

Module Details	
Module Title	Mass Transfer Operations
Module Code	CPE5004-B
Academic Year	2024/5
Credits	20
School	School of Engineering
FHEQ Level	FHEQ Level 5

Contact Hours	
Type	Hours
Directed Study	140
Laboratories	6
Lectures	42
Tutorials	12

Availability	
Occurrence	Location / Period
BDA	University of Bradford / Academic Year

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

Outcome Number	Description
01	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.
02	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.
03	Implement practical design in laboratory work.
04	Apply simplifying assumptions to complex problems to gain useful design information individually and in a team.
05	Communicate (written and verbal) the outcome of practical work.

Learning, Teaching and Assessment Strategy

This module is assessed by 1 written coursework and 1 closed book examination at the end of each of Semesters 1 and 2. Supplementary examinations will be held in the summer term. Each coursework consists of 1 critical report of group laboratory experiments and design, one on Distillation and one on Gas Absorption. The reports must include design and operation elements as well critical evaluation of the data collected. In these group laboratory experiments, particular attention must be given to Health and Safety with the students required to undertake a Risk Assessment on the rigs and to include a section on Health and Safety and a section on Sustainability of the operation in the reports submitted. The students will have two weeks to complete each of the two reports. Summative peer evaluation will be taken into account when calculating the individual mark for the coursework. Students who fail the CW are required to repeat it.

An integral part of the learning is the ability to use professional software used in industry. To that effect training in the use of software ASPEN will be given through 2x 2hr sessions in weeks 5 and 6 of semester 1 (Application to Gas Absorption Design) and semester 2 (Application to Distillation Design).

All lectures and tutorials will be supported by copies of presentations posted on the VLE. Instructions on conducting the Labs together with a video explaining the operation of the Gas Absorption and Distillation rigs will be posted on the VLE.

Mode of Assessment			
Type	Method	Description	Weighting
Summative	Examination - Closed Book	Students required to answer 3 questions from 4 on the curriculum covered in Semester 1.	45%
Summative	Laboratory Report	1 written report of 1500 words in Semester 1 on Gas Absorption.	15%
Summative	Examination - Closed Book	Students required to answer 2 questions from 4 on the curriculum covered in Semester 2.	25%
Summative	Laboratory Report	1 written report of 1500 words in Semester 2 on Distillation.	15%

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.

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