Universitat de Lleida

DEGREE CURRICULUM

THERMOHYDRAULICS

Academic year 2014-15

Subject's general information

Subject name	THERMOHYDRAULICS
Code	14534
Semester	2nd Semester
Typology	Optional
ECTS credits	6
Theoretical credits	0
Practical credits	0
Department	Computer and Industrial Engineering
Modality	Presencial
Important information on data processing	Consult this link for more information.
Language	Catalan
Degree	Master's Degree in Industrial Engineering
Distribution of credits	Josep Eras Vilà (6)
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Josep Eras Vilà

Learning objectives

See competences.

Competences

General competences

- Capacity to convey information, ideas, problems and solutions both to a specialised and no specialised public.
- Capacity to conceive, design and implement projects and/or provide new solutions, using the tools that the engineering offers.
- To have suitable knowledge of the scientific and technological issues of: mathematical, analytical and numerical methods in engineering, electrical engineering, energetic engineering, chemical engineering, mechanical engineering, mechanics of continuous means, industrial electronics, automation, manufacture, material, quantitative methods of management, industrial computing, urbanism, infrastructures, etc.

Specific competences

- Knowledge and capacity for the design and analysis of heat engines, hydraulic machines and installations of heat and industrial refrigeration.

Subject contents

1. Properties of Pure Substances
1.1. Pure Substance
1.2. Phases of a Pure Substance
1.3. Phase-Change Processes of Pure Substances
1.4. Property Diagrams for Phase-Change Processes
1.5. Property Tables
1.6. The Ideal-Gas Equation of State
1.7. Compressibility Factor—A Measure of Deviation from Ideal-Gas Behavior
1.8. Specific Heats
1.9. Internal Energy, Enthalpy, and Specific Heats of Ideal Gases
1.10. Internal Energy, Enthalpy, and Specific Heat of Solids and Liquids

2. The First Law of Thermodynamics
2.1. The First Law of Thermodynamics
2.2. Energy Analysis of Closed Systems
2.3. Energy Analysis of Steady-Flow Systems
2.4. Some Steady-Flow Engineering Devices
2.5. Energy Analysis of Unsteady-Flow Processes

3. The Second Law of Thermodynamics
3.1. Introduction to the Second Law
3.2. Thermal Energy Reservoirs
3.3. Heat Engines
3.4. Thermal Efficiency
3.5. Refrigerators and Heat Pumps
3.6. The Carnot Cycle
3.7. The Reversed Carnot Cycle
3.8. The Carnot Refrigerator and Heat Pump

4. Gas and Vapor Power Cycles
4.1. Basic Considerations in the Analysis of Power Cycles
4.2. The Carnot Cycle and Its Value in Engineering
4.3. Air-Standard Assumptions
4.4. An Overview of Reciprocating Engines
4.5. Otto Cycle: The Ideal Cycle for Spark-Ignition Engines
4.6. Diesel Cycle: The Ideal Cycle for Compression-Ignition Engines
4.7. The Carnot Vapor Cycle
4.8. Rankine Cycle: The Ideal Cycle for Vapor Power Cycles

5. Hydraulics
5.1. Introduction
5.2. The basic equations
5.3. Head loss
5.4. Pump theory and characteristics
5.5. Series pipe flow
5.6. Parallel pipe flow, equivalent pipes
5.7. Three reservoir problem

6. Pipe Network Analysis
6.1. Introduction
6.2. Defining an appropriate pipe system
6.3. Basic relations between network elements
6.4. Equation systems for steady flow in networks

7. Oleohydraulics
7.1. Introduction
7.2. The oleohydraulic circuit
7.3. The power elements: pumps
7.4. The regulation and control elements
7.5. The work elements: pistons and motors
7.6. Design of circuits

Methodology

The methodological axes of the subject will divide in:
1.-Theoretical master classes where the professor will expose necessary theoretical contents for the acquisition of knowledge and for the correct development of the practical sessions.
2.-Problem sessions where the professor will do some examples but where the students will take active part of their learning process working in small groups or individually.
3.-Practical sessions to the laboratory where the students will work in group in practices related with the topic developed in the theoretical sessions

Development plan

Dates (weeks)	Description	Activities	HTP (hours)
1	Subject presentation Topic 1. Properties of Pure Substances	Master class	4
2	Topic 1. Properties of Pure Substances	Master class Problems based learning	4
3	Topic 2. The First Law of Thermodynamics	Master class Problems based learning	4

4	Topic 2. The First Law of Thermodynamics	Master class Problems based learning	2
5	Topic 3. The Second Law of Thermodynamics	Master class Problems based learning	4
6	Topic 3. The Second Law of Thermodynamics	Problems based learning	4
7	Topic 4. Gas and Vapor Power Cycles	Master class Problems based learning	4
8	Topic 4. Gas and Vapor Power Cycles	Problems based learning	4
9	First term evaluation	Evaluation	
10	Topic 5. Hydraulics	Master class Practices in classroom	2
11	Topic 5. Hydraulics	Master class Practices in classroom	4
12	Topic 6. Pipe Network Analysis	Master class Practices in classroom	4
13	Topic 6. Pipe Network Analysis	Master class Practices in classroom	4
14	Topic 7. Oleohydraulics	Master class External practices / visits	4
15	Topic 7. Oleohydraulics	Master class External practices / visits	4
16	Second term evaluation	Evaluation	
17	Second term evaluation	Evaluation	
18	Tutorization	Tutorization	
19	Retrieval activities	Evaluation	

Evaluation

Evaluation Activities. Criteria	Dates	%	C/O (1)	I/G (2)	Observations
Exam	Week 9	30	C	I	
Presentation and written document of the project	Week 9	20	C	G	
Report of the practices	Week 16 and 17	30	C	G	
Report of the external practices and visits	Week16 and 17	20	C	G	

Exam	Week 19	80	C	I	For students that have not passed the subject yet

(1) Compulsory / Optional (2) Individual/ Group

Bibliography

Basic bibliography

-Yunus A. Çengel, Michael A. Boles "Thermodynamics, an engineering approach", International Edition, Fourth Edition, Mc Graw Hill, ISBN: 0-07-238332-1

-Bruce E. Larock, Roland W. Jeppson, “Hydraulics of pipelines systems”. Ed. CRC Press. 2000 (ISBN:0-8493-1806-8)

-Renate Aheimer, Christine Löffler, Dieter Merkle, Georg Prede, Klaus Rupp, Dieter Scholz, Burkhard Schrader "Fundamentos de la hidráulica y electrohidráulica: Manual de estudio TP 501", Festo Didactic

Complementary bibliography

-J.Agüera Soriano, “Mecánica de fluidos incompresibles y turbomáquinas hidráulicas”, 5ª ed., Editorial Ciencia3 S.A., 2002 (ISBN: 84-95391-01-05)

- Claudio Mataix, “Mecánica de fluidos y máquinas hidraulicas” , 2ª ed.,Ediciones del Castillo S.A., Madrid 1986 (ISBN: 84-219-0175-3)