

# