

## Course guide

### 820330 - TDFE - Energy Fluid Transmission and Distribution

Last modified: 08/08/2024

**Unit in charge:** Barcelona East School of Engineering  
**Teaching unit:** 713 - EQ - Department of Chemical Engineering.

**Degree:** BACHELOR'S DEGREE IN ENERGY ENGINEERING (Syllabus 2009). (Compulsory subject).

**Academic year:** 2024    **ECTS Credits:** 6.0    **Languages:** Catalan, Spanish

#### LECTURER

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**Coordinating lecturer:** FRANCISCO ESTRANY CODA

**Others:** Primer quadrimestre:  
FRANCISCO ESTRANY CODA - Grup: M11, Grup: M12, Grup: M13  
MARGARITA SÁNCHEZ JIMÉNEZ - Grup: M11, Grup: M12, Grup: M13

#### PRIOR SKILLS

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Sufficient capacity of written communication. Autonomous learning.

#### REQUIREMENTS

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MECÀNICA DE FLUIDS - Prerequisit  
TERMODINÀMICA I TRANSFERÈNCIA DE CALOR - Precorequisit

#### DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

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**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

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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

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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 f LNG vaporization installations.



## STUDY LOAD

Type	Hours	Percentage
Hours small group	7,5	5.00
Hours large group	52,5	35.00
Self study	90,0	60.00

Total learning time: 150 h

## CONTENTS

### CHAPTER 1: SYSTEMS OF UNITS USED IN ENGINEERING, DIMENSIONAL ANALYSIS AND MACROSCOPIC BALANCE OF ENERGY

#### Description:

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.

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

Theory classes: 1h

Self study : 2h

### CHAPTER 2: PIPELINES FOR ENERGY TRANSPORT OF LIQUIDS

#### Description:

Energy balance applied to channeled fluids: Bernoulli's principle, I raise general and specific pose for gases and vapors in isothermal 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. methods of physical determination of the flow rate that circulates through a pipe. Applications and solved problems. Pumps for transporting fluids. Centrifugal pumps. cavitation Engine-pump group performance. Characteristic curves. Laws of similarity of centrifugal pumps. Coupling of pumps in the network. Operating point of a pump.

**Full-or-part-time:** 16h

Theory classes: 6h

Self study : 10h

### Chapter 3: STEAM AS A TRANSPORTATION AGENT FOR MECHANICAL AND HEAT ENERGY

#### Description:

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.

**Full-or-part-time:** 20h 30m

Theory classes: 6h 30m

Laboratory classes: 4h

Self study : 10h

#### CHAPTER 4 - MODELLING AND SIMULATION OF FLUID PIPES AND VAPOR TRANSPORT INSTALLATIONS

**Description:**

Modelling and simulation of fluid liquid pipelines energy (oil). Pipeline sizing and calculation of the power required for pumping the liquid.

**Full-or-part-time:** 16h

Theory classes: 2h

Laboratory classes: 6h

Self study : 8h

#### CHAPTER 5 - NATURAL GAS AS STRATEGIC FLUID FOR ENERGY TRANSPORT

**Description:**

Composition of natural gas. Thermodynamic properties of methane. Natural gas extraction plants. Types of natural gas. Transportation by pipeline to the distribution center. Solving exercises and problems.

**Full-or-part-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.

**Full-or-part-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.

**Full-or-part-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.

**Full-or-part-time:** 14h 30m

Theory classes: 1h 30m

Laboratory classes: 5h

Self study : 8h



## PROJECT IN THE FIELD OF ENERGY

### 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.

**Full-or-part-time:** 45h

Guided activities: 15h

Self study : 30h

## GRADING SYSTEM

First Control Partial: 30%

Second Partial Control: 30%

Exercises in charge and Reports of Practice: 20%

Project (including the assessment of competition): 20%

No Examination of Reevaluation will take place

## EXAMINATION RULES.

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:

- Ramos Carpio, Miguel Angel. Refino de petróleo, gas natural y petroquímica. Madrid: Fundación Fomento Innovación Industrial, 1997. ISBN 8460567559.
- Liengme, Bernard V.; Ellert, David J. A Guide to Microsoft Excel 2007 for scientists and engineers [on line]. London: Elsevier/AP, 2009 [Consultation: 17/06/2020]. Available on: <https://www.sciencedirect.com/science/book/9780123746238>. ISBN 9780123746238.
- Vian Ortuño, Ángel; Ocón García, Joaquín. Elementos de ingeniería química : operaciones básicas. 5ª ed. Madrid: Aguilar, 1967. ISBN 8403201532.

### Complementary:

- Manual del ingeniero químico [on line]. 4ª ed. Madrid [etc.]: McGraw-Hill, cop. 2001 [Consultation: 29/04/2020]. Available on: [http://www.ingebook.com/recursos.biblioteca.upc.edu/ib/NPcd/IB\\_BooksVis?cod\\_primaria=1000187&codigo\\_libro=6572](http://www.ingebook.com/recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=6572). ISBN 9788448612788.
- Ocón García, Joaquín; Tojo Barreiro, Gabriel. Problemas de ingeniería química : operaciones básicas. 3ª ed. Madrid: Aguilar, 1968. ISBN 9788403201057.