



8842

BENCH METAL (10)

20S/20E/20M

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 to 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 the use of cutting and non-cutting hand tools and bench operations. Basic measurement, interpretation of engineering drawings, metallurgy, metal cutting physics, and semi-precision layout are emphasized as a foundation for students who plan on pursuing future course studies.

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 10.1.1.1 I identify safety and health requirements. (A1.1)
- SLO 10.1.1.2 Identify personal protective equipment (PPE) and PPE procedures. (A1.2)
- SLO 10.1.1.3 Identify appropriate safety procedures for working with electricity. (A1.3)
- SLO 10.1.1.4 Identify appropriate safety procedures to reduce fire hazards. (A1.4)
- SLO 10.1.1.5 Identify ergonomically correct procedures to avoid injury (e.g., stress, strain). (A1.5)
- SLO 10.1.1.6 Identify hazard recognition and control. (A1.6)
- SLO 10.1.1.7 Describe the hazards of confined-space entry. (A1.7)
- SLO 10.1.1.8 Identify first aid/cardiopulmonary resuscitation (CPR). (A1.8)
- SLO 10.1.1.9 Identify safety requirements as they apply to the WHMIS. (A1.9)
- SLO 10.1.1.10 Describe the identification and control of specified hazards. (A1.10)
- SLO 10.1.1.11 Identify types of personal protective equipment (PPE), and describe their applications. (A2.1)
- SLO 10.1.1.12 Describe the procedures used to care for and maintain PPE. (A2.2)

SLO 10.1.1.13	Identify types of fire extinguishing equipment, and describe their applications and procedures for use. (A2.3)
SLO 10.1.1.14	Identify workplace hazards, and describe safe work practices and equipment. (A2.4)
SLO 10.1.1.15	Identify and interpret workplace safety and health regulations. (A2.4)
SLO 10.1.1.16	Identify hazards, and describe safe work practices pertaining to fluids and coolants. (A8.2)
SLO 10.1.1.17	Identify hazards, and describe safe work practices pertaining to hand and power tools. (B1.1)
SLO 10.1.1.18	Demonstrate understanding and adherence to safe work procedures/job hazards analysis documents for each piece of equipment, tool, and consumable that they use.
SLO 10.1.1.19	Demonstrate understanding and adherence to safe practices and procedures for facilities, processes, tools, and equipment found in machining technology.
SLO 10.1.1.20	Discuss worker's responsibility to refuse unsafe work.
SLO 10.1.1.21	Demonstrate use of personal protective equipment (PPE) and adherence to PPE procedures used in machining technology.
SLO 10.1.1.22	Demonstrate the safe use of compressed air.
SLO 10.1.1.23	Practise appropriate cleaning and maintenance of the machining technology area and equipment for the promotion of a safe work/learning environment.
SLO 10.1.1.24	Practise appropriate safe behaviour to ensure personal safety, as well as the safety of others.
SLO 10.1.1.25	Demonstrate an understanding of the machinist's responsibility to maintain and clean equipment and tools.
SLO 10.1.1.26	Develop appropriate safety habits.
SLO 10.1.1.27	Demonstrate a safe, clean, organized, and uncluttered work area.
SLO 10.1.1.28	Explain the purpose/importance and use of accident report forms.
SLO 10.1.1.29	Identify hazards, and describe safe work practices pertaining to being present in a machine shop.
SLO 10.1.1.30	Identify machine-shop-related safety concerns.
SLO 10.1.1.31	Practise safe set-up/operation of tools used.

GLO 1.2: Demonstrate knowledge of the **Trade Safety Awareness Manual.**

(www.gov.mb.ca/tce/apprent/apprentice/trade_safety/)

