Course Unit	Heat Transfer			Field of study	Thermodynamics and Thermal Processes		
Bachelor in	Mechanical Engineering			School	School of Technology and Management		
Academic Year	2023/2024	Year of study	3	Level	1-3	ECTS credits	6.0
Type	Semestral	Semester	2	Code	9123-759-3203-00-23		

Workload (hours)	162	Contact hours	T -	TP 60	PL -	TC -	S -	E -	OT -	O -

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s): Carlos Alberto Rodrigues Andrade

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:
1. characterize the different physical processes of heat transfer.
2. apply the laws that govern and quantify the physical processes of heat transfer.
3. understand how to design or improve the thermal efficiency of a space.
4. consult and make good use of thermal characteristics tables of the materials.
5. understand the physical meaning of different dimensionless parameters in heat transfer phenomena.

Prerequisites

Before the course unit the learner is expected to be able to:
Not applicable.

Course contents

Introduction. Conduction and general equation of heat conduction. One-dimensional, steady-state conduction. Fins. Transient conduction. Free and forced convection. Radiation and thermal radiation; Radiant properties; Radiation exchange between surfaces.

Course contents (extended version)

1. Introduction
   - Objectives. Examples. Mechanisms and modes of transport. Thermal resistance
2. Conduction
   - Thermal conductivity. General equation. One-dimensional steady-state conduction. Critical radius
3. Fins
   - Conduction equation in fins. Effectiveness and efficiency
4. One-dimensional and transient heat conduction
   - Global system and Heisler-Grober Temperature Charts
5. Forced convection
   - The energy equation. Boundary layer. Laminar and turbulent flows. Empirical correlations
6. Free natural convection
   - Dimensionless parameters. Correlations for natural convection
7. Radiation
   - Thermal radiation. Blackbody. Properties of real bodies. Kirchoff's law.
   - Radiation exchange between surfaces. Re-radiating surface. Radiation shields. Reo-electric analogy

Recommended reading

1. Incropera, F. , DeWitt, D. , Fundamentals of Heat and Mass Transfer, John Wiley & Sons.
2. Çengel, A. Y. , Heat Transfer - A Practical Approach. McGraw-Hill.
3. Özisik, M. N. , Heat Transfer. A Basic Approach. McGraw-Hill.
4. Santos, P. ; Matias, L. ; Coeficientes de transmissão térmica de elementos da envolvente dos edifícios. Versão actualizada, Série ITE 50, LNEC

Teaching and learning methods

In lecture classes, the contents will be presented with the help of simple and illustrative examples. In the theoretical-practical classes will be solved more complex exercises.

Assessment methods

1. Alternative 1 - (Regular, Student Worker) (Final, Supplementary, Special)
2. Alternative 2 - (Student Worker) (Final)
   - Final Written Exam - 50%
   - Practical Work - 50%

Language of instruction

Portuguese

Electronic validation

Carlos Alberto Rodrigues Andrade	João Eduardo Pinto Castro Ribeiro	João da Rocha e Silva	José Carlos Rufino Amaro
19-02-2024	19-02-2024	19-02-2024	25-02-2024