ABET-Course Syllabus

1. **Course number and name: (0935442) Heat and Mass Transfer Operations**
2. **Class schedule:** 3 Credits Hours
   a. Time and place: Section 1: Sun., Tue., and Thur.: 09:00-10:00 at Al-Taher Hall
   Section 2: Sun., Tue., and Thur.: 11:00-12:00 at Al-Taher Hall
   b. Office hours: Sun: 12:00 -13:00 and Mon: 11:00-12:00
3. **Instructor:** Prof. Mohammad Al-Shannag
   Office Tel. number: 5355000, Ext.: 22903
   Email: m.shannag@ju.edu.jo ; mohammad_al_shannag@hotmail.com
4. **Textbook:**
   - Geankoplis, C.J., Transport Processes and Separation Process Principles, 4th Ed, Prentice Hall, 2003.
   - Power point slides provided by instructor.

   Other interesting references:
   - **Books:**
     - Henley E.J.; Seader J.D.; Roper D.K., Separation Process Principles, 3rd Ed., John Wiley and Sons, New York, 2011.
     - McCabe, W.L.; Smith, J.C.; Harriott, P., Unit Operations of Chemical Engineering, 7th Ed., McGraw Hill, 2005.
     - Coulson, J.M.; and Richardson, J.F.; Chemical Engineering Volume 2, 5th Ed., Butterworth-Heinemann, 1999.
     - Treybal, R. E., Mass Transfer Operation, 3rd Ed. McGraw Hill, 1980.
     - Wankat P. C., Separation Process Engineering Includes Mass Transfer Analysis, 3rd Ed., Prentice Hall, 2003.
   - **Selected Journals:**
     - International Communications in Heat and Mass Transfer: http://www.sciencedirect.com/science/journal/07351933/26/6
     - Heat and Mass Transfer http://link.springer.com/journal/231
     - Chemical Engineering Journal: http://www.journals.elsevier.com/chemical-engineering-journal/
     - Separation Science and Technology: http://www.tandfonline.com/action/journalInformation?journalCode=lsst20#.VghFbMuqqkp
5. **Course website**: https://elearning.ju.edu.jo//
6. **Course information:**
   a. Catalog description: Humidification: equilibrium data, adiabatic and non-adiabatic operations, evaporative cooling, cooling towers; Drying: definitions, batch, mechanism of drying, drying at low temperature, continuous drying, material and enthalpy balances, design of driers; Crystallization: theory, batch and continuous, equilibrium enthalpy balances, design of different types of crystallizers; Evaporation: single and multiple effects, and flow arrangements, heat pumps, barometric condensers; Adsorption and ion-exchange: stagewise adsorption, continuous adsorption, design using LUB concept and regeneration; Dialysis and reverse osmosis.
   b. Prerequisite: Mass Transfer Operations (0935441), Materials Science and Engineering (0915331)

c. Course classification: Mandatory course in the B.Sc. program.

7. Specific goals of the course:

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 of evaporation, liquid-liquid extraction, leaching, crystallization, humidification/dehumidification, and drying processes.	■						
Deal with various phase diagrams, humidity charts, enthalpy-concentration diagrams, steam tables 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 evaporation, liquid-liquid extraction, leaching, crystallization, humidification/dehumidification, and drying.		■		■			
Solve separation problems related to evaporation, liquid-liquid extraction, leaching, crystallization, humidification/dehumidification, and drying.	■						

8. Course topics: Course topics will be covered through around 28 (75 minutes) classes according to the following distribution:

Content	Reference(s)	# of lectures
• **General Separation Techniques**	Seader et al. (Ch.1)	1
• **Evaporation**	Geankoplis (Ch. 7) Seader et al. (Ch.17)	6
• **Extraction**	Geankoplis (Ch. 12) Seader et al. (Ch.8)	
• **Leaching**	Geankoplis (Ch. 12)	
Midterm exam		
• **Crystallization**	Geankoplis (Ch. 12) Seader et al. (Ch. 17) McCabe & Smith (Ch. 27)	4
• **Humidification and cooling towers**	Geankoplis (Ch. 9 & 10) McCabe & Smith (Ch. 19) Seader et al. (Ch. 18)	6
• **Drying**	Geankoplis (Ch. 9) Seader & Henley (Ch. 18)	4
Final Exam		

9. Policies and procedures:

Attendance. Students are expected to attend each class session and they are responsible for all material, announcements, and schedule changes discussed in class. University policy states that teachers must keep a record of attendance throughout the semester and may impose academic penalties commensurate with the importance of the work missed because of unexcused absences.

Lateness. Coming late to class is disruptive and may be treated as an unexcused absence.

Computer skills. You are encouraged to use computer softwares such as excel, Matlab, or Polymath to perform the required computations and to represent your findings in graphs or tables.

Grading policy. A weighted average grade will be calculated as follows:

- First exam	30%
- Second exam:	30%
- Final exam:	40%

10. Contribution of Course to Meeting the Professional Component:

This course contributes to building the fundamental and design concepts in separation processes.

11. Relationship to Program Outcomes (%):

O1	O2	O3	O4	O5	O6	O7
50	40		10			

12. Relationship to Chemical Engineering Program Objectives:

PEO1	PEO2	PEO3	PEO 4
√	√	√	√

Prepared by: Prof. Mohammad Al-Shannag
Last Modified: September 22, 2025