



## **PETROLEUM – TECHNOLOGIST (PETY 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 Petroleum CTS is relevant to programs including, but not limited to, hydrocarbon technologist, geology and geophysics, exploration technologist, extraction and production technologist, reservoir technologist; and subsurface technologist 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 Petroleum Engineering Technology - Technologist programs have career opportunities in such areas as: business, industry, construction, government, and public organizations. They may find employment in careers such as: exploration; design of processes, infrastructure, or systems; interpretation or preparation of specifications, drawings, or instructions; quality management; construction management, operations and maintenance; field and customer service; surveying and cartography; management and project management; technical sales; supervision of projects; and training activities.

## Discipline Learning Outcomes (DLOs)

### **PET01 Drilling and Well Intervention**

- Design, analyze, and implement procedures for drilling, completion, and well intervention.

Learning Outcome Indicators include:

- 1.1 Design and plan well intervention operations.
- 1.2 Design equipment for well abandonments.
- 1.3 Design and plan vertical, horizontal, and directional drilling programs.
- 1.4 Differentiate between types of drilling fluid systems and drilling fluid equipment.
- 1.5 Perform calculations associated with drilling fluids.
- 1.6 Apply well control techniques and procedures commonly used in industry.
- 1.7 Specify commonly used drilling applications, techniques, and equipment.
- 1.8 Specify initial well bore conditions for completion and determine perforating techniques and equipment.
- 1.9 Apply appropriate methodologies to interpret forces involved in tubing strings, setting packers, anchors, bridge plugs, et cetera.
- 1.10 Specify procedure for commonly used stimulation techniques.
- 1.11 Appraise major components of normal drilling operations involved in rotary drilling.
- 1.12 Specify drill bits used for typical drilling applications.

### **PET02 Petroleum Formations**

- Identify and apply appropriate methods of evaluating petroleum formations.

Learning Outcome Indicators include:

- 2.1 Select and recommend coring equipment.
- 2.2 Interpret and analyze core samples.
- 2.3 Analyze data from specialty logs and recognize their limitations.
- 2.4 Analyze data from cased hole logging tools to determine formation characteristics and well performance.
- 2.5 Evaluate operation of open hole logging tools.
- 2.6 Interpret open hole logging tool responses to rock properties and pore fluids.
- 2.7 Determine interaction between drilling fluid and a potential reservoir rock.
- 2.8 Analyze and document data from suites of open-hole logs.
- 2.9 Calculate hydrocarbon saturation and movability.
- 2.10 Analyze results from drill stem tests qualitatively and quantitatively utilizing concepts of drill stem testing.
- 2.11 Perform basic analysis of rock cuttings and samples.

### **PET03 Petroleum Reservoirs**

- Identify and apply appropriate methods of evaluating petroleum reservoirs and reserves.

Learning Outcome Indicators include:

- 3.1 Perform calculations associated with reservoir depletion techniques.
- 3.2 Determine properties of reservoir fluids under various conditions.
- 3.3 Evaluate and predict phase behaviour of hydrocarbon in reservoir or in surface processing equipment.
- 3.4 Determine volume of oil, gas, and condensate in reservoir using appropriate methodology.
- 3.5 Assess and calculate natural gas from coal reserves.
- 3.6 Analyze and predict the behaviour of reservoir given various drive mechanisms.
- 3.7 Evaluate and compare oilfield projects based on decline rate predictions, royalty calculations, and resource pricing.
- 3.8 Analyze and retrieve well information utilizing appropriate software.
- 3.9 Use appropriate software to Perform decline curve analysis using well production data and appropriate software.
- 3.9.1 *Interpret economic evaluation of petroleum industry projects.*
- 3.10 Identify and apply physical laws and relationships affecting multi-phase fluid flow through petroleum reservoirs.

### **PET04 Oil and Gas Well Production**

- Interpret and analyze oil and gas well production techniques and methodology.

Learning Outcome Indicators include:

- 4.1 Interpret well production data and make recommendations to improve oil and gas well production.
- 4.2 Interpret and apply Darcy's equation of flow through porous media to oil and gas well productivity.
- 4.3 Evaluate performance of rod pump and pump jack on conventional oil well.
- 4.4 Design electric submersible pumps and down-hole oil water separators for producing high water cut oil wells.
- 4.5 Design progressive cavity pumps for producing cold heavy oil wells.
- 4.6 Apply nodal analysis to flowing wells and gas-lifted wells.
- 4.7 Model wellbores in order to identify well performance problems and solutions applying appropriate software.
- 4.8 Analyze production facility capacity and forecast future requirements.
- 4.9 Determine personnel requirements and plan for system reliability applying methods of Operational Planning and Control.
- 4.10 Analyze economic performance of wells.
- 4.10.1 *Determine areas of well economic improvement.*

## **PET05 Petroleum Facilities**

- Evaluate, research, design, and plan petroleum facilities.

