



8858

CNC MACHINING (12D)

40S/40E/40M

A Machining Technology Course

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Course Description

Students develop skills and knowledge necessary to select, operate, and maintain tools, as well as perform calculations, interpret engineering drawings, work set-up, and cut material in a safe, efficient, and responsible manner through the application of practical projects related to CNC machining.

Goal 1: Describe and apply appropriate **health and safety** practices as they relate to the **maintenance of a safe workplace**.

GLO 1.1: Create and maintain a **safe working environment** in machining technology.

- SLO 12D.1.1.1 Identify safety and health requirements. (A1.1)
- SLO 12D.1.1.2 Identify personal protective equipment (PPE) and PPE procedures. (A1.2)
- SLO 12D.1.1.3 Identify appropriate safety procedures for working with electricity. (A1.3)
- SLO 12D.1.1.4 Identify appropriate safety procedures to reduce fire hazards. (A1.4)
- SLO 12D.1.1.5 Identify ergonomically correct procedures to avoid injury (e.g., stress, strain). (A1.5)
- SLO 12D.1.1.6 Identify hazard recognition and control. (A1.6)
- SLO 12D.1.1.7 Describe the hazards of confined-space entry. (A1.7)
- SLO 12D.1.1.8 Identify first aid/cardiopulmonary resuscitation (CPR). (A1.8)
- SLO 12D.1.1.9 Identify safety requirements as they apply to the WHMIS. (A1.9)
- SLO 12D.1.1.10 Describe the identification and control of specified hazards. (A1.10)
- SLO 12D.1.1.11 Identify types of personal protective equipment (PPE), and describe their applications. (A2.1)
- SLO 12D.1.1.12 Describe the procedures used to care for and maintain PPE. (A2.2)
- SLO 12D.1.1.13 Identify types of fire extinguishing equipment, and describe their applications and procedures for use. (A2.3)
- SLO 12D.1.1.14 Identify workplace hazards, and describe safe work practices and equipment. (A2.4)

- SLO 12D.1.1.15 Identify and interpret workplace safety and health regulations. (A2.4)
- SLO 12D.1.1.16 Identify hazards, and describe safe work practices pertaining to fluids and coolants. (A8.2)
- SLO 12D.1.1.17 Identify hazards, and describe safe work practices pertaining to hand and power tools. (B1.1)
- SLO 12D.1.1.18 Demonstrate understanding and adherence to safe work procedures/job hazards analysis documents for each piece of equipment, tool, and consumable that they use.
- SLO 12D.1.1.19 Demonstrate understanding and adherence to safe practices and procedures for facilities, processes, tools, and equipment found in machining technology.
- SLO 12D.1.1.20 Discuss worker's responsibility to refuse unsafe work.
- SLO 12D.1.1.21 Demonstrate use of personal protective equipment (PPE) and adherence to PPE procedures used in machining technology.
- SLO 12D.1.1.22 Demonstrate the safe use of compressed air.
- SLO 12D.1.1.23 Practise appropriate cleaning and maintenance of the machining technology area and equipment for the promotion of a safe work/learning environment.
- SLO 12D.1.1.24 Practise appropriate safe behaviour to ensure personal safety, as well as the safety of others.
- SLO 12D.1.1.25 Develop safe habits.
- SLO 12D.1.1.26 Demonstrate a safe, clean, organized, and uncluttered work area.
- SLO 12D.1.1.27 Explain the purpose/importance and use of accident report forms.
- SLO 12D.1.1.28 Identify hazards, and describe safe work practices pertaining to CNC machines.
- SLO 12D.1.1.29 Practise safety procedures related to CNC machine safety.
- SLO 12D.1.1.30 Practise safe set-up/operation of CNC machines.

GLO 1.2: Demonstrate knowledge of the **Trade Safety Awareness Manual**.
(www.gov.mb.ca/tce/apprent/apprentice/trade_safety/)

No applicable SLOs.

Goal 2: Understand **terminology, abbreviations, symbols, and acronyms** related to machining technology.

GLO 2.1: Understand **terminology, abbreviations, symbols, and acronyms** related to machining technology.

