

## DIM-GITI-314 Heat Transfer

**SEMESTER:** Fall

**CREDITS:** 4.5 ECTS (3 hrs. per week: 2 Theory + 1 Lab, on average)

**LANGUAGE:** Spanish

**DEGREES:** GITI

### Course overview

This course is an introduction to the three basic heat transfer modes: conduction, convection and thermal radiation. Heat exchangers, as elements of particular relevance in industrial applications of heat transfer are also discussed.

### Prerequisites

Basic knowledge of thermodynamics and fluid mechanics.

### Course contents

#### Theory:

1. Introduction to heat transfer. Conduction, Convection and Radiation. Energy balance for control volumes and surfaces.
2. Conduction. The heat diffusion equation: initial and boundary conditions. One-dimensional, steady-state conduction. Thermal resistance. Thermal contact resistance. Critical radius of insulation. Conduction with thermal energy generation. Fins. Transient conduction: the lumped capacitance model. Geometrical effects. The semi-infinite solid.
3. Convection. Hydrodynamic and thermal boundary layers. Laminar and turbulent flow. Nusselt number. Functional forms of convection coefficients. Non dimensional groups in heat transfer. Forced convection: internal and external flow. Free convection: internal and external flow. Mixed convection.
4. Heat exchangers. Classification. Overall heat transfer coefficient. Basic equations: the log mean temperature method and the Effectiveness-NTU method.
5. Radiation. Blackbody radiation: Planck's, Wien's and Stefan-Boltzmann's laws. Radiation exchange between black surfaces: view factor. Radiative properties of real surfaces. Kirchoff's Law. Radiation exchange between opaque diffuse surfaces. Solar radiation.

## Laboratory:

Students will complete three of the six sessions proposed:

- P1.** Conductive heat transfer
- P2.** Convective heat transfer
- P3.** Radiation heat transfer
- P4.** Boiling heat transfer
- P5.** Heat exchangers
- P6.** Numerical methods in heat transfer

## Textbook

- Yunus A. Çengel; Afshin J. Ghajar. Transferencia de calor y masa. Mc Graw Hill, 2011.

## Grading

The following conditions must be accomplished to pass the course:

- A minimum overall grade of at least 5 over 10.
- A minimum grade in the final exam of 5 over 10.

The overall grade is obtained as follows:

- Final exam 50%.
- Other exams 25%.
- Lab exam 20%.
- Performance during the lab sessions 5%.