- SLO 10.1.2.1 Explain the importance of trade safety and health in reducing injuries and fatalities to young employees in Manitoba. (TSA 1)
 - SLO 10.1.2.2 Describe the rights and responsibilities of employees, employers, and supervisors under the *Workplace Safety and Health Act*. (TSA 2)
 - SLO 10.1.2.3 Describe the steps to use in the Right to Refuse process. (TSA 3)
 - SLO 10.1.2.5 Demonstrate how to handle a potentially dangerous work situation. (TSA 5)
 - SLO 10.1.2.6 Explain the S.A.F.E. acronym. (TSA 6)
 - SLO 10.1.2.7 Define workplace safety and health hazards. (TSA 7)
 - SLO 10.1.2.8 Give examples of trade-specific workplace safety and health hazards. (TSA 8)
 - SLO 10.1.2.9 Give examples of five types of safety and health hazards. (TSA 9)
 - SLO 10.1.2.10 Define workplace safety and health risks. (TSA 10)
 - SLO 10.1.2.11 Give examples of trade-specific workplace safety and health risks. (TSA 11)
 - SLO 10.1.2.12 Explain the principles of hazard recognition and control as they apply to the specific trade. (TSA 12)
 - SLO 10.1.2.13 Match the WHMIS hazardous materials symbols and their meanings. (TSA 14)
 - SLO 10.1.2.14 Describe the importance of the Material Safety Data Sheets (MSDS). (TSA 15)
 - SLO 10.1.2.15 Demonstrate proper selection and use of a variety of personal protective equipment and fall protection systems. (TSA 17)
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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 10.2.1.1 Identify metallurgical terminology, abbreviations, symbols, and acronyms.
- SLO 10.2.1.2 Define terminology, abbreviations, symbols, and acronyms associated with basic layout. (C3.1)
- SLO 10.2.1.3 Define terminology, abbreviations, symbols, and acronyms associated with threads. (A4.1)
- SLO 10.2.1.4 Define terminology, abbreviations, symbols, and acronyms associated with hand tools and bench work..

Goal 3: Understand technical drawings.

GLO 3.1: Understand technical drawings.

- SLO 10.3.1.1 Produce basic paper-and-pencil sketch of project.
- SLO 10.3.1.2 Interpret and extract information from drawings. (A6.3)
- SLO 10.3.1.3 Identify types of threads, and describe their purpose and applications. (A4.3)
- SLO 10.3.1.4 Explain thread fit, classifications, and series. (A4.4)

Goal 4: Demonstrate layout and planning.

GLO 4.1: Demonstrate planning and layout procedures.

- SLO 10.4.1.1 Calculate layout dimensions and reference points. (C3.4)
- SLO 10.4.1.2 Identify types of basic layout tools, equipment, and accessories, and describe their applications and procedures for use. (C3.2)
- SLO 10.4.1.3 Use planning worksheets for projects.
- SLO 10.4.1.4 Identify and use tools required to perform basic layout on bench projects.
- SLO 10.4.1.5 Perform basic layout. (C3.9)
- SLO 10.4.1.6 Use ruler and scribe.

Goal 5: Use measurement and quality control tools.

GLO 5.1: Use measurement and quality control tools.

- SLO 10.5.1.1 Describe the importance of thread fit and the use of thread gauges. (A4.6)
- SLO 10.5.1.2 Measure and gauge threads, and describe their associated procedures. (A4.9)

- SLO 10.5.1.3 Identify basic measuring tools.
 - SLO 10.5.1.4 Describe care and calibration of measuring tools.
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Goal 6: Identify basic elements of metallurgy.

GLO 6.1: Identify basic elements of metallurgy.

- SLO 10.6.1.1 Identify metallurgical processes.
 - SLO 10.6.1.2 Identify the effects of carbon content on steel.
 - SLO 10.6.1.3 Describe basic metallurgy.
 - SLO 10.6.1.4 Identify alloy metals.
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Goal 7: Understand tools, equipment, and accessories.

GLO 7.1: Identify tools, equipment, accessories, and work-holding devices.

- SLO 10.7.1.1 Identify types of thread inserts, and describe their applications and installation procedures. (A4.5)
 - SLO 10.7.1.2 Identify types of hand tools, and describe their applications and procedures for use. (B1.2)
 - SLO 10.7.1.3 Identify types of power tools and equipment, and describe their applications and procedures for use. (B1.5)
 - SLO 10.7.1.4 Identify chip-cutting machines.
 - SLO 10.7.1.5 Identify non-chip-cutting machines.
 - SLO 10.7.1.6 Identify new generation machines.
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GLO 7.2: Use tools, equipment, accessories, and work-holding devices.

