



## ChE 362: Unit Operations

3 credit hour, 3 contact hour lecture, 3 credit hour Eng.

### Instructor

Instructor: Dr. Mohammad Al-Harabsheh

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### Textbooks & References

#### A. Textbook

	Textbook 1	
<b>Title</b>	Unit Operations of Chemical Engineering	Chemical Engineering; Volume 2
<b>Author(s)</b>	McCabe W.L., Smith J.C. and Harriot, P	Coulson J.M., Richardson J.F., Backhurst J.R. and J.H. Harker
<b>Publisher</b>	McGraw-Hill	Butterworth Heinemann
<b>Year</b>	2005	1991
<b>Edition</b>	7 <sup>th</sup>	4 <sup>th</sup>

#### B. References

1. Geankoplis C.J. "Transport Processes and Separation Process Principles", 4<sup>th</sup> edition, Prentice Hall, 2003.
2. Martin Rhodes, Introduction to particle technology, 2<sup>nd</sup> Ed. Wiley, 2008.
3. Perry J. H. (ed.) "Chemical Engineers' Handbook", 6<sup>th</sup> edition, McGraw-Hill, 1984.

### Specific Course Information

#### A. Course Catalog:

Characterization of solid particles, Storage of solids, Drag and drag coefficients, Flow through beds of solids, Mechanics of particle motion, Settling, Fluidization, Size Reduction, Screening, Filtration, Gravity sedimentation processes, Separation by centrifuges, Separation by cyclones, Evaporation.

#### B. Prerequisites or co-requisites

CHE 345 Heat Transfer

#### C. Required/Elective or Selected Elective

### Objectives and Outcomes\*

1. Understand the properties of particulate solids [1]
2. Analyze the data taken from screening test [1,6]
3. Understand the different regions on the drag coefficient-Re plots [1]
4. Derive the one-dimensional equation of motion of particle through fluid in both gravitational and centrifugal fields [1,6]

\* Number in brackets refer to the Program outcomes

5. Understand the flow of fluids through fixed beds [1]
6. Understand the principles of free and hindered settling [1]
7. Understand the phenomenon of fluidization [1,2,6]
8. Understand the principle of operation of different types of crushers, grinders, and cutting machines [1]
9. Apply Rittinger's, Kick's, and Bond's laws to estimate energy requirements in size reduction operations [1,2,6]
10. Understand the principles of cake filtration [1,2,6]
11. Understand the principles of gravitational settling processes [1,2,6]
12. Understand the principles of centrifugal settling processes [1,2,6]
13. Applying energy and material balances to single effect evaporators [1,2,6]

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### Contribution of Course to Meeting the Professional Component

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#### Relationship to Student Outcomes (%)

1	2	3	4	5	6	7
40	30				30	

#### Relationship to Chemical Engineering Program Objectives

PEO1	PEO2	PEO3	PEO4	PEO5	PEO6
√	√	√	-	√	-

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### Topics Covered

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Week#1	Introduction + Properties of Particulate Solids	Ch28 (1)&Ch1 (2)
Week#2	Properties of Masses of Particles & Storage of solids	Ch28 (1) &Ch1 (2)
Week#3	Size Reduction	Ch 28
Week#4	Drag and drag coefficients	Ch 7
Week#5	Flow through beds of solids	Ch 7
Week#6	Mechanics of particle motion	Ch 7
Week#7	Settling	Ch 7
Week#8-9	Fluidization	Ch 7
Week#10-11	Filtration	Ch 29
Week#12	Gravity sedimentation processes	Ch 29
Week#13	Separation by centrifuges	Ch 29
Week#14	Evaporation	Ch 29

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### Evaluation

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Homework & Quizzes	10%
First Exam	25%
Second Exam	25 %
Final Exam	40 %