820330 - TDFE - Energy Fluid Transmission and Distribution

Coordinating unit: 295 - EEBE - Barcelona East School of Engineering
Teaching unit: 713 - EQ - Department of Chemical Engineering
Academic year: 2019
Degree: BACHELOR'S DEGREE IN ENERGY ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
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ECTS credits: 6
Teaching languages: Catalan, Spanish

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Coordinator: FRANCISCO ESTRANY CODA
Others: Primer quadrimestre:
FRANCISCO ESTRANY CODA - M11, M12
MARGARITA SÁNCHEZ JIMÉNEZ - M11, M12
Segon quadrimestre:
FRANCISCO ESTRANY CODA - T11, T12
MARGARITA SÁNCHEZ JIMÉNEZ - T11, T12

Opening hours
Timetable: Generally, during the hour before the start time of the class and during the hour after class.

Prior skills

Requirements
MECÀNICA DE FLUIDS - Prerequisite
TERMODINÀMICA I TRANSFERÈNCIA DE CALOR - Corequisite

Degree competences to which the subject contributes
Specific:
CEENE-220. Knowledge of the principles of operation of liquid, gas and vapour transport and distribution systems for the transport.
Transversal:
5. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.

Teaching methodology
The course uses the methodology exhibition by 40%, individual work by 20%, work in groups by 40%.
Ability in "Team Work", which is the rate that corresponds to this subject will be evaluated within the student's work to make the project that is commissioned during the semester.

Learning objectives of the subject
Acquire the knowledge necessary for the calculation, modeling and simulation of transport facilities and channeling fluid power, knowledge and calculation of the thermodynamic properties of water vapor, and ability to design industrial distribution of water vapor. Knowledge of the physical properties of natural gas, and the operation of extraction facilities and distribution of this fuel. Computing capacity of LNG vaporization installations.

### Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group:</th>
<th>Hours medium group:</th>
<th>Hours small group:</th>
<th>Guided activities:</th>
<th>Self study:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>52h 30m</td>
<td>0h</td>
<td>7h 30m</td>
<td>0h</td>
<td>90h</td>
</tr>
<tr>
<td></td>
<td>35.00%</td>
<td>0.00%</td>
<td>5.00%</td>
<td>0.00%</td>
<td>60.00%</td>
</tr>
</tbody>
</table>
## Content

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Description</th>
<th>Learning time</th>
<th>Theory classes</th>
<th>Self study</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CHAPTER 1: SYSTEMS OF UNITS USED IN ENGINEERING, DIMENSIONAL ANALYSIS AND MACROSCOPIC BALANCE OF ENERGY</strong></td>
<td>Unit systems used in the engineering field. Usefulness of dimensional analysis for solving equations in analytical calculations. Application of dimensional analysis to the deduction of equations representative of the behavior of Physical Systems. The macroscopic balance of energy framed in the transport of fluids.</td>
<td>3h</td>
<td>1h</td>
<td>2h</td>
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<tr>
<td><strong>CHAPTER 2: PIPELINES FOR ENERGY TRANSPORT LÍQUIDES</strong></td>
<td>Energy balance applied to channeled fluids: Bernoulli's principle. I raise general and specific pose for gases and vapors in isoentálpico regimes, isothermal and adiabatic. Fluid flow regimes. Calculation of friction head loss in a pipeline. Calculating the minimum diameter and the diameter of a driving optimum transport of a fluid. Concept and calculation of a bypass. Exercises and problems</td>
<td>16h</td>
<td>6h</td>
<td>10h</td>
</tr>
<tr>
<td><strong>Chapter 3: STEAM AS A TRANSPORTATION AGENT FOR MECHANICAL AND HEAT ENERGY</strong></td>
<td>Saturated steam, wet steam and superheated steam: degrees of freedom and thermodynamic quantities. Specific calculation of the magnitudes of both the saturated steam as the wet steam and superheated steam. Determining a moisture vapor (condensation and strangulation methods). Enthalpy balances in steam plant. Mollier diagram. Comprehensive facility energy use, with steam as the main carrier of energy. Application to a waste incineration plant. Exercises and problems.</td>
<td>20h 30m</td>
<td>6h 30m</td>
<td>10h</td>
</tr>
<tr>
<td><strong>CHAPTER 4 - MODELLING AND SIMULATION OF FLUID PIPES AND VAPOR TRANSPORT INSTALLATIONS</strong></td>
<td>Modelling and simulation of fluid liquid pipelines energy (oil). Pipeline sizing and calculation of the power required for pumping the liquid.</td>
<td>16h</td>
<td>2h</td>
<td>8h</td>
</tr>
</tbody>
</table>
### CHAPTER 5 - NATURAL GAS AS STRATEGIC FLUID FOR ENERGY TRANSPORT

**Description:**

**Learning time:** 16h
- Theory classes: 6h
- Self study: 10h

### CHAPTER 6 - LIQUEFIED NATURAL GAS (LNG)

**Description:**
Composition of LNG compared to the GN. History of LNG. Security of LNG. Liquefaction of natural gas. Regasification of LNG-transport of LNG. Solving exercises and problems.

**Learning time:** 16h
- Theory classes: 6h
- Self study: 10h

### CHAPTER 7 - PROCESSING AND DISTRIBUTION OF ENERGY

**Description:**
End of the route of transport of energy by fluid power piping. Operation of power stations. Starting the electricity supply system.

**Learning time:** 3h
- Theory classes: 1h
- Self study: 2h

### CHAPTER 8 - MODELING AND SIMULATION OF GAS PIPELINES AND STEAM ACCUMULATORS

**Description:**
Modeling and programmed simulation of large Natural Gas pipelines (approximating their properties to methane). Pipeline sizing and calculation of the power required for compression and gas drive. Modeling and programmed simulation of the start-up of a Steam Accumulator.

**Learning time:** 14h 30m
- Theory classes: 1h 30m
- Laboratory classes: 5h
- Self study: 8h
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**PROJECT IN THE FIELD OF ENERGY**

<table>
<thead>
<tr>
<th>Learning time: 45h</th>
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<tr>
<td>Guided activities: 15h</td>
</tr>
<tr>
<td>Self study : 30h</td>
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**Description:**
The Project will focus on a topic contained within the field of three of the specific subjects of the degree "Degree in Energy Engineering" taught in the fifth four-month term: "Thermofluidodynamic Generation", "Transport and Distribution of Energy Fluids" and "Management of the Energy Sectors". It is a common activity.

**Qualification system**

First Control Partial: 25%
Second Partial Control: 25%
Exercises in charge and Reports of Practice: 20%
Project (including the assessment of competition): 30%
No Examination of Reevaluation will take place

**Regulations for carrying out activities**

Students will be tested individually in a classroom in partial checks. Submit exercises correspond to proposals for calculating industrial installations and process units, derived from topics of Modelling and Simulation practices, and experimental practice of the steamer, and carried out by groups outside the classroom. The Transversal Project will conform to the standards common to all courses involved.

**Bibliography**

**Basic:**

**Complementary:**