CM2200
Introduction to Minerals and Materials Processing

Curricular Designation: Elective

Catalog Description:

Fundamentals of minerals processing, raw materials production, and extractive metallurgy, including primary metals production. MWF 1:05-1:55 PM, Room 211, Chemical Sciences and Engineering Building. 3.0 credits: 3 lecture, 0 recitation, 0 laboratory

Textbooks(s) and/or Other Required Materials:

Mineral Processing Technology, by B. A. Wills

Prerequisies by Topic:

High-school level physics, chemistry, and mathematics.

Course Objectives:

- Master the principles involved in the extraction of metals, commodity chemicals, and other materials from natural minerals and recycled industrial byproducts.
- Familiarity with the physical, chemical, and thermal treatments of minerals needed to prepare them for further processing and to extract useful materials from low-value feedstocks.
- Familiarity with the unit operations used in processing particulate materials and how they are integrated to create an entire process.
- Introduction to technical report writing.

Topics Covered:

1. Process Accounting and Control
2. Particle Size Analysis
3. Fine Particle Production
4. Crushers and Grinding Mills
5. Industrial Particle Size Control
6. Screens and Gravity Classifiers
7. Hydrocyclones
8. Particulate Separation Processes
9. Heavy-Media Separations
10. Jigging and Hindered Settling
11. Flowing Film - Spirals, Tables, and Cones
12. Froth Flotation
13. Column Flotation
14. Magnetic Separators
15. Electrostatic Separators
16. Dewatering and Materials Handling
17. Thickeners
18. Filters and Centrifuges
19. Primary Metal Production
20. Smelting and Refining Basics
21. Hydrometallurgy Basics
22. Copper, Aluminum, Steel, Precious Metals, Rare Metals

Class/Laboratory Schedule (note: 1 hour = 50 minutes)**:**

Lecture: 40.5 hours = 3 hours/week for 14 weeks; one 1.5 h holiday
Laboratory: 2 hours, by arrangement
Plant Trip: 6 hours, to an operating mineral processing or primary metal production plant

Contribution of Course to Meeting the Professional Component: Mathematics and Basic Sciences

Relationship of Course to Program Outcomes:

Outcome	Topics and Level of Coverage			Comments/Examples
	Important	***Moderately important***	***Not covered***	
a) Apply knowledge of mathematics, science, and engineering	`1-22			All topics are math, science, and engineering.
b) Design and conduct experiments, analyze and interpret data			x	
c) Design a system, component, or process to meet desired needs			x	
d) Function on a multi-disciplinary team			x	
e) Identify, formulate, and solve engineering problems		1-22		
f) Understand professional and ethical responsibility		1		
g) Communicate effectively		1-22		Formal reports required for laboratory sessions and plant trip
h) Understand global and social impact of engineering solutions			x	
i) Recognize the need for life-long learning			x	
j) Demonstrate knowledge of contemporary issues			x	
k) Use the techniques and tools of modern engineering practice			x	

Relationship of Course to AIChE Program Criteria:

Outcome	Topics and Level of Coverage			Comments/Examples
	Important	***Moderately important***	***Not covered***	
A-1) Thorough grounding in chemistry and a working knowledge of advanced chemistry such as organic, inorganic, physical, analytical, materials chemistry, or biochemistry, selected as appropriate to the goals of the program	`	x		
A-2) Working knowledge, including safety and environmental aspects of material and energy balances applied to chemical processes	x			Extensive application of mass balance and process accounting
A-3) Thermodynamics of physical and chemical equilibria		x		
A-4) Heat, mass, and momentum transfer			x	
A-5) Chemical reaction engineering			x	
A-6) Continuous and stage-wise operations	x			
A-7) Process dynamics and control		x		
A-8) Process design			x	
A-9) Modern experimental and computing techniques			x	

Prepared by:

S. K. Kawatra, Professor of Chemical Engineering, August 26, 2010