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