- SLO 12D.2.1.1 Define terminology, abbreviations, symbols, and acronyms associated with computer numerical control machining.
- SLO 12D.2.1.2 Define and describe Cartesian coordinates.
- SLO 12D.2.1.3 Define computer-aided design and computer-aided machining.
- SLO 12D.2.1.4 Define computer numerical control.

Goal 3: Understand **technical drawings**.

GLO 3.1: Understand **technical drawings**.

- SLO 12D.3.1.1 Produce basic paper-and-pencil sketch of project.
- SLO 12D.3.1.2 Interpret and extract information from drawings. (A6.3)
- SLO 12D.3.1.3 Describe dimensions found on drawings.
- SLO 12D.3.1.4 Describe tolerances found on drawings.

Goal 4: Demonstrate **layout and planning**.

GLO 4.1: Demonstrate **planning and layout procedures**.

- SLO 12D.4.1.1 Calculate layout dimensions and reference points. (C3.4)
- SLO 12D.4.1.2 Describe the datum or reference surfaces, their applications, and advantages.
- SLO 12D.4.1.3 Use planning worksheets for projects.

GLO 4.2: Demonstrate **layout on projects**.

- SLO 12D.4.2.1 Produce a basic CNC program for lathe and machining centres.
- SLO 12D.4.2.2 Perform basic layout. (C3.9)
- SLO 12D.4.2.3 Use graph paper to plot Cartesian coordinates of project.

Goal 5: Use measurement and quality control tools.**GLO 5.1: Use measurement and quality control tools.**

- SLO 12D.5.1.1 Identify coordinate measuring machine.
- SLO 12D.5.1.2 Identify surface finish with surface comparator gauge.
- SLO 12D.5.1.3 Describe rework of CNC-machined parts.
- SLO 12D.5.1.4 Describe the operation of a coordinate measuring machine.

Goal 6: Identify basic elements of metallurgy.**GLO 6.1: Identify basic elements of metallurgy.**

- SLO 12D.6.1.1 Describe the effects on cutting tools for different metals.
- SLO 12D.6.1.2 Describe physics of metal cutting.
- SLO 12D.6.1.3 Describe heat treatment.
- SLO 12D.6.1.4 Describe heat treatment processes.

Goal 7: Understand tools, equipment, and accessories.**GLO 7.1: Identify tools, equipment, accessories, and work-holding devices.**

- SLO 12D.7.1.1 Describe CNC machining centres and accessories.
- SLO 12D.7.1.2 Identify various work-holding devices.
- SLO 12D.7.1.3 Describe various work-holding devices.
- SLO 12D.7.1.4 No applicable SLO.
- SLO 12D.7.1.5 No applicable SLO.
- SLO 12D.7.1.6 No applicable SLO.

GLO 7.2: Use tools, equipment, accessories, and work-holding devices.

- SLO 12D.7.2.1 Describe CNC lathes and accessories.
- SLO 12D.7.2.2 Describe CAD and CAM.
- SLO 12D.7.2.3 Compare the accuracy of a conventional machine tool with that of a CNC machine tool.
- SLO 12D.7.2.4 Discuss advantages and disadvantages of CNC.
- SLO 12D.7.2.5 Describe various types of CNC equipment (e.g., water jet, laser, plasma...).
- SLO 12D.7.2.6 Prepare a basic CNC program for a milling machine.
- SLO 12D.7.2.7 Prepare a basic CNC program for a lathe.

- SLO 12D.7.2.8 Describe the format of a CNC program.
- SLO 12D.7.2.9 Compare g-code and m-code.
- SLO 12D.7.2.10 Define tool path.
- SLO 12D.7.2.11 Compare incremental and absolute positioning.
- SLO 12D.7.2.12 Compare linear and circular interpolation.
- SLO 12D.7.2.13 No applicable SLO.

GLO 7.3: Identify techniques used to **troubleshoot** and **predict potential problems**.

- SLO 12D.7.3.1 Identify potential CNC machining set-up problems, and describe their causes and solutions
- SLO 12D.7.3.2 Identify techniques used to troubleshoot CNC machine operations, and describe their associated procedures.

Goal 8: Describe and demonstrate the transferable **cross-curricular** knowledge and skills as they pertain to machining technology.

