



UNIVERSITI TEKNOLOGI MARA

CHE591: PROCESS ENGINEERING I

Course Name (English)	PROCESS ENGINEERING I APPROVED
Course Code	CHE591
MQF Credit	3
Course Description	This course deals with more detailed concepts in mass transfer and enhanced theory in separation process principles. These comprise the applications of the theory and concept in several major unit operations of chemical engineering including evaporation, drying of process materials, ion exchange, chromatography, reverse osmosis, ultrafiltration, microfiltration, nano filtration, dialysis and electro dialysis.
Transferable Skills	Upon completion of this course, the students should be able to: 1. Identify mass transfer and separation process principles in solving several unit operations such as adsorption, chromatography, drying, evaporation, ion exchange and membrane separation processes. 2. Apply mass transfer and separation process principles in solving several unit operations such as adsorption, chromatography, drying, evaporation, ion exchange and membrane separation processes. 3. Perform basic design calculation for separation processes equipment: evaporator, adsorption column, dryers, ion exchange column and membrane
Teaching Methodologies	Lectures, Tutorial, Presentation
CLO	CLO1 Ability to identify mass transfer and separation process principles in solving several unit operations such as adsorption, chromatography, drying, evaporation, ion exchange and membrane separation processes. CLO2 Ability to apply mass transfer and separation process principles in solving several unit operations such as adsorption, chromatography, drying, evaporation, ion exchange and membrane separation processes. CLO3 Ability to perform basic design calculation for separation processes equipment: evaporator, adsorption column, dryers, ion exchange column and membrane.
Pre-Requisite Courses	No course recommendations
Topics	
1. Evaporation 1.1) • Introduction to evaporation. 1.2) • Types of evaporation equipments and operation methods 1.3) • Overall heat-transfer coefficients in evaporators 1.4) • Single effect and multi-effect evaporators 1.5) • Evaporation of biological materials 1.6) • Evaporation using vapor recompression	
2. Drying of processes materials 2.1) • Introduction and methods of drying 2.2) • Vapor pressure of water and humidity 2.3) • Equilibrium moisture content of materials 2.4) • Rate of drying curves 2.5) • Calculation methods for constant-rate & falling-rate drying periods 2.6) • Combined convection, radiation & conduction heat transfer in constant rate period 2.7) • Drying in falling-rate period by diffusion and capillary flow 2.8) • Equation for various types of dryers 2.9) • Freeze-drying of biological materials	

3. Adsorption, chromatography, ion exchange and crystallization

- 3.1) Adsorption
- 3.2) • Sorbents: adsorbents, ion exchangers and sorbents for chromatography
- 3.3) • Equilibrium considerations
- 3.4) • Kinetic and transport considerations
- 3.5) • Adsorption-introduction to adsorption processes, batch adsorption and design on fixed bed adsorption column
- 3.6) Chromatography
- 3.7) • Chromatography-Batch, Countercurrent and Continuous Co-Current Chromatography Separations
- 3.8) Ion exchange
- 3.9) • Ion exchange-ion exchange processes and ion exchange cycle
- 3.10) Crystallization
- 3.11) • Crystallization-introduction and equipment for crystallization and crystallization theory

4. Membrane separation processes

- 4.1) • Introduction and types of membrane separation processes
- 4.2) • Liquid permeation and gas permeation
- 4.3) • Complete mixing models for gas separation and multicomponent mixtures
- 4.4) • Cross-flow model for gas separation and multi components mixtures
- 4.5) • Reverse osmosis: applications, equipment and models

5. Special topics

- 5.1) • Discussion on current problems and issue related mass transfer processes

Assessment Breakdown	%
Continuous Assessment	40.00%
Final Assessment	60.00%

Details of Continuous Assessment	Assessment Type	Assessment Description	% of Total Mark	CLO
	Assignment	This assignment falls under special topic chapter and the report to be presented in Week 14.	10%	CLO1 , CLO2
	Quiz	Quiz 1	5%	CLO1 , CLO2
	Quiz	Quiz 2	5%	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>, Prentice Hall US [ISBN: 0-13-121760-7]
	Reference Book Resources	<ul style="list-style-type: none"> Warren Lee McCabe, Julian Cleveland Smith, Peter Harriott, <i>Unit Operations of Chemical Engineering</i>, Mc Graw Hill [ISBN: 0-07-118173-3] i. Seader, J.D., and Earnest J. Henley. (1998). <i>Separation Process Principles</i>. John Wiley & Sons, <i>Separation Process Principles</i>.
Article/Paper List	This Course does not have any article/paper resources	
Other References	This Course does not have any other resources	