Learning Outcome Indicators include:

- 5.1 Design and size gathering and distribution systems with appropriate software.
- 5.2 Analyze production facility capacity and forecast future requirements.
- 5.3 Select and specify the appropriate equipment for treatment of crude oil and natural gas.
- 5.4 Write safe operating procedures.
- 5.5 Diagnose problem scenarios relative to flow rates, tank gauging, and flow meters.
- 5.6 Manipulate start-up, operate, run at steady rate and shut-down pilot plant and process simulations as part of process team.
- 5.7 Create and implement written procedures for pigging a flowline, swinging a well into the test separator, and gauging a production tank.
- 5.8 Diagnose and determine heater treater performance and problems.
- 5.9 Interpret and measure physical pumping parameters of triplex pump.
- 5.10 Calculate flow-through orifice meter given differential and operating conditions and orifice plates.
  - 5.10.1 *Calibrate differential bellows on orifice gas flow meter.*
- 5.11 Interpret relevant information from propane refrigeration system.
  - 5.11.1 *Evaluate operation of propane refrigeration unit performing necessary calculations.*
- 5.12 Determine properties of natural gas and model gas processing systems utilizing appropriate software.
- 5.13 Determine inspection and commissioning requirements for pipelines and production/process equipment.
- 5.14 Manage corrosion control and monitoring programs.

## **PET06 Environmental and Economic Projects**

- Evaluate and develop petroleum engineering projects in manner consistent with environmental and economic criteria.

Learning Outcome Indicators include:

- 6.1 Plan, schedule, and monitor projects in upstream petroleum industry applying technical, economic, and quality principles.
- 6.2 Resolve project management problems.
  - 6.2.1 *Implement basic quality control systems and measurement.*
- 6.3 Interpret and identify regulations and licensing requirements in upstream petroleum facilities.
- 6.4 Interpret and identify industry standards in upstream petroleum facilities.
- 6.5 Apply basic economic principles such as profit, present and future value of money interest rates, compounding interest, ROI, and DCF-ROR.
- 6.6 Identify and mitigate contributors to accidents in workplace.
- 6.7 Identify and mitigate workplace hazards commonly found in workplace.

- 6.8 Apply environmental procedures pertaining to drilling of oil and gas wells, construction and decommissioning of oil and gas production facilities, events such as spills and releases, and waste management.
- 6.9 Manage to ensure compliance with relevant environmental legislation pertaining to operation, construction and decommissioning of upstream oil and gas production facilities, and jurisdictions of regulatory agencies involved in each phase.
- 6.10 Apply basic economic principles to petroleum industry projects.

### **PETY07 Geological Data**

- Interpret and identify geological and geophysical data.

Learning Outcome Indicators include:

- 7.1 Select appropriate exploratory methodology for oil and gas.
- 7.2 Apply fundamental aspects of stress and strain and mechanical behaviour of rock materials to analysis and solution of structural geology problems.
- 7.3 Interpret and create maps, fence diagrams, and sections using drill hole, surface geology, and geophysical data.
- 7.4 Analyze subsurface data to construct geological maps, which show stratigraphic sequences.
- 7.5 Interpret and identify structural and stratigraphic traps as possible locations for further exploration.
- 7.6 Analyze common depositional environments using basic criteria of facies models.
- 7.7 Determine processes of sedimentation and origins of deposits utilizing sedimentary structures and textures.
- 7.8 Interpret topographic maps to assist in resource exploration and development.
- 7.9 Interpret geologic maps to assist in resource exploration and development.
- 7.10 Interpret air photos to assist in resource exploration and development.
- 7.11 Interpret and identify possible migration routes for hydrocarbons.
- 7.12 Interpret seismic data.
- 7.13 Test and identify pore fluids in host rocks.
- 7.14 Test host rock porosity and permeability.
- 7.15 Prepare reports using geological data.

### **PETY08 Surveys, Maps**

- Interpret surveys, maps, land divisions, and acquisition procedures.

Learning Outcome Indicators include:

- 8.1 Interpret and analyse retrieved survey data.
- 8.2 Collect and edit data into a GIS system.
- 8.3 Explain the land acquisition process.

## **PETY09 Gathering Systems for Oil and Gas**

- Contribute to planning, design, and sizing of gathering systems for oil and gas.

Learning Outcome Indicators include:

- 9.1 Describe procedures used for field handling of gas.
- 9.2 Size and construct flow diagrams.
- 9.3 Plan and design pipeline transportation systems.

## **PETY10 Project Management**

- Apply principles of project management.

Learning Outcome Indicators include:

- 10.1 Understand basic concepts of project management as it relates to petroleum sector.
- 10.2 Manage project-specific information using appropriate software.
- 10.3 Use project-related records and inventories to prepare schedules and reports.

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