Course guide
820330 - TDFE - Energy Fluid Transmission and Distribution

Last modified: 04/06/2026

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: 2026 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: FRANCISCO ESTRANY CODA

Others:

Primer quadrimestre:
FRANCISCO ESTRANY CODA - Grup: M11, Grup: M12, Grup: M13, Grup: M14
MARGARITA SÁNCHEZ JIMÉNEZ - Grup: M11, Grup: M12, Grup: M13, Grup: M14

Segon quadrimestre:
FRANCISCO ESTRANY CODA - Grup: T11
MARGARITA SÁNCHEZ JIMÉNEZ - Grup: T11
JORDI SANS MILÀ - Grup: T11

PRIOR SKILLS

Sufficient capacity of written communication. Autonomous learning.

REQUIREMENTS

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

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 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 TRANSPOR LÍQUIDES

Description:
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. 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 ANS 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

Any academic fraud, plagiarism or use or possession of unauthorised means in an assessment activity leads to a mark of zero (0) for the affected test or assignment. Furthermore, in accordance with the University's regulations, if disciplinary proceedings are initiated the subject is recorded as "Pending Assessment" until a decision is reached. These incidents are managed in accordance with the **Action Framework for Academic Integrity in Assessment at the UPC**.

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. ISBN 9788448612788.
- Ocón García, Joaquín; Tojo Barreiro, Gabriel. Problemas de ingeniería química : operaciones básicas. 3ª ed. Madrid: Aguilar, 1968. ISBN 9788403201057.