- SLO 10.7.2.1 Describe the procedures used to inspect, maintain, and store hand tools. (B1.3)
- SLO 10.7.2.2 Perform the procedures used to inspect, maintain, and store hand tools. (B1.4)
- SLO 10.7.2.3 Describe the procedures used to inspect, maintain, and store power tools and equipment. (B1.6)
- SLO 10.7.2.4 Perform procedures used to inspect, maintain, and store power tools and equipment. (B1.7)
- SLO 10.7.2.5 Describe the procedures used to produce threads using taps and dies. (A4.10)
- SLO 10.7.2.6 Perform procedures used to cut or tap a thread. (A4.11)
- SLO 10.7.2.7 Use files.
- SLO 10.7.2.8 Use hacksaw.
- SLO 10.7.2.9 Use bench vise.
- SLO 10.7.2.10 Use punch and ball peen hammer.

SLO 10.7.2.11	Use chisels.
SLO 10.7.2.12	Use screwdrivers.
SLO 10.7.2.13	Use wrenches.
SLO 10.7.2.14	Identify types of thread failures, and describe their causes and remedies. (A4.7)
SLO 10.7.2.15	Identify techniques used to troubleshoot hand tool operations, and describe their associated procedures.

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

SLO 10.7.3.1	Identify types of thread failures, and describe their causes and remedies. (A4.7)
SLO 10.7.3.2	Identify techniques used to troubleshoot hand tool 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 10.8.1.1	Solve problems involving fractions and decimals.
SLO 10.8.1.2	Solve problems involving metric and imperial measure.
SLO 10.8.1.3	Solve problems involving length, perimeter, circumference, volume, area, mass, angles, ratio, and percentage.
SLO 10.8.1.4	Convert between imperial and metric measurements.
SLO 10.8.1.5	Use formulas to accurately calculate data for use in machining operations.
SLO 10.8.1.6	Accurately calculate and measure parts and angles.
SLO 10.8.1.7	Perform mathematical calculations, conversions, and measurements, as required for the project.
SLO 10.8.1.8	Calculate and select tap drill sizes in metric and imperial. (A4.8)
SLO 10.8.1.9	Estimate stock required.
SLO 10.8.1.10	Estimate time required for task completion.
SLO 10.8.1.11	Estimate material waste from material removal.
SLO 10.8.1.12	Use charts and reference books to determine tap drill sizes.
SLO 10.8.1.13	Use charts and reference books to determine conversions among metric, fractional, and decimal units of measurement.

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 10.9.1.1 Describe the structure and scope of the trade. (A3.1)
- SLO 10.9.1.2 Identify post-secondary opportunities that complement the skills of a machinist.

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 10.10.1.1 Research the history of the machining trade and the evolution of machine tools.

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

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

- SLO 10.11.1.1 Demonstrate regular attendance and punctuality.
- SLO 10.11.1.2 Demonstrate accountability by taking responsibility for their actions.
- SLO 10.11.1.3 Demonstrate adaptability and effort.
- SLO 10.11.1.4 Demonstrate the ability to accept and follow directions and listen to feedback.
- SLO 10.11.1.5 Demonstrate the ability to stay on task and make effective use of time in class and shop environments.
- SLO 10.11.1.6 Demonstrate the ability to communicate respectfully and effectively.
- SLO 10.11.1.7 Demonstrate being responsible to oneself and to the facility.
- SLO 10.11.1.8 Demonstrate behaviour appropriate to the workplace.
- SLO 10.11.1.9 Demonstrate neat personal appearance and proper hygiene.
- SLO 10.11.1.10 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 10.12.1.1 Understand the need for and the importance of ethics in the machining industry.
- SLO 10.12.1.2 Discuss the need for and the uses of engineering specifications.

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

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

- SLO 10.13.1.1 Discuss human sustainability.

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

- SLO 10.13.2.1 Discuss and demonstrate appropriate recycling, reduction of waste, and reusing of materials as they pertain to the machining industry.
- SLO 10.13.2.2 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 10.13.3.1 Discuss the importance of machining to the economy.