Course guide
240IEN34 - 240IEN34 - Thermal Equipment

Last modified: 20/05/2024

Unit in charge: Barcelona School of Industrial Engineering
Teaching unit: 724 - MMT - Department of Heat Engines.

Degree: MASTER'S DEGREE IN INDUSTRIAL ENGINEERING (Syllabus 2014). (Optional subject).

Academic year: 2024 **ECTS Credits:** 4.5 **Languages:** Spanish

LECTURER

Coordinating lecturer: Martinez Ballester, Santiago

Others: Martinez Ballester, Santiago

PRIOR SKILLS

Thermotechnology
Thermodynamics
Fluid Mechanics
Basic Informatics

TEACHING METHODOLOGY

The classes combine theory and problems, inviting students to actively participate in them, in case analysis and technical decision making. Continuous work is encouraged throughout the course with the proposition of problems and analysis exercises and team design.

LEARNING OBJECTIVES OF THE SUBJECT

GENERAL OBJECTIVE
Apply the fundamentals of heat transfer, thermotechnics and thermodynamics to the calculation of equipment with generation, supply and / or recovery of thermal energy

SPECIFIC OBJECTIVES
1) Know the main types and particularities of industrial equipment in which there is generation, supply and / or recovery of thermal energy.
2) Know how to size the equipment mentioned above or determine its performance from:
a) Obtaining more or less complex models for proposing mass and energy balances and applying the heat and / or mass transfer equations.
b) The application of simplified calculation methods for specific thermal equipment. All this through the application of analytical and numerical calculation techniques.
3) Know the most appropriate sensors and equipment to use in thermal facilities and equipment for their correct experimental analysis.

STUDY LOAD

Type	Hours	Percentage
Hours small group	13,5	12.00
Self study	72,0	64.00
Hours medium group	27,0	24.00

Total learning time: 112.5 h

CONTENTS

INTRODUCTION

Description:
Presentation of the subject. Introduction to heat generation.

Full-or-part-time: 1h 30m
Theory classes: 1h 30m

HEAT GENERATION

Description:
Combustion fundamentals. Typology and characteristics of fuels. Description of main generation equipment. Problems.

Full-or-part-time: 12h
Theory classes: 12h

CONVECTION IN HEAT EXCHANGERS

Description:
Single-phase convection and phase change. Correlations of coefficients of heat transmission and friction with emphasis on those of application in heat exchangers. Calculation of pressure drop. Problems.

Full-or-part-time: 6h
Theory classes: 6h

HEAT EXCHANGERS

Description:
Types and characteristics. Applications. Calculation methods: ε-NTU and LMTD. Problems.

Full-or-part-time: 12h
Practical classes: 12h

THERMOECONOMICS

Description:
Introduction to thermoeconomics. Application examples.

Full-or-part-time: 1h 30m
Practical classes: 1h 30m

INSTRUMENTATION IN THERMAL INSTALLATIONS

Description:
Introduction to instrumentation and monitoring of thermal installations. Thermometers. Pressure sensors. Flow sensors.

Full-or-part-time: 6h
Theory classes: 6h

GRADING SYSTEM

The student's grade will be: Nfinal = 0,35 Npartial_1 + 0,35 Npartial_2 + 0,3 Npartial_3

Nfinal: final mark
Npartial_i: mark of the partial exams
Nexfinal: mark of the final exam

The problems and design exercises proposed by the teachers to do at home are essential to reach the final exam in better conditions.

For the sole purpose of improving the course grade, the teaching staff reserves the possibility of incorporating, where appropriate, other elements or evaluation criteria.

EXAMINATION RULES.

Partial exams are written tests that are taken during class time, excepting the partial 3 which takes place on the date set by the Barcelona School of Industrial Engineering. They will consist of solving numerical problems or multiple choice questions that may contain small exercises. You must carry a calculator (not programmable) and for problems only a handwritten form on an A4 sheet is allowed on one side, while for tests and theory questions only the calculator (not programmable) is allowed.

BIBLIOGRAPHY

Basic:
- Incropera, Frank Paul ; David P. DeWitt. Fundamentos de transferencia de calor. 4a ed. México: Prentice Hall, 1999. ISBN 9701701704.
- American Society of Heating, Refrigerating and Air-Conditioning Engineers. The ASHRAE handbook. Fundamentals. Atlanta, GA: American Society of Heating, Refrigerating and Air-Conditioning Engineers, [1993?]-. ISBN 15237222.
- Turns, Stephen R.; Haworth, Daniel C. An introduction to combustion : concepts and applications. 5th ed. New York: McGraw-Hill, 2020. ISBN 9781260575521.
- Webster, John G. ; Halit Eren. Measurement, Instrumentation, and Sensors Handbook [on line]. 2nd ed. New York: CRC Press, 2014 [Consultation: 17/10/2022]. Available on: https://www-taylorfrancis-com.recursos.biblioteca.upc.edu/books/mono/10.1201/9781315217109/measurement-instrumentation-sensors-handbook-john-webster-halit-eren. ISBN 9781439848890.

Complementary:
- Kakaç, Sadik (ed.). Boilers, evaporators, and condensers. New York: John Wiley & Sons, cop. 1991. ISBN 0471621706.
- Schlünder, Ernst U. [et al.]. Heat exchanger design handbook. New York: Hemisphere, 1983. ISBN 0891161252.
- Ganapathy, V. Applied heat transfer. Tulsa, Okla: PennWell Books, cop. 1982. ISBN 0878141820.
- Bonals Muntada, Ll. A. Transferència de calor : apunts de classe (Termotècnia - 240171) [on line]. Barcelona: Iniciativa Digital Politècnica, 2016 [Consultation: 13/09/2022]. Available on: https://upcommons.upc.edu/handle/2117/90176. ISBN 9788495355898.

RESOURCES

Other resources:
Audiovisual and computer equipment
- Files in MS Powerpoint with transparencies about the theme of the course.

- Files in MS Excel with some exercises solved.
- Digital Campus ATENEA
- Collection of problems.