هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

T-104
2022

Course Specification

Course Title:	**Separation Process**
Course Code:	**221 CHET**
Program:	**Chemical Engineering Technology (CHET)**
Department:	**Chemical Engineering Technology**
College:	**College of Applied Industrial Technology (CAIT)**
Institution:	**Jazan University**
Version:	**V2022-Eng-revised**
Last Revision Date:	**01 March 2024**

Table of Contents:

A. General information about the course:

Course Identification					
1. Credit hours:	3 hours **(Contact hours: 4 hours/ week)**				
2. Course type					
a.	University ☐	College ☐	Department ■	Track☐	Others☐
b.	Required ■	Elective☐			
3. Level/year at which this course is offered:	**Level 5/ Third Year**				

4. Course general Description

This course deals with the application of the science and engineering science that you have learned to the separation of chemical and biological mixtures. Specific processes considered will include distillation, gas absorption, extraction, adsorption, and membrane-based processes. The object of the subject is to understand how separation work, and to further develop your ability to apply basic principles to the solution of specific problems. Laboratory experiments and/or exercise problems support the theoretical classes

- This course introduces fundamentals of equilibrium-based unit operations frequently encountered in industry which include distillation, absorption and membrane etc.
- This course covers the fundamental concepts of equilibrium-based analysis of separation processes and gives examples of relevant separation processes. It introduces the concept and analysis of a unit operation as applied to separation processes and demonstrates the analysis of relevant separation processes by applying mass and energy balance methods.

Distillation covers fractional, vacuum, steam, extractive, and azeotropic operations. The course also covers mixing processes and dimensionless numbers utilized for mass transfer calculation.

5. Pre-requirements for this course (if any): **192 CHEM**

6. Co- requirements for this course (if any): None

7. Course Main Objective(s)

This course is designed for the 5th level students in chemical engineering. Separation processes constitute important unit operations in chemical process industries. Distillation is the most widely used industrial separation process. Good contact between two fluid phases is vital for effective separation in all processes that work by direct contact. Area of contact available per unit volume is an area of on-going development.
The overall objective of this section is to give the students visual illustration on the internals of gas/vapour-liquid contacting devices used to improve separation performances. At this point the course would be able to satisfy the following objectives:

- Explain how separations are used in a typical chemical plant
- Define the concepts of equilibrium stages and unit operations
- Explain what is meant by phase equilibrium
- Explain the basic concepts of mass transfer
- List the steps in the structured problem-solving approach and start to use this approach
- Have some familiarity with the prerequisites

The object of the subject is twofold: to understand how separation work, and to further develop your ability to apply basic principles to the solution of specific problems.

1. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1.	Traditional classroom	48	100
2.	E-learning	--	--
3.	Hybrid • Traditional classroom • E-learning	--	--
4.	Distance learning	--	--

2. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	24
2.	Laboratory/Studio	24
3.	Field	--
4.	Tutorial	--
5.	Others (specify)	--
	Total	48

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	Explain the fundamentals and principles of separation processes.	K1	• Lectures/Presentations	• Quizzes/ • Mid exam • Assignment • Class Activity • Final Exam
2.0	Skills			
2.1	Study the steps involved in the distillation process, types, and essential component of gas absorption, stripping, drying, crystallization, and membrane separations.	S1.1	• Lectures / • Presentations	• Quizzes/ • Mid exam • Assignment • Class Activity • Final Exam
2.2	Evaluate the energy and calculations involved with the type of separation processes.	S2.2	• Lectures / • Presentations	• Quizzes/ • Mid exam • Assignment • Class Activity • Final Exam
2.3	Compute other processes like LLE, gas absorption, and drying based on the	S4.2	• Lectures / • Presentations	• Quizzes/ • Mid exam • Assignment

