The University of Jordan
School of Engineering
Chemical Engineering Department

Program: B.Sc.
Academic Year:
Semester:

CHE 0915351: Unit operations of Particulate solids
Course Catalog (2024)

Characterization of solids: solid properties, size analysis, solids in bulk, handling and flow of solids, size reduction. Fluid particle systems: packing and packed columns, sedimentation, filtration, centrifugation, mixing, flotation and fluidization.

Credit hours	3	level	3	**Pre-requisite(s)**	**0905241, 0905302**
Instructor Prof. Yahya Khraisha	**Office number CHE000**			**Office phone** Ext. 22881	
Course website https://elearning.ju.edu.jo/login/index.php Live Streaming Platform: Microsoft Teams		**E-mail** **khraisha@ju.edu.jo**		**Place** Refer to Registration website	

Textbooks:

- Coulson and Richardson's Chemical Engineering, 6th ed., Vol. 2A: Particulate Systems and Particle Technology, Editors: R. P. Chhabra Basavaraj Gurappa, Butterworth-Heinemann, 2019.
- J.M.Coulson and J.F.Richardson," Chemical Engineering", Vol.2, 4th ed., Pergamon Press, 2002.
- Handouts

References:

- Martin Rhodes, "Introduction to Particle Technology", 2nd ed., John Wiley & Son Ltd., 2008.
- R.H.Perry and C.H. Chilton, "Chemical Engineers Handbook" ,McGrow- Hill,1987.
- Coulson, J. M. & Richardson, J. F., Chemical engineering, vol. 6, Pergamon Press, Oxford, 2003.
- W.L.McCabe, J.C.Smith and P.Harriot, "Unit Operations of Chemical Engineering", McGrow- Hill, Fifth Edition,1993.

Learning Objectives and Intended Learning Outcomes

Objectives	Outcomes
1. Basic understanding of operations of solid particulates and its importance to chemical engineering applications.	**1.1** Gain knowledge to identify the characteristics of an individual particle (particle shape, sphericity, solid and bulk density, particle size). **O1**

	1.2 Realizing the important operations relating to systems of particles, such as storage in hoppers and mixing two or more solids. **1.3** Understand the science of particles in bulk behavior and unit operations processes. **O1**
2. Developing a fundamental understanding of the basic principles of solid particulates	**2.1** Demonstrate ability to identify the important physical mechanisms occurring in processes involving particles. **O1** 2.2 Demonstrate ability to characterize the particle size distribution in the mixture and to define a mean size. **O1, O2**
3. Realizing the important operations relating to systems of particles, such as storage in hoppers and mixing two or more solids.	3.1 Understand the science of particles in bulk behavior and unit operations processes**. O1**
4. Particle mechanics analysis for spherical and non-spherical particles.	**4.1** Understand the analysis of forces on spherical and non-spherical particles moving in gravitational and centrifugal fields. **O1** 4.2 Finding the terminal falling velocities for different regimes (Stokes', transition and form drag regimes). **O1**
5. Fundamental understanding of the particles preparation, separation and motion.	**5.1** Demonstrate ability to describe and analyze the processes of crushing, grinding, classification, flotation, thickening and particles transport. **O1**, **O2** **5.2** Know the interaction between the particles and the surrounding fluid. **O1**
6. Designing of unit operations involving solid particulate materials.	**6.1** Apply knowledge from general science and engineering courses to design and solve problems in unit operations related to solid particulates in different application **O1** 6.2 Realize the concept of flow of fluids through granular beds and packed columns, and particles fluidization **O1, O2**
7. Enhance the ability of students for life-long learning and communication skills.	7.1 Enhance students' skills through intensive use of available data resources and short projects with written and oral presentations. **O7**

Topics Covered

Week	Topic	Ref.
1	Introduction & Syllabus	Handouts, Textbook
2-3	Characterization of single particle	Handouts, Textbook
4	Solid particulates in bulk	Handouts, Textbook
5	Mixing and blending of solid particles	Handouts, Textbook
6	Solid particles separation	Handouts, Textbook
7-8	Size reduction	Handouts, Textbook
9-10	Motion of particles in gravitational and centrifugal fluids	Handouts, Textbook
11-12	Flow through granular/fixed bed (Packed column)	Handouts, Textbook
13-14	Sedimentation	Handouts, Textbook
15	Fluidization	Handouts, Textbook
16	Filtration	Handouts, Textbook

Evaluation

Evaluation tools	**Weight**	**Dates**
Midterm Exam	30	Will be announced by the department
Project	10	Will be arranged between the 5th and 16th weeks
Quizzes and activities	10	-
Final Exam	50	Will be announced by the University

Relationship to Program Outcomes

O1	O2	O3	O4	O5	O6	O7				
X	X					X				

Relationship to CHE Program Objectives

PEO1	PEO2	PEO3	PEO4	PEO5	PEO6	PEO7	PEO8	PEO9	PEO10	PEO11
√	√	√		√						

Document Control

Prepared by	Prof. Yahya Khraisha
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