Machinist
Level 3

10-2019/Rev 05-2025

Apprenticeship Manitoba

Machinist

Unit: **C1 Machinable Materials**

Level: Three

Duration: 7 hours

Theory: 7 hours

Practical: 0 hours

Overview:

This unit of instruction is designed to introduce knowledge of metals and their characteristics. It is also designed to introduce knowledge of machinable materials, their applications and procedures for use.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Define terminology associated with machinable materials.	**10%**
2. Identify hazards and describe safe work practices pertaining to machining materials.	**10%**
3. Describe the properties of metals and their characteristics. a. Chemical b. Physical c. Mechanical	**20%**
4. Identify and interpret markings and documentation relating to material selection. a. Identifications systems • American Society of Mechanical Engineering (ASME) • American National Standards Institute (ANSI) • Colour coding (manufacturer specific). • Number b. Documentation • Mill certificates	**10%**
5. Identify types of machinable materials and describe their characteristics and applications. a. Metallic • Ferrous • Non-ferrous b. Non-metallic c. Specialty • Refractory metals • Precious metals	**20%**

6. **Identify types of coolants used with machinable materials and describe the considerations affecting their selection.** **10%**

7. **Explain the operating principles of machining materials.** **10%**

a. Metallic.
b. Non-metallic.
c. Specialty

8. **Describe the procedures used to set up and use machine materials.** **10%**

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Unit: **C2 Material Testing**

Level: Three

Duration: 17 hours

Theory: 7 hours

Practical: 10 hours

Overview:

This unit of instruction is designed to introduce knowledge of material testing and its applications. It is also designed to introduce knowledge of material testing procedures.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Define terminology associated with material testing.	**15%**
2. Identify hazards and describe safe work practices pertaining to material testing.	**10%**
3. Describe the purpose and applications of material testing. a. Hardness b. Composition c. Properties	**15%**
4. Identify types of tests performed on materials and describe their applications. a. Destructive • Tensile strength • Impact b. Non-destructive • X-ray • Dye penetrant/liquid penetrant • Magnetic particle c. Spark d. File	**15%**
5. Perform tests on materials. a. Destructive • Tensile strength • Impact b. Non-destructive • X-ray	**30%**

- Dye penetrant/liquid penetrant
- Magnetic particle

6. Identify the machines and scales used to determine material hardness and describe their associated procedures. **15%**

a. Rockwell

b. Brinell

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Unit: **C3 Precision Layout**

Level: Three

Duration: 14 hours

Theory: 4 hours

Practical: 10 hours

Overview:

This unit of instruction is designed to introduce knowledge of precision layout and its applications. It is also designed to introduce knowledge of precision layout tools and equipment, their applications, maintenance and procedures for use.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Identify precision layout tools and equipment and describe their applications and procedures for use. a. Universal bevel protractor b. Sine bar c. Precision height gauge d. Gauge blocks e. Granite table f. Surface plate	**10%**
2. Describe the procedures used to perform precision layout.	**15%**
3. Perform precision layout.	**30%**
4. Calculate sine bar values.	**10%**
5. Perform gauge block build-up.	**10%**
6. Calculate angles, arcs and location from reference point.	**15%**
7. Describe the procedures used to inspect, maintain and store precision layout tools and equipment.	**10%**

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Unit: **C4 Horizontal/Universal Milling Machine Operation**

Level: Three

Duration: 95 hours

Theory: 20 hours

Practical: 75 hours

Overview:

This unit of instruction is designed to introduce knowledge of horizontal/universal milling machines, their set up, maintenance and procedures for use.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Identify hazards and describe safe work practices pertaining to horizontal/universal milling machines.	**10%**
2. Describe the considerations used to determine speed, feed and depth of cut for horizontal/universal milling machine operations.	**5%**
3. Calculate speed, feed and depth of cut.	**10%**
4. Identify potential set up problems and describe their cause and remedies.	**5%**
5. Describe the procedures used to align workpieces.	**5%**
6. Describe the procedures used to set up horizontal/universal milling machines to perform basic milling operations.	**5%**
7. Identify the considerations and requirements for selecting tools and accessories for milling operations.	**5%**
8. Describe the procedures used to inspect and maintain horizontal/universal milling machines.	**5%**
9. Describe the procedures used to perform milling operations on horizontal/universal milling machines. a. Contouring b. Surfacing c. Keyways and keyseats d. Straddle e. Gang f. T-slot	**20%**

g. End milling
h. Slitting
i. Slotting

10. Perform procedures used to perform milling operations on horizontal/universal milling machines. 20%

11. Identify milling cutter failures and describe their causes and remedies. 5%

12. Identify techniques used to troubleshoot horizontal/universal milling operations and describe their associated procedures. 5%

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Unit: **C5 Gears and Gear Cutting**

Level: Three

Duration: 45 hours

Theory: 20 hours

Practical: 25 hours

Overview:

This unit of instruction is designed to introduce knowledge of gears and gear cutting. It is also designed to introduce knowledge of gear measurement and gear milling operations.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Define terminology associated with gears and gear cutting.	**5%**
2. Identify hazards and describe safe work practices pertaining to gears and gear cutting.	**5%**
3. Explain the principles of gears and describe their purpose and operation.	**10%**
4. Identify types of gears and describe their characteristics and applications. a. Spur b. Helical c. Bevel d. Worm e. Rack f. Splines	**10%**
5. Identify methods of gear tooth measurement and describe their associated procedures.	**5%**
6. Calculate gear cutting requirements.	**5%**
7. Calculate ratios for simple and compound gears.	**5%**
8. Identify machines and accessories used to cut gears.	**5%**
9. Identify types of gear cutting tools and describe their characteristics and applications.	**5%**