GLO 8.1: Apply **mathematical knowledge and skills** related to machining technology.

- SLO 12D.8.1.1 Solve problems involving fractions and decimals.
- SLO 12D.8.1.2 Solve problems involving metric and imperial measure.
- SLO 12D.8.1.3 Solve problems involving length, perimeter, circumference, volume, area, mass, angles, ratio, and percentage.
- SLO 12D.8.1.4 Convert between imperial and metric measurements.
- SLO 12D.8.1.5 Use formulas to accurately calculate data for use in machining operations.
- SLO 12D.8.1.6 Accurately calculate and measure parts and angles.
- SLO 12D.8.1.7 Perform mathematical calculations, conversions, and measurements, as required for the project.
- SLO 12D.8.1.8 Plot points using Cartesian coordinates.
- SLO 12D.8.1.9 Accurately calculate RPM for CNC lathe and machining centres.
- SLO 12D.8.1.10 Accurately calculate feed rate for CNC lathe and machining centres.
- SLO 12D.8.1.11 Accurately calculate feed rate for CNC lathe and machining centres.
- SLO 12D.8.1.12 Use charts and reference books to determine tap drill sizes.
- SLO 12D.8.1.13 Use charts and reference books to determine conversions among metric, fractional, and decimal units of measurement.

SLO 12D.8.1.14 Use charts and reference books to obtain data for use in machining operation calculations.

Goal 9: Demonstrate an awareness of **education and career opportunities** in machining technology and associated occupations.

GLO 9.1: Describe **education and career opportunities** in machining technology

SLO 12D.9.1.1 Compare machinist, CNC machinist, CNC operator, CNC programmer, and CNC set-up person.

SLO 12D.9.1.2 Locate information about the various occupations that are available specific to CNC.

Goal 10: Describe the **history, technological progression, and emerging trends** in machining technology.

GLO 10.1: Describe the **history, technological progression, and emerging trends** in machining technology.

SLO 12D.10.1.1 Research the evolution, technological progression, and emerging trends in CNC machining.

Goal 11: Demonstrate **employability skills** related to machining technology.

GLO 11.1: Demonstrate **employability skills** related to machining technology.

SLO 12D.11.1.1 Demonstrate regular attendance and punctuality.

SLO 12D.11.1.2 Demonstrate accountability by taking responsibility for their actions.

SLO 12D.11.1.3 Demonstrate adaptability and effort.

SLO 12D.11.1.4 Demonstrate the ability to accept and follow directions and listen to feedback.

SLO 12D.11.1.5 Demonstrate the ability to stay on task and make effective use of time in class and shop environments.

SLO 12D.11.1.6 Demonstrate the ability to communicate respectfully and effectively.

SLO 12D.11.1.7 Demonstrate being responsible to oneself and to the facility.

SLO 12D.11.1.8 Demonstrate behaviour appropriate to the workplace.

SLO 12D.11.1.9 Demonstrate neat personal appearance and proper hygiene.

SLO 12D.11.1.10 Prepare/revise a personal resumé specific to an application to an employer of machinists.

Goal 12: Demonstrate awareness of the **ethical and legal standards** as they pertain to machining technology.

GLO 12.1: Demonstrate awareness of the **ethical and legal standards** as they pertain to machining technology.

SLO 12D.12.1.1 No applicable SLO.

SLO 12D.12.1.2 No applicable SLO.

Goal 13: Demonstrate awareness of **sustainability** as it pertains to machining technology.

GLO 13.1: Demonstrate awareness of **human sustainability** on machinists.

SLO 12D.13.1.1 No applicable SLO.

GLO 13.2: Describe machining technology's sustainability practices and impact on the environment.

SLO 12D.13.2.1 Discuss and demonstrate appropriate recycling, reduction of waste, and reusing of materials as they pertain to the machining industry.

SLO 12D.13.2.2 Discuss and demonstrate the appropriate disposal of coolants, oils, and non-recyclable waste.

GLO 13.3: Demonstrate awareness of the **business sustainability** of a machining technology facility.

SLO 12D.13.3.1 Discuss the relationship between employee training and business sustainability.

