Last update: 23-04-2019

220208 - Engineering of Thermal and Fluids Systems

Coordinating unit: 205 - ESEIAAT - Terrassa School of Industrial, Aerospace and Audiovisual Engineering

Teaching unit: 724 - MMT - Department of Heat Engines
729 - MF - Department of Fluid Mechanics

Academic year: 2019

Degree: MASTER'S DEGREE IN INDUSTRIAL ENGINEERING (Syllabus 2013). (Teaching unit Compulsory)

ECTS credits: 7,5 Teaching languages: Catalan, Spanish

Teaching staff

Coordinator: MANUEL QUERA MIRO - SALVADOR DE LAS HERAS

Others: OSCAR RIBE TORIJANO - ALBERT PUIG KOWERDOWICZ - HIPOLIT MORENO - DAIBEL DE ARMAS

Degree competences to which the subject contributes

Specific:

1. Knowledge and skills for the design and analysis of heat engines and machines, hydraulic machines and installations of heating and cooling industry.

Teaching methodology

The course is divided into three parts:
1. Sessions to present content.
2. Sessions for practice (exercises, problems and laboratory).
3. Self study, exercises and activities.

In the content of the sessions, teachers will introduce the theoretical foundations of the subject, concepts and methods, using appropriate examples to facilitate understanding.
In the practical sessions, teachers will guide students in applying theoretical concepts and using critical reasoning. We propose that students solve exercises in the classroom and outside the classroom, to promote contact and use the basic tools needed to solve the problems.
Students, independently, will work with material provided by the teacher to fix and assimilate concepts. The teachers provide a curriculum and monitoring activities (ATENEA).

Learning objectives of the subject

The course is divided into three modules or themes:
1) Fluid Engineering: Hydraulic machines and systems (2.5 ECTS)
2) Thermal Engineering: Industrial heating and cooling systems (2.5 ECTS)
3) Thermal Engineering: Heat engines (2.5 ECTS)

Hydraulic systems and machines
Study of operating principles, technology and applications of basic hydraulic machines, as well as various equipment and facilities of hydraulic systems.
Students should know the types of machines studied, scope and operation, and the basic criteria used in engineering selection. Students should also dominate the interaction between the machine and the system to which is connected, and how to act to change the operating point. Finally, students should be aware of the common operation problems and how to avoid them.

Industrial heating and cooling systems

Last update: 23-04-2019

220208 - Engineering of Thermal and Fluids Systems

Study of operating principles, technology and applications of the main equipment and systems used for industrial heating and cooling.
The student must know how to use the energy balances to determine the efficiency and performance of the equipment and systems studied. At the same time should know the types of applications and limitations of use of each system, focusing especially on the environmental impact that its use may produce.

Heat engines
Study of operating principles, technology and applications of heat engines. The heat engine can generate mechanical energy, based on the energy content of a fluid (usually heat generated by combustion). The main applications of this equipment focus on transport, the operation of machinery and the generation of electrical energy.
In a similar way to the heating and cooling systems, the student must know how to use the energy balances to determine the efficiency and performance of the equipment studied. At the same time should know the types of applications and limitations of use of each equipment, focusing especially on the environmental impact that its use may produce.

Study load

Total learning time: 187h 30m	Hours large group:	45h	24.00%
	Hours medium group:	0h	0.00%
	Hours small group:	22h 30m	12.00%
	Guided activities:	0h	0.00%
	Self study:	120h	64.00%

Last update: 23-04-2019

220208 - Engineering of Thermal and Fluids Systems

Content

Module 1: Hydraulic machines and systems

Learning time: 62h 30m

Theory classes: 15h
Laboratory classes: 7h 30m
Self study : 40h

Description:
Previous concepts.
Pumps and fans. Curves. Selection. Scope and applications.
Systems with turbomachinery. Operating point.
Dimensionless groups and similarity theory models.
Regulation. Control valves. Types and selection
Unstable operation. Water hammer. Cavitation.

Module 2 : Industrial heating and cooling systems

Learning time: 62h 30m

Theory classes: 15h
Laboratory classes: 7h 30m
Self study : 40h

Description:
Heat exchangers
Fuels and combustion
Refrigeration equipment
Heat generators

Module 3 : Heat engines

Learning time: 62h 30m

Theory classes: 15h
Laboratory classes: 7h 30m
Self study : 40h

Description:
Internal combustion engines
Steam turbines
Gas turbines
Combined heat and power systems

Qualification system

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220208 - Engineering of Thermal and Fluids Systems

Bibliography

Basic:

Heras, Salvador de las. Fluidos, bombas e instalaciones hidráulicas [on line]. Barcelona: Iniciativa Digital Politècnica, 2011 [Consultation: 30/06/2016]. Available on: <http://hdl.handle.net/2099.3/36653>. ISBN 9788476538012.

Heras, Salvador de las. Mecánica de fluidos en ingeniería [on line]. Barcelona: Iniciativa Digital Politècnica, 2012 [Consultation: 30/06/2016]. Available on: <http://hdl.handle.net/2099.3/36608>. ISBN 978-84-7653-935-4.

Çencel, Y.A.; Boles, M.A. Termodinámica [on line]. 7ª ed. México: McGraw-Hill, 2009 [Consultation: 21/05/2014]. Available on: <http://site.ebrary.com/lib/upcatalunya/docDetail.action?docID=10747893&p00=9781456213381>. ISBN 9786071507433.

Kays, W.M.; London, A.L. Compact heat exchangers. 3rd ed. Malabar: Krieger Publishing, 1984. ISBN 1575240602.

Chase, Malcom W. NIST-JANAF thermochemical tables set. 4th ed. Springer Verlag Gmbh, 1998. ISBN 9781563968310.

Pita, Edward G. Principios y sistemas de refrigeración. México: Limusa, 1991. ISBN 9681839692.

ASHRAE handbook: refrigeration. Atlanta: American Society of Heating, Ventilating and Air-Condtioning Engineers, 2014. ISBN 9781936504725.

Carreras, R.; Comas, A.; Calvo, A. Motores de combustión interna: fundamentos. Barcelona: Edicions UPC, 1993. ISBN 8476533543.

Basshuysen, R. van; Schäfer, F. Internal combustion engine handbook: basics, components, systems, and perspectives. Warrendale, PA: Society of Automotive Engineers, 2004. ISBN 9780768011395.

McBirnie, Samuel C. Marine steam engines and turbines. 4th ed. London: Butterworths, 1980. ISBN 0408003871.

Saravanamuttoo,H.I.H. [et al.]. Gas turbine theory. 6th ed. Harlow; New York: Pearson Prentice Hall, 2009. ISBN 9780132224376.