UNIVERSITI TEKNOLOGI MARA

CHE311: MASS TRANSFER AND UNIT OPERATIONS

Course Name (English)	MASS TRANSFER AND UNIT OPERATIONS APPROVED
Course Code	CHE311
MQF Credit	3
Course Description	This course involves the study of mass and heat transfer as well as the performance of equipment for solvent extraction, leaching, gas absorption and distillation.
Transferable Skills	Higher order thinking skills.
Teaching Methodologies	Lectures, Blended Learning, Tutorial
CLO	CLO1 Comprehend and define the fundamental concepts of mass transfer and separation processes. CLO2 Identify and solve engineering problems for unit operations. CLO3 Discover other types of separation process instead of the aforementioned separation processes.
Pre-Requisite Courses	No course recommendations

Topics
1. MASS TRANSFER 1.1) 1.1 Introduction to mass transfer 1.2) 1.2 Fick's law and molecular diffusion 1.3) 1.3 Applications of Fick's law: diffusion through stagnant film and equimolar counter diffusion 1.4) 1.4 Molecular diffusion in gas, liquid and solid 1.5) 1.5 Convective mass transfer and mass transfer coefficient 1.6) 1.6 Interphase mass transfer
2. DISTILLATION 2.1) 2.1 Definition and general description of the process 2.2) 2.2 Physical concepts of distillation 2.3) 2.3 Vapor-liquid equilibrium relationship 2.4) 2.4 Relative volatility 2.5) 2.5 Batch distillation 2.6) 2.5.1 Rayleigh equation 2.7) 2.6 Continuous distillation 2.8) 2.6.1 Rectification and stripping: definition and description of process 2.9) 2.6.2 Reflux ratio 2.10) 2.6.3 Number of theoretical stages for binary mixtures: Lewis Sorel and McCabe-Thiele method 2.11) 2.6.4 Overall plate efficiency 2.12) 2.6.5 Minimum reflux ratio 2.13) 2.7 Azeotropic Distillation 2.14) 2.7.1 Azeotrope / Azeotropic 2.15) Mixtures 2.16) 1.7.2 Azeotropic distillation 2.17) Process 2.18) 2.8 Multi component distillation (MCD) 2.19) 2.8.1 Boiling Point and Dew Point 2.20) 2.8.2 Number of theoretical 2.21) stages for multi component 2.22) mixtures: Lewis Matheson 2.23) method

3. LIQUID-LIQUID EXTRACTION
3.1) 3.1 Definition and cases for using liquid-liquid extraction
3.2) 3.2 Solvent selectivity
3.3) 3.3 Phase diagrams
3.4) 3.4 Single-stage calculation
3.5) 3.5 Multi stages calculation for counter-current flow
3.6) 3.5.1 Partially miscible system – ternary phase diagram
3.7) 3.5.2 Immiscible system –
3.8) graphical method
3.9) 3.6 Liquid-liquid extraction equipment

4. GAS ABSORPTION
4.1) 4.1 Definition, applications and notations used in gas absorption
4.2) 4.2 Gas-liquid equilibrium for ideal solution according to Raoult's Law
4.3) 4.3 Two film theory of gases-liquid system
4.4) 4.3.1 Rate of absorption
4.5) 4.3.2 Evaluation of mass transfer
4.6) coefficient- individual and
4.7) overall
4.8) 4.4 Packed tower - description and design
4.9) 4.4.1 Packing materials – description and flow
4.10) arrangement
4.11) 4.4.2 Pressure drop and flooding in packed tower – determination of tower diameter
4.12) 4.4.3 Determination of tower Height
4.13) 4.5 Plate tower - description and design
4.14) 4.5.1 Introduction to plate tower
4.15) 4.5.2 Multistage countercurrent operation - graphical
4.16) method to determine number of theoretical
4.17) stages.

5. LEACHING
5.1) 5.1 Principles of continuous countercurrent leaching
5.2) 5.2 Single stage calculation
5.3) 5.3 Multi-stage countercurrent system
5.4) 5.4 Leaching equipment

6. SPECIAL TOPICS
6.1) n/a

Assessment Breakdown	%
Continuous Assessment	40.00%
Final Assessment	60.00%

Details of Continuous Assessment

Assessment Type	Assessment Description	% of Total Mark	CLO
Assignment	Assignment 1: Chapter 1 & 2	10%	CLO1 , CLO2
Assignment	Assignment 2: Chapter 3, 4, 5	10%	CLO1 , CLO2
Group Project	Case Study on Other Separation Process	10%	CLO1 , CLO2 , CLO3
Test	Test 1	5%	CLO1 , CLO2
Test	Test 2	5%	CLO1 , CLO2

Reading List

Recommended Text

- **Geankoplis C.J 2003, *Transport Processes and Separation Process Pr*, 4 Ed., New York:Prentice Hall**

Reference Book Resources

- **McCabe,L.,Smith,J.C. and Harriot,P 1999, *Chemical Engineering*, 5 Ed., NewYork:McGraw-Hill**
- **Trybal,E 1999, *Mass-Transfer Operations*, 2 Ed., New York:McGraw-Hill**
- **Coulson,M and Richardson,J.F 1999, *Chemical Engineering:Unit Operations,Vol.2*, 4 Ed., Oxford:Pergamon Press**

Article/Paper List: This Course does not have any article/paper resources

Other References: This Course does not have any other resources