University of Jordan
School of Engineering
Chemical Engineering Department

1. **Course number and name: (0915451) Separation Processes (1)**
2. **Prerequisites: Transport Phenomena (2) (0915342)**
1. **Class schedule:** 3 credits
    a. Time and place: Specified according to schedule of the semester
    b. Office hours: : Specified according to schedule of the semester
2. **Instructor:** Determined later
3. **Text book:** Christie John Geankoplis, Transport processes and separation process principles, 5 edition Prentice Hall; (March 15, 2018)

4. **References:**
    1. **J. D. Seader, Ernest J. Henley, D. Keith Roper, separation process principles, Wiley, 2011**
    2. Coulson, J.M.; and Richardson, J.F.; Chemical Engineering Volume 2, 5th Ed., 1999, Butterworth-Heinemann

5. **Course information:**
Material balance on steady-state continuous co-current and counter current processes. Distillation: Equilibrium data, batch, flash, continuous binary steady state distillation, multicomponent, steam, Gas absorption: Equilibrium data, multistage continuous contacting, non-isothermal, multi-component, design of trays and packed columns. Solvent extraction: Phase equilibria, stage wise calculations, transfer units, tower design, and mixer-settler. Design of stirred vessel systems. Leaching: Equilibrium relations, stage-wise calculations

6. **Course objectives and Outcomes:**

This course is devoted primarily to the basic principles and practical applications of fluid mechanics. Upon the successful completion of the course, the student will be able to:	**Chemical Engineering program outcomes:**						
	O1	O2	O3	O4	O5	O6	O7
Classify various operations as phase creation, addition, barrier, solid agent, external field/gradient separation process.	■						
Identify importance, industrial applications, different types, mode of operations, and selection criteria.	■						
Deal with various phase diagrams, Txy, yx diagrams, enthalpy-concentration diagrams, and other chemical engineering tables/diagrams related to the separation processes considered.	■						
Examine both equilibrium controlled separation processes as well as separation processes that involve both heat/mass transport.	■						
Design single stage and multistage equilibrium chemical processes for distillation, absorption, liquid-liquid extraction and leaching,		■		■			
Solve separation problems related to distillation, absorption, liquid-liquid extraction and leaching.	■						

7. Topics covered:

Content	Text book	Ref. 1	Week
Vapor-Liquid Separation Processes ***Topics Covered:*** Vapor liquid Equilibrium, Simple Distillation Methods: flash distillation, batch distillation.	**Ch 26**	**Ch 2 + ch 4**	**1+2**
Continuous distillation ***Topics Covered:*** Distillation with reflux, McCabe Thiele Method, ponchon savarit method: Enthalpy concentration diagram	**Ch 26**	**Ch 4**	3-5
Design of Vapor-Liquid Separation equipment ***Topics Covered:*** Tray column, packed bed column.	**Ch 26**	**Ch 5**	6
Stage and Continuous Gas-Liquid Separation **Processes** ***Topics Covered:*** Gas--Liquid Equilibrium, Single-Stage Equilibrium Contact for Gas-Liquid System, Multiple-Contact Stages, Mass Transfer Using Film Mass-Transfer Coefficients and Interface Concentrations, Overall Mass-Transfer Coefficients and Driving Forces	Ch 22	**Ch 6**	7+8
Absorption in Plate and Packed Towers ***Topics Covered:*** Design of Plate Packed bed Absorption Towers.	Ch 22	**Ch 6**	9
Extraction: Equilibrium Relations in Extraction, Single-Stage Equilibrium Extraction, continuous multi stage Extraction, extraction equipment, Design of Towers for Extraction	Ch 27	Ch.8	10+13
Leaching: Equilibrium Relations in Leaching, Single-Stage Leaching, continuous multi stage Leaching, Types of Equipment for Leaching,	Ch. 31		14+15
Final exams			16

8. Minimum student materials: Text book, class handouts, engineering calculator, and an access to Personal Computer with MATLAB and/or Excel.

9. Instructional methods:
Lectures, group assignments, class discussion and problem solving Projects and Assignments

10. Homework Assignments:

Assignments are due at the beginning of the class period on the specified date; late homework will NOT be accepted (i.e it will be awarded a zero). Please write only on one side of the page. Your name and ID number should be clearly written on first page. Start each problem on a new page. Clearly mark your answers in a box (Never use a red pen in your work). Staple the pages together.

11. Assessment & Grading:

Quizzes & Assignments	:	20%
Midterm Exam	:	30%
Final exam	:	50%
Total	**:**	**100%**

12. Relationship to Program Outcomes (%)

O1	O2	O3	O4	O5	O6	O7
√	√					

13. Relationship to Chemical Engineering Program Objectives

PEO1	PEO2	PEO3	PEO 4
√	√	√	√

14. Notes:

a. Discuss the assignments among yourselves. This is helpful to the learning process. However, direct copying of others work will NOT be allowed or tolerated and will result in a reduction of grade.

b. All cases of academic dishonesty will be handled in accordance with university policies and regulations.

c. There will be a number of unannounced quizzes during the semester. Students are expected to be ready to take a quiz any time they have a class. There will be no make-up quizzes.

d. Students are expected to attend EVERY CLASS SESSION and they are responsible for all material, announcements, schedule changes, etc., discussed in class. The university policy regarding the attendance will be strictly adhered

e. Any students with disabilities who need accommodations in this course are encouraged to speak with the instructor as soon as possible to make appropriate arrangements for these accommodations.

f. Exams are scheduled as shown in the syllabus and last 90 minutes. The exams are close textbook and notes. It is your responsibility to bring a calculator, pencils and paper. If you MUST miss one of these exams for an emergency situation, please let me know as soon as possible. If you oversleep or skip an exam you will not have an opportunity to make it up. If you have a valid (according to me) time conflict and you let me know in advance, there is the possibility of taking an exam at an alternate time.

15. ABET Criteria : Outcomes and Assessment: Engineering programs must demonstrate that their graduates have

O1 Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

O2 Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

O3 Communicate effectively with a range of audiences.

O4 Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

O5 Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

O6 Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

O7 Acquire and apply new knowledge as needed, using appropriate learning strategies.