9153
MINERAL PROCESSING
(12B)

40S/40E/40M

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Course Description

This course focuses on the processing of minerals. The curriculum focuses on the milling process, including crushers, ball and rod mills, flotation cells, and furnaces. Students require basic chemistry and math skills. Topics include the following:

- all processes from detection, accessing, mining, and processing ore
- chemical makeup of ores
- chemical processes involved in milling processes
- calculations to determine tonnage of milling products
- comparing and contrasting metallic and non-metallic ore flotation
- calculate products of flotation processes
- chemical processes in fire and electro-refining metallic ores

Goal 1: Describe and apply appropriate **health and safety** practices.

GLO 1.1: Describe and apply appropriate **health and safety** practices.

SLO 12B.1.1.1	Demonstrate an understanding of hazards found in the mining industry.
SLO 12B.1.1.2	Discuss and demonstrate safe work practices.
SLO 12B.1.1.3	Demonstrate an understanding of air quality hazards.
SLO 12B.1.1.4	Discuss and demonstrate safe work practices related to air quality.
SLO 12B.1.1.5	Create and maintain a safe and organized work environment.
SLO 12B.1.1.6	Discuss procedures for reporting hazards.

GLO 1.2: Demonstrate an awareness of safety as it pertains to the **Trade Safety Awareness Manual**.

No applicable SLOs.

Goal 2: Demonstrate the identification, selection, use, and maintenance of **tools, equipment, materials, and consumables.**

GLO 2.1: Demonstrate the identification, selection, use, and maintenance of **tools, equipment, materials, and consumables.**

SLO 12B.2.1.1 Demonstrate the identification, selection, use, and maintenance of tools, equipment, materials, and consumables.

Goal 3: Demonstrate an understanding of the theories related to the **origins of the universe, solar system, and planet earth.**

GLO 3.1: Demonstrate an understanding of the theories related to the origins of planet earth, particularly with respect to geology.

No applicable SLOs.

Goal 4: Demonstrate the ability to provide basic descriptions of the **layered structure of planet earth, the dynamic processes that affect it, and the evidence** that supports our current understanding.

GLO 4.1: Demonstrate the ability to provide basic descriptions of the **layered structure of the earth, the dynamic processes that affect it, and the evidence** that supports our current understanding.

No applicable SLOs.

Goal 5: Identify the environment that allows for the formation of **minerals** that are important to the mining sector, as well as the basic characteristics of those minerals.

GLO 5.1: Demonstrate a basic understanding of the formation of **minerals**, and the ability to identify common minerals and their characteristics.

No applicable SLOs.

Goal 6: Demonstrate an understanding of the formation of **rocks** and how their formation is related to their characteristics and identification.

GLO 6.1: Demonstrate an understanding of the environment that allows for the formation of common **rocks**, and relate their characteristics to their identification.

No applicable SLOs.

Goal 7: Use various **surveying** techniques to describe and map potential ore bodies in a field setting.

GLO 7.1: Use various **surveying** techniques in land surveying.

No applicable SLOs.

GLO 7.2: Use various surveying techniques in **hydrographic surveying**.

No applicable SLOs.

GLO 7.3: Use various surveying techniques in **mine surveying**.

No applicable SLOs.

Goal 8: Demonstrate an understanding of **exploration, development,** and **production** of mineral resources from a position of environmental stewardship and sustainability.

GLO 8.1: Demonstrate an understanding of common **exploration** techniques, with attention to the principles of **sustainable practices**.

No applicable SLOs.

GLO 8.2: Demonstrate an understanding of mine **development** with an emphasis on **environmental responsibility**.

No applicable SLOs.

GLO 8.3: Demonstrate an understanding of **mine production** and its place within the overall **life cycle** of a mine operation.

No applicable SLOs.

Goal 9: Demonstrate an understanding of the processes used in **accessing, recovering, transporting, and processing ore**.

GLO 9.1: Demonstrate an understanding of the processes used in **accessing, recovering, transporting, and processing ore.**

SLO 12B.9.1.1	Operationally define mineral processing, and describe the principal branches of mineral processing.
SLO 12B.9.1.2	Describe, by way of example, the process of obtaining concentrate from ore and the separation of tailings.
SLO 12B.9.1.3	Define relevant terms in milling, and make the necessary tonnage calculations of mill products.
SLO 12B.9.1.4	Describe the various steps in the proper sequences that take place in a typical milling plant.
SLO 12B.9.1.5	Describe in detail the entire comminution process.
SLO 12B.9.1.6	Describe grinding circuit and circulate load calculations.
SLO 12B.9.1.7	Define and explain the purpose and importance of sampling and the usefulness of representative sampling.
SLO 12B.9.1.8	Demonstrate an understanding of the flotation process through simple diagrams of flotation cells and flotation circuits.
SLO 12B.9.1.9	Name and describe the function of reagents used in the flotation process.
SLO 12B.9.1.10	Describe different concentrates obtained from a typical Cu-Ni sulfide ore.
SLO 12B.9.1.11	Explain the specifications for different concentrates that are to be obtained from lead-zinc-copper (Pb-Zn-Cu) ore.
SLO 12B.9.1.12	Describe the differences between metallic and non-metallic ore flotation.
SLO 12B.9.1.13	Describe different types of gold ores common to Canadian situations and the processes that are applied to extract them.
SLO 12B.9.1.14	Describe in detail a typical pyrometallurgical process including the chemical reactions involved.
SLO 12B.9.1.15	Describe the steps involved in the hydrometallurgical process of leaching uranium ore(s).
SLO 12B.9.1.16	Describe how fire-refining and electro-refining are carried out.
SLO 12B.9.1.17	Explain how vapo-metallurgy is carried out, including the principal chemical reactions involved.

