

Heat Transfer

Introducing

Description

Common Section :

The student should be able, for plan, cylindrical, and spherical systems in steady-state conditions, with or without heat generation, to:

- Establish and solve the energy balance equations in steady-state conditions to calculate heat fluxes and characterize temperature gradients,
- Calculate heat fluxes, thicknesses of materials composing walls, pipes, spherical tanks in steady-state conditions,
- Calculate temperatures at interfaces.

Section GP3E:

The student should be able to:

- Explain the different heat fluxes
- Establish energy balances on reactive or non-reactive systems
- Integrate differential equations to determine temperature profiles and assess heat fluxes
- Know how to transmit a given amount of heat between two systems
- Know how to limit heat losses through a surface
- Study cases applicable to processes.

Section GB:

The student should be able to:

- Choose a technology and configuration of heat exchanger according to its uses
- Calculate heat exchange between fluids within a heat exchanger based on steady-state configurations
- Calculate the efficiency of a heat exchanger based on steady-state configurations
- Size the heat exchange surface of a heat exchanger

according to its steady-state configuration

- Calculate the performance of heat exchangers based on flow rates and inlet and outlet temperatures of fluids
- Solve, in transitional regime, the energy balance equations on a perfectly stirred tank to calculate heating and cooling times according to the implemented technologies (coil, double-wall, external heat exchanger) with or without thermal loss

Objectives

Common Section :

At the end of this common teaching section, the student should have understood and be able to explain (main concepts):

- The general equation of energy conservation,
- The different modes of heat transfer and the associated laws into the phenomena of conduction (Fourier's law) and forced and natural convection (Newton's law),
- The expressions for heat flux by conduction and convection and temperature profiles within different systems in steady-state conditions (simple and composite walls, cylindrical and spherical layers, simple and composite).

Section GP3E:

At the end of this common teaching section, the student should have understood and be able to explain (main concepts):

- Heat transfer in solids with and without heat production in steady-state
- Heat transfer in solids with and without heat production in transitional regime
- Heat transfer by radiation

Section GB:

At the end of this teaching section, the student should have understood and be able to explain (main concepts):

- Different technologies of heat exchangers (tubular, plate, coil, double-wall) implemented industrially
- Principles and operating theories of heat exchangers
- Sizing of heat exchangers

Necessary prerequisites

- Thermodynamics
- Differential Equations and Partial Differential Equations

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

📍 Toulouse