

MS4670 Commodities' Geology and Metallurgy

(Phased out in AY2019/20 and onwards)

[Lecture: 26 hrs; Tutorials: 13 hrs; Pre-requisite: Nil; Academic Unit: 3]

Learning Objective :

Students can expect to:

1. Acquire knowledge of main geological concepts of our dynamic earth focusing on understanding of Earth materials and availability and sustainability of Earth resources.
2. Acquire knowledge of the origin and distribution of metallic and nonmetallic ore deposits in geological space and time, and the methods of exploration, mining, and associated environmental and sustainability concerns.
3. Acquire knowledge of extractive metallurgy starting with ores as raw material and metals as finished products.

Course Content :

Plate tectonics, minerals, rock types, geological processes and rock cycle, geological structures, geological dating and time scale. Origin of metallic and nonmetallic ore deposits and of oil and gas reservoir and their detection and extraction and associated environmental and sustainability concerns.

Metals and mineral industry: Introduction to metallurgy; properties of metals, ores and minerals and their structure; commercial classification of metals and their uses; metal production and recycling. Mineral beneficiation. Extractive processes.

Course Outline :

S/N Topic

G1. Geologic concepts:

- › Plate tectonics
- › Minerals
- › Rock types: Igneous, sedimentary and metamorphic
- › Geological processes and rock cycle

G2. Understanding earth:

- › Geological structures
- › Geological time
- › Overview of earth history

G3. Earth materials and resources:

- › Geologic processes leading to ore formation
- › Methods in exploration, mining and closure of mines
- › Oil and gas origins, distribution, and exploration
- › Environmental and sustainability issues

- M1. Metals and the Mineral Industry
- › Different areas of metallurgy
 - › Properties of metals, ores and minerals and their structure
 - › Commercial classification of metals and their uses
 - › Metal production
 - › Recycling of metals
- M2. Mineral Beneficiation: enriching mineral raw material
- › Liberation
 - › Separation
- M3. Extractive processes: treatment of ores or enriched mineral raw materials to the desired metals
- › Pyrometallurgy
 - › Hydrometallurgy
 - › Electrometallurgy

Learning Outcome :

At the end of the course, students will be able to:

1. Understand the composition, structure, geological processes and historical evolution of our dynamic earth relevant to the use of earth material and resources.
2. Understand the geologic processes and conditions leading to metallic and nonmetallic ore formation and the methods of exploration and extraction and associated environmental and sustainability concerns.
3. Understand the geologic processes and conditions behind the origin of oil and gas reservoir and the technology used to find, extract, and process these resources.
4. Discuss metallurgy in the context of mineral and metal processing.
5. Discuss the economic classification of metals, metal production and recycling.
6. Understand and discuss the principles of mineral beneficiation and the techniques available for liberation and separation of minerals.
7. Understand and discuss the principles and application of pyrometallurgical, hydrometallurgical and electrometallurgical extractive processes.

References :

1. Grotzinger, John P., and Jordan, Thomas H. Understanding Earth. 7th ed. New York: W.H. Freeman, 2014.
2. Pohl, Walter L. Economic geology: principles and practice: metals, minerals, coal and hydrocarbons - introduction to formation and sustainable exploitation of mineral deposits, Wiley-Blackwell, 2011.
3. Earth science: Earth materials and resources, editor Dutch, Steven I., Salem Press, a Division of EBSCO Publishing, 2 volumes, 2013.
4. Fathi Habashi. Metals from Ores. An Introduction to Extractive Metallurgy. Quebec City, Canada: Métallurgie Extractive Québec, 2003.
5. Terkel Rosenqvist. Principles of Extractive Metallurgy. Tapir Academic Press, 2004