2: Guided activity
- Activity 3: Final exam

**Specific objectives:**
- To know the main energy sources, the main features of combustibles and its pollutant emissions
- To know the main features of gas turbines power plants

### Module 2: VAPOR POWER PLANTS AND COMBINED CYCLES

**Learning time:** 13h
- Theory classes: 1h
- Guided activities: 2h
- Self study: 10h

**Description:**
3.1 Vapor power plants and combined cycles.
3.1.- Components of a simple vapor power plant. 3.2.- Rankine cycle. Representation in the h-s and T-s diagrams. 3.3.- Principal work and heat transfers. Thermal efficiency. 3.4.- Effect of boiler and condenser pressures on the Rankine cycle. Superheat and reheat. 3.5 Principal irreversibilities and losses 3.6.- Modified Rankine cycles: regenerative vapor power cycle and double expansion with intermediate reheat cycle. 3.7.- Combined cycles.

**Related activities:**
- Activity 1: Large/Theory and exercises group sessions
- Activity 2: Guided activity
- Activity 3: Final exam

**Specific objectives:**
- To know the general operation and main characteristics and operating parameters of power plants with steam turbines and combined cycles.
Module 3: COMBINED HEAT AND POWER. 
COGENERATION

Description:
3.1.- Introduction to the cogeneration.
3.2 Main characteristics and areas of application
3.3 Trigeneration and microcogeneration
3.4 Technologies of cogeneration

Related activities:
Activity 1: Large/Theory and exercises group sessions
Activity 2: Guided activity
Activity 3: Final Exam.

Specific objectives:
- To know the fundamentals of cogeneration and its purpose as well as its advantages and disadvantages and trigeneration and microcogeneration
- To know the technologies of cogeneration and its advantages and disadvantages

Learning time: 16h
Theory classes: 2h
Guided activities: 4h
Self study: 10h

- Módulo 4: Biomass

Description:
4.1 What is Biomass
4.2 Sources of Biomass
4.3 Classification of Biomass
4.4 Biomass transformation processes

Related activities:
Theory classes
Final Exam
Guided activity

Specific objectives:
Learn the fundamental characteristics of biomass and its transformation processes

Learning time: 14h
Theory classes: 2h
Guided activities: 4h
Self study: 8h
# Module 5: SOLAR ENERGY AND THERMAL ENERGY STORAGE

**Learning time:** 16h  
- Theory classes: 2h  
- Guided activities: 4h  
- Self study: 10h

## Description:

## Related activities:
- Activity 1: Large/Theory and exercises group sessions  
- Activity 2: Guided activity  
- Activity 3: Final Exam.

## Specific objectives:
To know the possibilities and techniques for taking advantage of solar thermal energy in buildings.
# Planning of activities

<table>
<thead>
<tr>
<th>Activity 1: Theory and Exercises/Large Groups Sessions</th>
<th>Hours: 34h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methodology in large group</td>
<td></td>
</tr>
<tr>
<td>Contains are presented following an expositive and participative class</td>
<td></td>
</tr>
<tr>
<td>The subject is organized in 5 modules</td>
<td></td>
</tr>
<tr>
<td><strong>Support materials:</strong></td>
<td></td>
</tr>
<tr>
<td>Noted posted to the ATENEA platform</td>
<td></td>
</tr>
<tr>
<td>General literature of the course.</td>
<td></td>
</tr>
<tr>
<td><strong>Descriptions of the assignments due and their relation to the assessment:</strong></td>
<td></td>
</tr>
<tr>
<td>During some sessions, exercises will be conducted in the class, individually.</td>
<td></td>
</tr>
<tr>
<td><strong>Specific objectives:</strong></td>
<td></td>
</tr>
<tr>
<td>Transfer the necessary knowledge for a correct interpretation of the contents in the large group sessions, resolving doubts about the content of the course and generic skills development.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Activity 2: Guided Activities Session</th>
<th>Hours: 32h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guided activities: 16h</td>
<td></td>
</tr>
<tr>
<td>Self study: 16h</td>
<td></td>
</tr>
<tr>
<td><strong>Description:</strong></td>
<td></td>
</tr>
<tr>
<td>Students in groups will select, in agreement with professors, a report title that should develop from a list proposed by professors. This report must follow an scheme which will be discussed and fixed conveniently by professors.</td>
<td></td>
</tr>
<tr>
<td><strong>Support materials:</strong></td>
<td></td>
</tr>
<tr>
<td>Noted posted to the ATENEA platform.</td>
<td></td>
</tr>
<tr>
<td>Specific material uploaded by professors in Atenea Platform</td>
<td></td>
</tr>
<tr>
<td>Bibliography</td>
<td></td>
</tr>
<tr>
<td><strong>Descriptions of the assignments due and their relation to the assessment:</strong></td>
<td></td>
</tr>
<tr>
<td>Students will upload a report memory in Atenea Platform</td>
<td></td>
</tr>
<tr>
<td>It represents 50% of the final course grade</td>
<td></td>
</tr>
<tr>
<td><strong>Specific objectives:</strong></td>
<td></td>
</tr>
<tr>
<td>Acquire the necessary skills for the correct achievement of the subject objectives.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Activity 3: Final Exam</th>
<th>Hours: 6h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 2h</td>
<td></td>
</tr>
<tr>
<td>Self study: 4h</td>
<td></td>
</tr>
</tbody>
</table>
**220577 - Energy Technology**

---

**Description:**
Individual and writing assessment about the contents of modules 1, 2, 3, 4 and 5.

**Support materials:**
Instructions and terms for the final exam.

**Descriptions of the assignments due and their relation to the assessment:**
The hand-in will be the result of the exam.
This activity represents a 50% of the final course grade.
It represents 45% of the final course grade.

**Specific objectives:**
The exam must demonstrate that the student has acquired and assimilated the concepts, principles and fundamentals related to modules 1, 2, 3, 4 and 5.

---

**Qualification system**
The final grade depends on the following assessment criteria:

- Final Exam, weight: 50%
- Guided activity, weight: 50%

Students that fail or do not present the final exam have the possibility to repeat it.

**Regulations for carrying out activities**
Guided activities and final exam will be written.
Bibliography

Basic:


Complementary:


Others resources:

Noted posted to the ATENEA platform

Audiovisual material

Apunts de l'assignatura disponibles a la plataforma digital ATENEA
They are notes and the transparencies of class