Course Unit	Transport Phenomena			Field of study	Physics/Chemistry		
Bachelor in	Renewable Energy Engineering			School	School of Technology and Management		
Academic Year	2023/2024	Year of study	2	Level	1-2	ECTS credits	6.0
Type	Semestral	Semester	2	Code	9910-743-2202-00-23		

Workload (hours)	162	Contact hours	T	TP	PL	TC	S	E	OT	O
			30	-	30	-	-	-	-	-

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): Hélder Teixeira Gomes, Rolando Carlos Pereira Simões Dias

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:
1. demonstrate the acquisition of knowledge about the concepts involved in heat transfer processes
2. formulate and solve problems involving steady-state and transient heat conduction in biomass combustion processes
3. project heat exchangers for application to thermal heating and biofuels production processes
4. demonstrate the acquisition of knowledge about the concepts involved in mass transfer processes
5. formulate and apply mass conservation general equations to describe biomass combustion and gasification reactions
6. apply correlations to describe convective mass transfer in biomass combustion processes, considering different types of flows and geometries
7. integrate developed concepts in the resolution of problems involving simultaneous heat and mass transfer in gasification and combustion processes
8. Apply MATLAB in the numerical resolution of mass/heat transfer problems, namely considering initial value problems (IVP) e boundary value problems (BVP).

Prerequisites

Before the course unit the learner is expected to be able to:
1. demonstrate strong knowledge on the fundamentals of basic sciences
2. demonstrate strong knowledge on the fundamentals of fluid mechanics
3. demonstrate strong knowledge on the use of informatic tools to solve engineering problems

Course contents

Heat transfer fundamentals. Steady-state and transient heat conduction. Convective heat transfer. Project of heat exchangers. Fundamentals of diffusion and mass convection phenomena. Analysis of steady-state and transient molecular diffusion. Correlations applied in convective mass transfer.

Course contents (extended version)

1. Heat transfer fundamentals
   - Conduction
   - Convection
   - Radiation
2. Conduction and convection
   - Steady-state
   - Transient
3. Heat exchangers
   - Type of heat exchangers
   - Project of heat exchangers
4. Fundamentals of diffusion and mass convection phenomena
   - Molecular diffusion
   - Convection
5. Molecular diffusion
   - Steady-state
   - Transient
6. Convective mass transfer
   - Correlations applied in the determination of convective coefficients

Recommended reading

1. J. Welty, G. L. Rorrer, D. G. Foster, Fundamentals of Momentum, Heat, and Mass Transfer, 7th Ed, Wiley, 2019
2. R. B. Bird, W. E. Stewart, E. N. Lightfoot, Transport Phenomena, Revised Second Edition, 2007
3. M. N. Pinho, D. M. Prazeres, Fundamentos de Transferência de Massa, 2ª ed. , IST Press, 2014
4. F. P. Incropera, D. P. DeWitt, Introduction to Heat Transfer, 6th Edition, John Wiley & Sons, 2007
5. S. Middleman, An Introduction to Mass and Heat Transfer, John Wiley & Sons, 1997

Teaching and learning methods

Theoretical classes: exposition of concepts involved in heat and mass transfer processes, discussion, presentation of examples and resolution of typical exercises. Practical classes: supervised resolution of application exercises and critical analysis of results. Non-contact period: study of subjects, resolution of exercises and home assignments.

Assessment methods

1. Alternative 1 - (Regular, Student Worker) (Final)
   - Case Studies - 15% (Homework: weekly exercises, covering the topics taught during contact hours)
   - Intermediate Written Test - 35% (Intermediate Evaluation: exam carried out in week 7 or 8)
   - Final Written Exam - 50% (Final evaluation: exam carried out during the normal evaluation season, week 17 or 18)
2. Alternative 2 - (Regular, Student Worker) (Supplementary, Special)
   - Final Written Exam - 100%
3. Alternative 3 - (Student Worker) (Final, Supplementary, Special)
   - Final Written Exam - 100%

Language of instruction

Portuguese

Electronic validation

Hélder Teixeira Gomes, Rolando Carlos Pereira Simões Dias	Simão Pedro de Almeida Pinho	Ana Maria Alves Queiroz da Silva	José Carlos Rufino Amaro
11-03-2024	11-03-2024	12-03-2024	16-03-2024