INSTITUTO POLITÉCNICO DE BRAGANÇA

Course Unit	Advanced Separation Processes			Field of study	Chemical Process Engineering		
Master in	Chemical Engineering			School	School of Technology and Management		
Academic Year	2019/2020	Year of study	1	Level	2-1	ECTS credits	6.0
Type	Semestral	Semester	1	Code	6362-354-1105-00-19		

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 - Tuturial; O - Other

Name(s) of lecturer(s): José António Correia Silva

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:
1. Analyze and design multicomponent distillation columns by approximate methods: Fenske-Underwood-Gilliland Method (FUG)
2. Analyze and design multicomponent distillation using free commercial software ChemSep
3. Understand enhanced distillation: extractive distillation, azeotropic distillation, reactive distillation
4. Analyze and design adsorption separation processes in membranes
5. Analyse and design adsorption separation processes by adsorption, ion-exchange and chromatography

Prerequisites

Before the course unit the learner is expected to be able to:
Dominate basic concepts of thermodynamics, heat and mass transfer

Course contents

Multicomponent distillation (FUG method). Application of ChemSep software for multicomponent distillation. Enhanced distillation and supercritical extraction. Membrane separations. Adsorption processes.

Course contents (extended version)

1. Multicomponent distillation
   - Fenske–Underwood–Gilliland Method
2. Application of software ChemSep in the project of multicomponent distillation
3. Enhanced Distillation and Supercritical Extraction
   - Use of Triangular Graphs
   - Extractive Distillation
   - Salt distillation
   - PSA distillation
   - Azeotropic distillation
   - Reactive distillation
4. Membrane Separations
   - Types of membranes
   - Membrane modules
   - Gas Separation
   - Dialysis
   - Reverse Osmosis
5. Separation by adsorption, ion exchange and chromatography
   - Adsorbents
   - Adsorption equilibrium
   - Kinetics of sorption
   - Adsoprtive systems: PSA, TSA and SMB

Recommended reading

1. J. D. Seader, Ernest J. Henley, Separation Process Principles, John Wiley & Sons, 2nd Edition, 2006.
2. Christie John Geankoplis, Transport Processes and Separation Process Principles, Prentice-Hall, 2003.
3. Philip C. Wankat, Rate Controlled Separations, Blackie Academic & Professional, 1994.

Teaching and learning methods

Theory: Description of theoretical concepts Practice: Discussion of course materials and homework assignments

Assessment methods

1. Alternative 1 - (Regular, Student Worker) (Final)
   - Intermediate Written Test - 30% (Week 5)
   - Intermediate Written Test - 30% (Week 10)
   - Intermediate Written Test - 40% (Week 15)
2. Alternative 2 - (Regular, Student Worker) (Final, Supplementary, Special)
   - Final Written Exam - 100%

Language of instruction

English

Electronic validation

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10-10-2019	10-10-2019	10-10-2019	13-10-2019

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