UNIVERSITAT POLITÈCNICA DE CATALUNYA
BARCELONATECH

Course guide
295452 - 295TM013 - Advanced Heat Transfer and Energy Technologies

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: 2025 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: FRANCESC FONT MARTÍNEZ - MARIO MIGUEL VALERO PÉREZ

Others:

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 date centers.

Full-or-part-time: 32h
Theory classes: 6h
Laboratory classes: 6h
Self study : 20h

GRADING SYSTEM

BIBLIOGRAPHY

Basic:
- Bergman, T. L. Fundamentals of heat and mass transfer. 7th ed. Hoboken, NJ: Wiley, cop. 2011. ISBN 9780470501979.
- Çengel, Yunus A.; Ghajar, Afshin J. Heat and mass transfer : fundamentals & applications. 4th ed. New York: McGraw-Hill, cop. 2011. ISBN 9780073398129.
- Poling, Bruce e.; O'Connell, John P.; Prausnitz, J. M. The properties of gases and liquids. 5th ed. New York: McGraw-Hill, 2001. ISBN 9786610913176.
- Naterer, Greg F. Advanced heat transfer. Second edition. Boca Raton: CRC Press, 2018. ISBN 9781138579323.