



UNIVERSITI TEKNOLOGI MARA

CHE520: PROCESS UNIT OPERATION

Course Name (English)	PROCESS UNIT OPERATION APPROVED
Course Code	CHE520
MQF Credit	3
Course Description	The syllabus introduces the students to one of the fundamentals knowledge that the students must acquire in chemical engineering. The topics covered are the principle concepts of material balance and equipment description for distillation, gas absorption, extraction and leaching. In addition to this, special topic on mass transfer would also be introduced to the students.
Transferable Skills	Upon completion of this module, students should be able to: 1. Identify various types of unit operations based on mass transfer and fluid interactions principles. 2. Apply the process principles of distillation, gas absorption, liquid-liquid extraction and leaching. 3. Perform chemical engineering calculations involving mass transfer in various unit operations.
Teaching Methodologies	Lectures, Tutorial
CLO	CLO1 Ability to identify various types of unit operations based on mass transfer and fluid interactions principles. CLO2 Ability to apply the process principles of distillation, gas absorption, liquid-liquid extraction and leaching. CLO3 Ability to perform chemical engineering calculations involving mass transfer in various unit operation equipment.
Pre-Requisite Courses	No course recommendations
Topics	
1. 1. Distillation 1.1) 1.1. Introduction to mass transfer 1.2) 1.2. Basic separation principles in distillation, vapor liquid equilibrium 1.3) 1.3. Relative volatility 1.4) 1.4. Batch distillation 1.5) 1.4.1. Rayleigh equation 1.6) 1.5. Continuous distillation 1.7) 1.5.1. Definition and description of process 1.8) 1.5.2. Reflux ratio 1.9) 1.5.3. Calculation of theoretical stages using McCabe-Thiele method and Lewis-Sorel method 1.10) 1.5.4. Overall plate efficiency and Minimum reflux ratio 1.11) 1.6. Introduction to azeotropic distillation 1.12) 1.7. Multi-component distillation (MCD) 1.13) 1.7.1. Introduction and Phase equilibria 1.14) 1.7.2. Fractionation of multi component mixtures	
2. 2. Gas Absorption 2.1) 2.1. Definition, applications and notations used in gas absorption. 2.2) 2.2. Gas-liquid equilibrium for ideal solution. 2.3) 2.3. Packed tower - description and design 2.4) 2.3.1. Packing materials – description and flow arrangement 2.5) 2.3.2. Determination of tower diameter 2.6) 2.4. Multistage countercurrent operation - graphical method to determine number of theoretical stages. 2.7) 2.5. Two film theory of gases-liquid system 2.8) 2.5.1. Rate of absorption 2.9) 2.5.2. Mass transfer coefficient- individual and overall	

2.10) 2.6. Determination of tower height

3. 3. Liquid-liquid extraction

- 3.1) 3.1. Definition and process operation
- 3.2) 3.2. Solvent selectivity
- 3.3) 3.3. Phase diagrams
- 3.4) 3.4. Single-stage calculation
- 3.5) 3.5. Multi-stage countercurrent system
- 3.6) 2.5.1. Ternary phase diagram
- 3.7) 3.5.2. Graphical method - mass balance
- 3.8) balance
- 3.9) 3.6. Liquid-liquid extraction equipment

4. 4. Solid Liquid Extraction (Leaching)

- 4.1) 4.1 Definition and process application
- 4.2) 4.2 Principles of continuous countercurrent leaching
- 4.3) 4.3 Single-stage calculation
- 4.4) 4.4 Multi-stage countercurrent system
- 4.5) 4.5 Leaching equipment

5. 5. Special topic

- 5.1) 5.1 Introduction
- 5.2) 5.2 Types of equipment used
- 5.3) 5.3 Process Operation

Assessment Breakdown	%
Continuous Assessment	40.00%
Final Assessment	60.00%

Details of Continuous Assessment	Assessment Type	Assessment Description	% of Total Mark	CLO
	Assignment	n/a	8%	CLO2 , CLO3
	Quiz	Quiz 1	6%	CLO1 , CLO2
	Quiz	Quiz 2	6%	CLO1 , CLO2
	Test	Test 1	10%	CLO1 , CLO2 , CLO3
	Test	Test 2	10%	CLO1 , CLO2 , CLO3

Reading List	Recommended Text	<ul style="list-style-type: none"> Christie J. Geankoplis 2003, <i>Transport Processes and Separation Process Principles (Includes Unit Operations)</i>, 4th Ed., 10,11, 12, 14, Prentice Hall [ISBN: 0-13-121760-7]
	Reference Book Resources	<ul style="list-style-type: none"> Coulson, M. and Richardson, J.F. (1993). Vol. 2, 4th Edition. Oxford: Pergamon Press, <i>Chemical Engineering: Unit Operations</i> McCabe, L., Smith J.C. and Harriot, P 2001, <i>Unit Operations of Chemical Engineering</i>, 6th Ed., McGraw –Hill New York Seader, J.D. and Henley, E.J (1998). New York: Wiley & Sons., <i>Separation Process Principles</i>. Treybal, E. (1990). 4th Edition. New York: McGraw-Hill, <i>Mass Transfer Operations</i>
Article/Paper List	This Course does not have any article/paper resources	
Other References	This Course does not have any other resources	