MINERAL RESOURCE – TECHNOLOGIST (MRTY 2021)

Preamble

The Canadian Technology Standards (CTS) are a collection of learning outcomes for Canada's engineering technology and applied science profession at the technician and technologist level.

Stakeholders

The CTS may be utilized by accreditation bodies, provincial professional associations, educational institutions, government agencies, industry and others for the purposes accreditation, certification and other applications.

Educational Programs

The Mineral Resource CTS is relevant to programs including, but not limited to, mining, extractive metallurgy/mineral processing, geological, geotechnical, environmental geology, and hydrological at the at the technologist level.

Learning Outcomes

This CTS list Discipline Learning Outcomes (DLO) which describe the significant and essential learning that students have achieved and can reliably demonstrate at the time of graduation. Each DLO has a number of Learning Outcome Indicators (LOI), which are examples illustrating, defining and clarifying the level of performance expected. The list of LOI is not comprehensive and there may be other indicators which can be used to assess achievement of learning outcomes.

Graduate Capability

Students graduating from an accredited program have demonstrated achievement of all general learning outcomes, including a prescribed level of math, and discipline learning outcomes selected by the program.

Having completed a program that is based on applied mathematics and scientific and engineering theory, principles and practices and having acquired the knowledge, skills and attitudes to function in the work place, graduates are;

- able to evaluate assignments, establish objectives, set parameters and determine appropriate procedures and actions.
- able to exercise due diligence in the workplace and adhere to related practices, applicable laws and health and safety practices.
- able to work in accordance with labor-management principles and practices.
- able to work independently or interdependently as part of a discipline or multi-disciplinary team.
- prepared to assume responsibility for their work.

Graduate Career Opportunities

Graduates of Mineral Resource Technology - Technologist Programs have career opportunities in such areas as: business, industry, exploration, construction, government, and public organizations. They may find employment in careers such as: mineral exploration; design of equipment, processes, infrastructure, or systems; interpretation or preparation of specifications, drawings, or instructions; quality management; construction management; operations and maintenance; field and customer service; estimating; geological, geophysical, geochemical, hydrographic, oceanographic or underground mine surveying; management and project management; technical sales; supervision of operations; and training activities.

Discipline Learning Outcomes (DLOs)

MRTY01 Geophysical Surveys

- Designs analyze and conduct geophysical surveys and create geophysical profiles and maps.

Learning Outcome Indicators include:

1.1 Interpret, analyze and identify hydrocarbon, coal, or other economic potential of geologic zones using combination of open-hole log readings.
1.2 Calculate water saturation and/or other properties of subsurface sediments, rocks, and structures using electrical properties.
1.3 Apply appropriate methodology and practical procedures for surface electromagnetic (EM) methods.
1.4 Apply appropriate methodology and practical procedures for magnetic methods.
1.5 Evaluate electromagnetic data from geophysical borehole logs.
1.6 Interpret and analyse seismic geophysical data.
1.7 Calculate results using gravity exploration methods.
1.8 Evaluate results using electrical exploration methods.
1.9 Determine and identify rock properties using a variety of open-hole logs.

MRTY02 Mineral Exploration

- Interpret and create geological maps for mineral exploration.

Learning Outcome Indicators include:

2.1 Compare and correlate geologic units using stratigraphic principles.
2.2 Interpret and create complex geological maps and cross sections.
2.3 Interpret, create and measure, stratigraphy from outcrop data.
2.4 Create and manipulate stereo net to solve structural problems.
2.5 Categorize and identify surficial deposits.
2.6 Create and illustrate geological data utilizing appropriate computer software.

MRTY03 Field Procedures

- Generate geological and geochemical data implementing appropriate field procedures. Indicators

Learning Outcome Indicators include:

3.1 Measure and layout distances and create grids with chains.
3.2 Determine differences in elevations utilizing surveyor's levels.
3.3 Perform topographic survey that can be used in construction (e.g., for grading and contour plans).
3.4 Identify and perform field sampling procedures for rocks, sediments, and soils.
3.5 Identify targets for further exploration by evaluating geochemical database information as compiled by Geological Survey of Canada.

3.6 Design field mapping and geochemical sampling programs by interpreting existing geological maps and cross sections.
3.7 Create accurate geological maps from field observations applying field mapping methodologies.
3.8 Organize and implement mineral rights acquisition in various provincial and territorial jurisdictions in Canada.
3.9 Evaluate process of diamond drilling and log diamond drill core.
3.9.1 Explain mining agreements and equity finance.
3.9.2 Demonstrate knowledge of field safety and logistics.

MRTY04 Oil and Gas Exploration

- Interpret and create geological maps and cross sections for oil and gas exploration.

Learning Outcome Indicators include:

4.1 Determine the relative order of geological events utilizing the principles of stratigraphy.
4.2 Compare geologic units utilizing stratigraphic principles.
4.3 Interpret and create complex geological maps and cross sections.
4.4 Interpret and measure stratigraphy of sedimentary outcrops.
4.5 Illustrate and discriminate between facies relationships.
4.6 Interpret the occurrence and development of hydrocarbon resources.
4.7 Illustrate and process geological data utilizing appropriate computer software.
4.8 Evaluate depositional environments and hydrocarbon reserves including oil sands and coal bed methane.
4.9 Evaluate and interpret well cuttings.

MRTY05 Mineral Deposits

- Evaluate mineral deposits.

