



## ChE 462: Extractive Metallurgy

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

### Instructor

Instructor: Dr. Mohammad Al-Harabsheh

E-mail: [msalharabsheh@just.edu.jo](mailto:msalharabsheh@just.edu.jo)

### Textbooks & References

#### A. Textbook

	Textbook 1	Textbook 2
<b>Title</b>	Principles of extractive metallurgy	Principles of extractive metallurgy
<b>Author(s)</b>	Fathi Habashi	Terkel Rosenqvist
<b>Publisher</b>	Metallurgie Extractive Quebec, Quebec City	Tapir Academic Press, Trondheim
<b>Year</b>	1998	2004
<b>Edition</b>	-	2 <sup>nd</sup>

#### B. References

1. Fathi Habashi "Metals from Ores: An Introduction to extractive Metallurgy" Metallurgie Extractive Quebec, Quebec City. 2003
2. Fathi Habashi "Textbook of Hydrometallurgy" Metallurgie Extractive Quebec, Quebec City. 1999
3. Fathi Habashi "Textbook of Pyrometallurgy" Metallurgie Extractive Quebec, Quebec City. 2002.

### Specific Course Information

#### A. Course Catalog:

Scope of extractive metallurgy, chemistry of metals, classification of metals, Classification of ores and ore preparation, extraction of metals from ores, pyrometallurgy (copper and iron) and hydrometallurgy (Cu, Al, Au, and U), unit operations and technology aspects, thermodynamics and kinetics of extractive processes.

#### B. Prerequisites or co-requisites

ChE 312 Materials Science and Engineering and ChE 362 Unit Operations

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

**Required (To be elective based on 2020 study plan)**

### Objectives and Outcomes\*

1. Understand the principles of extractive Metallurgy [1,2]
2. Understand the chemistry of metals and their classifications [1,2]
3. Understand classification of ores and ore preparation [1,2]
4. Learn the methods used to extract metals from ores [1,2]

\* Number in brackets refer to the Program outcomes

5. Understand the principles of pyrometallurgy [1,2]
6. Describe pyrometallurgical processing, separation, metal extraction and recovery for copper and iron from their ores [1,2,3,6]
7. Understand and be able to communicate the fundamental principles and chemistry of hydrometallurgical processes as applied to extraction and recovery of metals (Cu, Al, Au, and U) including environmental issues associated herein [1,2,6]
8. Familiarize the students with the unit operations and technology aspects of extractive metallurgy thermodynamics and kinetics of extractive processes [1,2,6]
9. Apply kinetics to extractive metallurgy problems [1]
10. Understand the need for recycling of metals from economic and environmental points of views [4]

---

### Contribution of Course to Meeting the Professional Component

---

#### Relationship to Student Outcomes (%)

1	2	3	4	5	6	7
4	4		1			

#### Relationship to Chemical Engineering Program Objectives

PEO1	PEO2	PEO3	PEO4	PEO5	PEO6
√	√		-	√	-

---

### Topics Covered

---

Week#1	Introduction
Week#2	Ore and Metals Classification
Week#3	Mineralogy of metallic ores
Week#4-5	Hydrometallurgy
Week#6	Pyrometallurgy
Week#7	Kinetics of extractive processes
Week#8	Extractive metallurgy of copper
Week#9	Extractive metallurgy of iron and steel
Week#10	Extractive metallurgy of aluminium
Week#11-12	Extractive metallurgy of Gold
Week#13	Extraction of zinc
Week#14	Recycling of metals

---

### Evaluation

---

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