

Module Details	
Module Title:	Mass Transfer Operations
Module Code:	CPE5004-B
Academic Year:	2019-20
Credit Rating:	20
School:	Department of Chemical Engineering
Subject Area:	Chemical and Process Engineering
FHEQ Level:	FHEQ Level 5
Pre-requisites:	
Co-requisites:	

Contact Hours	
Type	Hours
Lectures	48
Tutorials	18
Laboratory	6
Directed Study	128

Availability	
Occurrence	Location / Period
BDA	University of Bradford / Academic Year (Sept - May)

Module Aims
To introduce the basic principles of chemical engineering separation processes and mass transfer and then proceed to study the design and operation of separation processes units operation such as distillation, gas-liquid absorption and stripping, liquid-liquid extraction, adsorption and crystallisation.

Outline Syllabus
Distillation (binary and multi-component). Calculation of number of plates, column height and diameter, heat transfer in condenser and reboiler. Crystallisation; application, theory, basic principles, super-saturation effects.

Gas absorption including application, different types of equipment in industry, process design of a column to find the height and diameter of the column, required solvent flow rate. The concepts and procedure for their calculation of the number of theoretical stages, height of theoretical stages, number of theoretical and height of theoretical units will be explained.

Liquid-solvent extraction when the phases are immiscible, including application, different types of equipment in industry, solvent selection, process design of a column to find the height and the diameter of the column and the required solvent flow rate. The concepts and procedure for their calculation of number of theoretical stages, height of theoretical stages, number of theoretical and height of theoretical units will be explained.

Liquid-solvent extraction when the phases are miscible, including application, different types of equipment in industry, solvent selection, process design of counter-current and cross flow stage wise operations to find the number of stages to meet operation constraints.

Learning Outcomes

1	Explain the physical phenomena, theoretical concepts and design aspects of mass transfer in separation processes, including distillation, gas-liquid absorption, gas-solid adsorption, liquid-liquid extraction and crystallisation.
2	Analyse the important separation processes of distillation, gas absorption, adsorption, liquid-liquid extraction and crystallisation and carry out design calculations appropriately of the above processes.
3	Apply simplifying assumptions to complex problems in order to gain useful design information individually and in a team
4	Communicate (written and verbal) outcome of practical work.

Learning, Teaching and Assessment Strategy

Learning outcomes will be achieved through interactive lectures, tutorials and laboratory sessions.

The lectures will be organised so that the students participate by organising them in groups in the class and assigning to them points of discussion throughout the lecture (LO3).

The tutorials will be organised so that the students work in groups discussing the problem at hands and its solution (LO1-2). Each group will be asked to raise and share questions with the rest of the class (LO3). All lecture notes and tutorial questions and their solutions will be posted on the VLE.

The laboratory sessions will be conducted with students working in groups. During the sessions, the students will be challenged to explain the objectives of the experiments, the operation of the experiment, health safety precautions and error analysis of the data collected and present them in their report (LO4).

The Learning outcomes covered by the examinations include an understanding of the fundamental principles of mass transfer operations and application of these principles to the design of operations such as distillation, gas absorption, liquid-liquid extraction and crystallisation (LO1-2).

The assessment will be by formal examination (70%) and course work (30%).

The formal exam, worth 70%, is of 2.0hr duration and taken at the end of semester 2. Formative assessment will take the form of frequent class tests on the unit operations of Distillation, Gas Absorption and Solvent Extraction.

The coursework consists of a critical report of the group laboratory experiments on Distillation and Gas Absorption. It will include in it design and operation elements as well critical evaluation of the data collected. The coursework is worth 30% and students will have two weeks to

complete it. Summative peer evaluation will be taken into account when calculating the individual mark for the coursework.

Mode of Assessment

Type	Method	Description	Length	Weighting
Summative	Examination - closed book	Examination - closed book	2 hours	70%
Summative	Coursework	1 written report 1200 words	-1200 words	30%

Reading List

To access the reading list for this module, please visit <https://bradford.rl.talis.com/index.html>.

Please note:

This module descriptor has been published in advance of the academic year to which it applies. Every effort has been made to ensure that the information is accurate at the time of publication, but minor changes may occur given the interval between publishing and commencement of teaching. Upon commencement of the module, students will receive a handbook with further detail about the module and any changes will be discussed and/or communicated at this point.