Learning Outcome Indicators include:

5.1 Evaluate and identify various metallic and precious mineral deposits.
5.2 Identify, illustrate, and list mineralization associated with basic rocks.
5.3 Identify and classify common ore minerals and their oxides and sulfates.
5.4 Identify and differentiate various types of uranium, sedimentary copper, kimberlite and industrial mineral occurrences.
5.5 Evaluate and interpret mineral processing and extraction in terms of communication, floatation, cyanidation, coal washing cycles, and density recovery.
5.6 Determine simple weighted grade and perform reserve calculation procedures as applied to core intervals or bore holes in alluvial deposit.
5.7 Compare blasting processes, common products, simple circuits, equipment, terms, and procedures.
5.8 Assess underground mining methods commonly employed.

MRTY06 Contaminants

- Assess behaviour of contaminants in soil and groundwater.

Learning Outcome Indicators include:

6.1 Identify and differentiate major types of groundwater contaminants, sources of groundwater contamination, and various criteria and standards that are applied to contaminants in ground water.
6.2 Evaluate behaviour and risks associated with both light (LNAPL) and dense (DNAPL) non-aqueous phase liquids.
6.3 Evaluate types of inorganic contaminants that might affect groundwater quality and their fate in the environment.
6.4 Implement preservation, documentation e and storage of ground water samples using proper sampling protocols.
6.5 Interpret soil and water quality guidelines.
6.6 Collect groundwater samples for laboratory analysis.
6.6.1 Collect and document water well field data for review and discussion of results.
6.7 Evaluate equipment and sampling protocols required to complete site assessment and contaminant monitoring program.
6.8 Interpret history of groundwater flow in basin and classify flow systems utilizing groundwater geochemistry.
6.9 Perform field screening techniques commonly used in groundwater and soil sampling evaluation.
6.10 Illustrate and predict groundwater flow and contaminant migration utilizing appropriate modelling software.

MRTY07 Geoscience

- Identify and contrast geological formations, structures, and processes.

Learning Outcome Indicators include:

7.1 Interpret history of geological formations using principles of geological time.
7.2 Identify and contrast landscapes and deposits resulting from weathering, erosion, mass wasting, and glacial processes.
7.3 Evaluate and classify formation of igneous, sedimentary, and metamorphic rocks.
7.4 Identify and contrast common geologic structures.
7.5 Interpret geologic and terrain features using topographic and geologic maps.
7.6 Identify and classify common sedimentary, igneous, and metamorphic rocks.
7.7 Identify various ore deposit processes, and associated alteration in discussion of ore deposits using appropriate terminology.
7.8 Identify and interpret coal depositional environments and stratigraphy of economic coal and hydrocarbon deposits of Western Canada.
7.9 Identify and classify sulfide, oxide, halide, carbonate, sulphate, phosphate, silicate, and native element mineral specimens.

MRTY08 Hydro-Geology

- Interpret and collect hydro-geological data.

Learning Outcome Indicators include:

8.1 Interpret porous media utilizing hydraulic parameters.

8.1.1 Explain fluid flow quantitatively in subsurface by calculating standard aquifer characteristics.

8.2 Test sediments and formations to determine grain size and permeability.

8.3 Interpret and analyze open whole logs of typical sedimentary zones and use drill stem test results to determine zone permeability and productivity.

8.4 Design and maintain water wells that meet a variety of defined needs.

8.5 Interpret groundwater flow systems.

8.5.1 Calculate groundwater flow parameters, boundary conditions, and safe-yields utilizing pump tests and slug tests.

8.6 Collect and document field data for drilling and installation of monitoring wells.

8.7 Evaluate pathways and prevailing groundwater flow conditions within local, intermediate, and regional flow systems using surface and subsurface data.

8.8 Interpret terrain and groundwater features using air photos and maps.

8.9 Interpret history of groundwater flow in a basin and classify flow system utilizing ground water geochemistry and isotope chemistry.

MRTY09 Economics of Projects

- Apply economic principles to technological projects.

Learning Outcome Indicators include:

9.1 Contribute to in research and collection of economic data.

9.2 Explain importance and relevance of accurate forecasts.

MRTY10 Cost Estimates

- Prepare cost estimates and schedules.

Learning Outcome Indicators include:

10.1 Construct charts to plan, schedule, and control complex projects.

10.2 Evaluate and document cost analysis.

10.3 Develop project proposals.

10.4 Determine contingencies on projects.

MRTY11 Survey

- Manage mining development and production areas of surface and underground mines using conventional and electronic survey equipment, including GIS hardware and software.

Learning Outcome Indicators include:

11.1 Apply established survey controls to aid production of mining excavations.

MRTY12 Mine Ventilation

- Design, analyze, and maintain mine ventilation networks.

Learning Outcome Indicators include:

12.1 Maintain adequate air flow volumes and flow rates applying fundamentals of air flow mechanics.
12.2 Analyse of mine ventilation networks using computer aided software.
12.3 Design, specify, install, and maintain fresh air heating systems.
12.4 Evaluate and monitor diesel equipment emissions.
12.5 Implement and maintain air quality sampling and monitoring programs.

MRTY13 Mine Excavations

- Appraise and design mine excavations applying principles of geo-mechanics.

Learning Outcome Indicators include:

13.1 Evaluate and identify development requirements of mining operations.
13.2 Assess and implement engineering studies of mining methods.
13.3 Interpret engineering layouts.
13.4 Interpret geologic plans and sections.