Goal 10: Describe and demonstrate the transferable **cross-curricular** knowledge and skills relevant to mining engineering technology.

GLO 10.1: **Read, interpret, and communicate** information relevant to mining engineering technology.

SLO 12B.10.1.1 Read, interpret, and communicate information relevant to mining engineering technology.

GLO 10.2: Apply the knowledge and skills from **mathematics** relevant to mining engineering technology.

SLO 12B.10.2.1 Define relevant terms in milling, and make calculations necessary in calculating tonnages of mill products.

SLO 12B.10.2.2 Calculate the mineral processing costs from data given with and without mineral dressing operation.

SLO 12B.10.2.3 Calculate various products in the flotation process.

GLO 10.3: Apply the knowledge and skills from **the sciences** relevant to mining engineering technology.

SLO 12B.10.3.1 Name important ore minerals (restricted to two-element complex ionic compounds) and write chemical formulas for them (e.g., $Fe_2(SO_4)_3$).

SLO 12B.10.3.2 Name the physical properties of minerals that are helpful in mineral separation.

GLO 10.4: Apply the knowledge and skills from **information and communication technology** (ICT) relevant to mining engineering technology.

No applicable SLOs.

Goal 11: Demonstrate an awareness of **sustainability principles** as they influence mining engineering technology.

GLO 11.1: Describe the mining industry's **sustainability practices** and impact on the environment.

No applicable SLOs.

GLO 11.2: Describe the impact of **human well-being as a sustainability priority** among those employed in the mining sector and the individuals and communities affected by mining practices.

No applicable SLOs.

GLO 11.3: Describe **sustainable business practices** within the mining industry.

No applicable SLOs.

Goal 12: Demonstrate an awareness of the **ethical and legal standards** as they pertain to the mining industry.

GLO 12.1: Demonstrate an awareness of the **ethical and legal standards** that pertain to the mining industry.

No applicable SLOs.

Goal 13: Demonstrate fundamental **employability skills**.

GLO 13.1: Demonstrate **fundamental employability skills**.

SLO 12B.13.1.1 Demonstrate regular and punctual attendance.

SLO 12B.13.1.2 Demonstrate the ability to communicate respectfully and effectively with teachers, supervisors, co-workers, and students.

SLO 12B.13.1.3 Demonstrate accountability by taking responsibility for their actions.

SLO 12B.13.1.4 Demonstrate adaptability, initiative, and effort.

SLO 12B.13.1.5 Demonstrate teamwork skills.

SLO 12B.13.1.6 Demonstrate the ability to stay on task and effectively use time in class and work environments.

SLO 12B.13.1.7 Demonstrate the responsible use of wireless communication devices.

GLO 13.2: Demonstrate an awareness of **cultural proficiency** and its importance in the workplace.

SLO 12B.13.2.1 Demonstrate an awareness of culture.

GLO 13.3: Demonstrate an understanding of the **business operation** of a mine complex.

No applicable SLOs.

GLO 13.4: Demonstrate **critical thinking skills**.

SLO 12B.13.4.1 Discuss the need for critical thinking.

SLO 12B.13.4.2 Discuss the need for problem-solving skills.

Goal 14: Demonstrate an understanding of the **mining industry**.

GLO 14.1: Demonstrate an understanding of the scope of the mining industry as it functions in Canada today in an international context.

No applicable SLOs.

GLO 14.2: Demonstrate an understanding of the **educational and career opportunities,** as well as **industry, professional, and trade associations,** related to mining engineering technology.

SLO 12B.14.2.1 Describe chemical engineering as a profession.

GLO 14.3: Demonstrate an understanding of **working conditions** in mining.

SLO 12B.14.3.1 Demonstrate an understanding of the physical demands and possible dangers involved in process engineering.

Goal 15: Demonstrate an awareness of the **evolution, technological progression,** and **emerging trends** in mining.

GLO 15.1: Describe the **history, technological progression**, and **emerging trends** in mining.

SLO 12B.15.1.1 Describe the history, technological progression, and emerging trends in mining process engineering.