10.	**Describe the procedures used to set up and produce gears.**	**15%**
11.	**Perform procedures used to set up and produce gears.**	**30%**

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Unit: **C6 Abrasive Finishing**

Level: Three

Duration: 14 hours

Theory: 7 hours

Practical: 7 hours

Overview:

This unit of instruction is designed to introduce knowledge of abrasive, their applications and procedures for use. It is also designed to introduce knowledge of grinding wheels, their applications and procedures for use. The unit introduces knowledge of abrasive finishing techniques.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Define terminology associated with abrasive finishing.	**5%**
2. Identify hazards and describe safe work practices pertaining to abrasives.	**10%**
3. Identify types of abrasives and describe their characteristics and applications.	**5%**
4. Identify types of grinding wheels and describe their characteristic and applications.	**5%**
5. Identify the considerations and requirements for selecting a grinding wheel for common grinding operations. a. Abrasive b. Grain c. Grade d. Structure e. Bond	**10%**
6. Describe the procedures used to mount and balance grinding wheels.	**5%**
7. Perform procedures used to mount and balance grinding wheels.	**5%**
8. Identify types of wheel dressers and describe their applications.	**5%**
9. Describe the procedures used to true and dress grinding wheels.	**5%**
10. Perform procedures used to true and dress grinding wheels.	**10%**

11.	**Describe the procedures used to inspect, maintain and store grinding wheels.**	**5%**
12.	**Describe the procedures used to shape or finish a workpiece using abrasive techniques.**	**5%**
13.	**Perform procedures used to shape or finish a workpiece using abrasive techniques.**	**5%**
14.	**Identify types of materials and equipment used to lap and hone workpieces.**	**5%**
15.	**Identify lapping and honing techniques and describe their associated procedures.**	**5%**
16	**Identify types of materials and equipment used to buff and polish workpieces.**	**5%**
17.	**Identify polishing and blending techniques and describe their associated procedures.**	**5%**

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Unit: **C7 Surface Grinders**

Level: Three

Duration: 35 hours

Theory: 10 hours

Practical: 25 hours

Overview:

This unit of instruction is designed to introduce knowledge of surface grinders, their set up, maintenance and procedures for use.

Objectives and Content:		**Percent of Unit Mark (%)**
1.	**Identify hazards and describe safe work practices pertaining to surface grinding.**	**10%**
2.	**Describe the considerations used to determine feed, and depth of cut for grinding operations.**	**5%**
3.	**Calculate feed and depth of cut.**	**5%**
4.	**Describe the procedures to set up grinders and their accessories.**	**5%**
5.	**Describe the procedures to align a workpiece.**	**5%**
6.	**Identify potential set up problems and describe their causes and remedies.**	**5%**
7.	**Identify types of accessories used for surface grinding operations and describe their applications.**	**5%**
8.	**Describe the procedures used to adjust and maintain surface grinding machines.**	**5%**
9.	**Describe the procedures used to perform surface grinding operations.**	**10%**
10.	**Perform procedures used to perform surface grinding operations.**	**20%**
11.	**Identify technique used to troubleshoot surface grinding operations and describe their associated procedures.**	**5%**
12.	**Identify types of wheel dressers and describe their applications.**	**5%**
13.	**Describe the procedures used to true and dress grinding wheels.**	**5%**

14. Perform procedures used to true and dress grinding wheels. 10%

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Unit: **C8 Cylindrical Grinders**

Level: Three

Duration: 25 hours

Theory: 5 hours

Practical: 20 hours

Overview:

This unit of instruction is designed to introduce knowledge of cylindrical grinders, their set up, maintenance and procedures for use.

Objectives and Content:		**Percent of Unit Mark (%)**
1.	**Identify hazards and describe safe work practices pertaining to cylindrical grinding.**	**10%**
2.	**Describe the considerations used to determine feed and depth of cut for grinding operations.**	**5%**
3.	**Calculate fee and depth of cut.**	**5%**
4.	**Describe the procedures used to set up grinders and accessories.**	**5%**
5.	**Describe the procedures used to align or dial workpieces.**	**10%**
6.	**Identify potential set up problems and describe their causes and remedies.**	**5%**
7.	**Identify types of accessories used for cylindrical grinding operations and describe their applications.**	**5%**
8.	**Describe the procedures used to inspect and maintain cylindrical grinding machines.**	**5%**
9.	**Describe the procedures used to perform cylindrical grinding operations.**	**5%**
10.	**Perform procedures used to perform cylindrical grinding operations.**	**30%**
11.	**Identify techniques used to troubleshoot cylindrical grinding operations and describe their associated procedures.**	**5%**
12.	**Identify types of wheel dressers and describe their applications.**	**5%**

13. Describe the procedures used to true and dress grinding wheels. 5%

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Unit: **C9 Computer Numerical Control (CNC) II – Program Code**

Level: Three

Duration: 28 hours

Theory: 7 hours

Practical: 21 hours

Overview:

This unit of instruction is designed to introduce control programming, computer aided design (CAD) and computer aided manufacturing (CAM). It also introduces programming and making parts.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Define terminology associated with control programming.	**8%**
2. Identify the quality control work practices pertaining to control programming.	**12%**
3. Define terminology associated with computer aided design (CAD).	**20%**
4. Identify the quality control work practices pertaining to CAD.	**20%**
5. Define terminology associated with computer aided manufacturing (CAM).	**20%**
6. Identify the quality control work practices pertaining to CAM.	**20%**

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