



Course guide

295452 - 295TM013 - Advanced Heat Transfer and Energy Technologies

Last modified: 15/05/2024

Unit in charge: Barcelona East School of Engineering
Teaching unit: 729 - MF - Department of Fluid Mechanics.

Degree: MASTER'S DEGREE IN MECHANICAL TECHNOLOGIES (Syllabus 2024). (Compulsory subject).

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

LECTURER

Coordinating lecturer: Font Martínez, Francesc
Valero Pérez, Mario Miguel

Others: Font Martínez, Francesc
Valero Pérez, Mario Miguel
Grau Barceló, Joan
Guardo Zabaleta, Alfredo De Jesus
Torres Camara, Ricardo

TEACHING METHODOLOGY

LEARNING OBJECTIVES OF THE SUBJECT

STUDY LOAD

Type	Hours	Percentage
Hours small group	27,0	18.00
Hours large group	27,0	18.00
Self study	96,0	64.00

Total learning time: 150 h

CONTENTS

Introduction

Description:

- Heat transfer by conduction, convection and radiation.
- Thermal transients.
- Equations of state beyond the ideal gas.
- Introduction to heat transfer equipment and the relevance of thermal management in 21st century technologies.

Full-or-part-time: 22h

Theory classes: 4h

Laboratory classes: 4h

Self study : 14h



Theoretical fundamentals of advanced heat transfer and computation

Description:

- Heat transfer and its coupling with mass and momentum transport. Parallelism between mass transfer and heat transfer.
- Heat transfer with phase changes, multiphase flow, combustion, composite and porous media.
- Heat transfer to the micro-nano ladder. Limit of validity and extensions of Fourier's law. Thermal resistance at interfaces.
- Computational simulation of heat transfer.

Full-or-part-time: 32h

Theory classes: 6h

Laboratory classes: 6h

Self study : 20h

Experimental heat transfer characterisation

Description:

- Sensors (infrared thermometers, thermal cameras, thermocouples, radiometers, pressure measurement, humidity measurement).
- Radiometry
- Data acquisition equipment
- Introduction to data acquisition systems (i.e., LabView software).

Full-or-part-time: 32h

Theory classes: 6h

Laboratory classes: 6h

Self study : 20h

Thermal systems analysis and modelling

Description:

- Introduction to thermal systems.
- Energy fluid transport networks. District heating/cooling networks.
- Thermal storage
- Thermal energy in industry
- Thermal energy in buildings.
- Modelling tools: Open Modelica, TRNSYS, ASPEN, EnergyPlus.

Full-or-part-time: 32h

Theory classes: 6h

Laboratory classes: 6h

Self study : 20h



title english

Description:

Study of energy technologies such as:

- Propulsion.
- Cryogenics.
- Aerothermics, geothermics.
- Renewable energies.
- Cogeneration and trigeneration.
- Climatization of data centers.

Full-or-part-time: 32h

Theory classes: 6h

Laboratory classes: 6h

Self study : 20h

GRADING SYSTEM

BIBLIOGRAPHY

Basic:

- T.L. Bergman, A.S. Lavine, F.P. Incropera, D.P. DeWitt. Fundamentals of Heat and Mass Transfer.
- Y.A. Cengel, A.J. Ghajar. Heat and Mass Transfer: Fundamentals and Applications.
- B.E. Poling, J. M. Prausnitz, J.P. O'Connell. The properties of gases and liquids.
- G. F. Naterer. Advanced Heat Transfer.