



# Course guide

## 295452 - 295TM013 - Advanced Heat Transfer and Energy Technologies

Last modified: 08/08/2024

**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:** MARIO MIGUEL VALERO PÉREZ - FRANCESC FONT MARTÍNEZ

**Others:** Primer quadrimestre:  
FRANCESC FONT MARTÍNEZ - Grup: T1  
JUAN GRAU BARCELÓ - Grup: T1  
MARIO MIGUEL VALERO PÉREZ - Grup: T1

### 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

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## BIBLIOGRAPHY

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**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.