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	energy requirements for the processes.			• Class Activity Final Exam
2.4				
3.0	Values, autonomy, and responsibility			
3.1	Manage deadlines for the given tasks by utilizing the information from several sources of information.	V1.1	• Group Discussion • Active learning • Lab Activity	• Lab Exercise • Marks will be given according to participation in classroom, Lab exam
3.2	Show independent timeliness; work in the classroom, effective contribution with the interpersonal skills and managed team work.	V2.2	• Group Discussion • Active learning • Lab Activity	• Lab Exercise • Participation in classroom
3.3				

C. Course Content

No	List of Topics	Contact Hours
1.	**Introduction to separation process:** fundamentals, mechanism and equilibrium relationships, types and structure of membranes, membrane	4

	permeation of liquids and gases, effects of concentration, pressure and temperature and industrial applications.	
2.	**Distillation processes:** main parts and function of distillation, types of distillation, muliticomponet separations, azeotropic and extractive distillation.	4
3.	**Design of fractionation columns:** exact calculation of number of stages by Mcab Thiel method, basic assumptions.	3
4.	**Gas absorption, stripping**	3
5.	**Liquid-liquid extraction, applications,** selectivity - choice of solvent - single-stage and multistage operations, leaching - factors affecting the rate of leaching - stage efficiency.	3
6.	**Membrane separations,** adsorption, types of adsorption, nature of adsorbents, adsorption equilibria.	3
7.	**Drying,** rate of drying, humidification, dehumidification and crystallization.	3
8.	Review of course	1
9.	Self Study (few selected topics)	--
10.		
Total		24

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Class activities (Quiz-1/Assignments/Labs)	Week 2 till Week 11	10%
2.	Oral discussion/Homework and participation in classroom/BB/Assignment/	All weeks	10%

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
3.	Midterm	Week 6	20%
.4	Quiz-2/ Self study	--	20%
5.	Final Term Exam	As scheduled	40%
6.	***Total***		**100%**

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	• Classroom policy • Soft and hard copies of lecture notes and some of sections from Separation Process Principles, J.D. Seader and E.J. Henley, Second Edition, John Wiley % Sons, 2006 • Phillip C Wankat - Separation process engineering _ includes mass transfer analysis-Prentice Hall. • Coulson and Richardson's Chemical Engineering Series, Volume 2 Particle Technology and Separation Processes, J.F. Richardson, J.H. Harker and J.R. Backhurst, Butterworth Heinemann, Oxford, Fifth Edition, 2002.
Supportive References	• Transport processes and Unit Operations, second edition, Prentice hall international, (1993) inc., by Christil J Geankolpis. ISBN 0-13-045253- • Warren L. McCabe, Julian C. Smith and Peter Harriott, Unit Operations Of Chemical Engineering, 5th Ed. (1993) ISBN 0-07-112738-0.
Electronic Materials	• Lecture slides (other reading materials) • https://sites.google.com/site/santhirajupilli/lecture-notes_jazan-university/chet-231-separation-properties
Other Learning Materials	• Virtual lab Videos/LAB demos

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• Classroom equipped with projector and whiteboard and enough seating arrangements. • Laboratory with required equipment setups and with a lab instructor. • Appropriate Seating arrangements
Technology equipment (projector, smart board, software)	• Smart Board • Internet connectivity • Speakers (for audio)
Other equipment (depending on the nature of the specialty)	• Whiteboard of good quality (to be used as a screen for playing videos as well) • Whiteboard markers • Paper for photocopying

Items	Resources
	• Photocopying and printing facilities for the teachers and the students

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Quality Assurance and Accreditation Unit/Faculty	Quizzes, Assignments, exams **Direct**
Effectiveness of students assessment	CRC / QAU / HoD	Direct/ Indirect
Quality of learning resources	Track leaders / CRC	Indirect
The extent to which CLOs have been achieved	HoD / committee nominated by HoD	Random re-checking of evaluated answer sheets Surveys designed by the CHET dept. faculty/ University - distributed among the course instructors. **Direct/ Indirect**
Other	Course Instrcutor / QAU	CLO assessment template that is further verified at course coordinator and QAU level.

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data

COUNCIL /COMMITTEE	**Chemical Engineering Technology**
REFERENCE NO.	**CAITCET24012**
DATE	**01 March 2024**