



9152

ADVANCED GEOLOGICAL
ENGINEERING (12A)

40S/40E/40M

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Course Description

This course will expand the knowledge and skills students acquired in 9148 Geological Engineering. It introduces students to the geologic processes that affect the deposition of minerals and rocks such as earthquakes, volcanoes, running water, ice, wind, and mass movement. The curriculum focuses on the methods of determining geological time scale in the context of paleontology and the three geological eras, the principles of structural geology as they relate to mining, and more detailed identification of minerals and rocks. Topics include the following:

- principles of earth structures and structural geology
- detection and prediction of volcanic activity
- function and use of a Brunton compass
- processes in the formation of fossils
- geologic setting, events, and life forms present during the three geological eras
- geological time scale
- energy resources within planet earth
- environmental issues surrounding harvesting and use of energy resources
- history of people's use and methods of harvesting mineral resources
- identification of minerals and rocks in a field setting

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

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

- SLO 12A.1.1.1 Demonstrate an understanding of hazards found in the mining industry.
 - SLO 12A.1.1.2 Discuss and demonstrate safe work practices.
 - SLO 12A.1.1.3 Demonstrate an understanding of air quality hazards.
 - SLO 12A.1.1.4 Discuss and demonstrate safe work practices related to air quality.
 - SLO 12A.1.1.5 Create and maintain a safe and organized work environment.
 - SLO 12A.1.1.6 Discuss procedures for reporting hazards.
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GLO 1.2: Demonstrate an awareness of safety as it pertains to the **Trade Safety Awareness Manual.**

- SLO 12A.1.2.1 Explain the importance of trade safety and health in reducing injuries and fatalities to young employees in Manitoba. (TSA 1)
- SLO 12A.1.2.2 Describe the rights and responsibilities of employees, employers, and supervisors under the *Workplace Safety and Health Act*. (TSA 2)
- SLO 12A.1.2.3 Describe the steps to use in the Right to Refuse process. (TSA 3)
- SLO 12A.1.2.4 Explain how and where to find information on workplace safety and health. (TSA 4)
- SLO 12A.1.2.5 Demonstrate how to handle a potentially dangerous work situation. (TSA 5)
- SLO 12A.1.2.6 Explain the S.A.F.E. acronym. (TSA 6)
- SLO 12A.1.2.7 Define workplace safety and health hazards. (TSA 7)
- SLO 12A.1.2.8 Give examples of trade-specific workplace safety and health hazards. (TSA 8)
- SLO 12A.1.2.9 Give examples of five types of safety and health hazards. (TSA 9)
- SLO 12A.1.2.10 Define workplace safety and health risk. (TSA 10)
- SLO 12A.1.2.11 Give examples of trade-specific workplace safety and health risks. (TSA 11)
- SLO 12A.1.2.12 Explain the principles of hazard recognition and control as they apply to the specific trade. (TSA 12)
- SLO 12A.1.2.13 Explain the Workplace Hazardous Material Information System (WHMIS). (TSA 13)
- SLO 12A.1.2.14 Match the WHMIS hazardous materials symbols with their meanings. (TSA 14)
- SLO 12A.1.2.15 Describe the importance of the Material Safety Data Sheets (MSDS). (TSA 15)
- SLO 12A.1.2.16 Describe the importance of using personal protective equipment (PPE). (TSA 16)
- SLO 12A.1.2.17 Demonstrate proper selection and use of a variety of PPE and fall protection systems. (TSA 17)
- SLO 12A.1.2.18 Outline the safety principles for working on and around electrical equipment. (TSA 18)
- SLO 12A.1.2.19 Outline workplace fire safety principles. (TSA 19)
- SLO 12A.1.2.20 Identify the hazards in confined spaces and the preparation needed to work in a confined space. (TSA 20)

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 12A.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.

SLO 12A.3.1.1 Demonstrate an understanding of the development of the geologic time scale, with particular reference to comparing and contrasting relative and absolute dating techniques.

SLO 12A.3.1.2 Describe, in a general way, the geologic setting, events, and life forms present during the Paleozoic, Mesozoic, and Cenozoic eras.

SLO 12A.3.1.3 Demonstrate an understanding of the various processes in the formation of fossils and how certain index fossils are important to the exploration for economic resource deposits.

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.

SLO 12A.4.1.1 Describe the processes in the formation of volcanoes and earthquakes and their impact on our planet.

SLO 12A.4.1.2 Describe types of mass movement, how it occurs, and its impact on the environment.

SLO 12A.4.1.3 Demonstrate an understanding of the basic principles of structural geology (e.g., folds, faults, horst/graben, anticline/syncline, and strike/dip).

- SLO 12A.4.1.4 Demonstrate an understanding of the various hydrological processes that affect the formation of geological structures.
- SLO 12A.4.1.5 Demonstrate an understanding of the formation and action of glaciers and their impact on geological structures.
- SLO 12A.4.1.6 Demonstrate the use of a Brunton compass (or similar) to determine the strike and dip of sedimentary structures in an outcrop.

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.

- SLO 12A.5.1.1 Identify, in a field setting, minerals based on physical and chemical properties, and on mode of occurrence.

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.

- SLO 12A.6.1.1 Identify common igneous rocks using physical and chemical properties in a field setting.
- SLO 12A.6.1.2 Identify common sedimentary rocks using physical and chemical properties in a field setting.
- SLO 12A.6.1.3 Identify common metamorphic rocks using physical and chemical properties in a field setting.

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**.

SLO 12A.8.1.1 Describe the various methods by which mining engineers find and identify mineral deposits.

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

SLO 12A.8.2.1 Describe the various types of and methods for recovery of energy resources from earth.

SLO 12A.8.2.3 Describe the various methods by which humans access mineral deposits.

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

SLO 12A.8.3.1 Describe the various methods by which humans harvest mineral deposits.

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**.

No applicable SLOs.

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 12A.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.

No applicable SLOs.

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

No applicable SLOs.

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.

SLO 12A.11.1.1 Discuss negative issues with the harvesting, transportation, and use of various energy resources.

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.

SLO 12A.11.3.1 Define and discuss the concept of sustainable business practices.

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 12A.13.1.1 Demonstrate regular and punctual attendance.

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

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

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

SLO 12A.13.1.5 Demonstrate teamwork skills.

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

SLO 12A.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.

No applicable SLOs.

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 12A.13.4.1 Discuss the need for critical thinking.

SLO 12A.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.

SLO 12A.14.1.1 Demonstrate an understanding of the mining industry as it pertains to geology.

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 12A.14.2.1 Describe geological engineering as a profession.

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

SLO 12A.14.3.1 Demonstrate an understanding of the physical demands involved in field geology.

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.

No applicable SLOs.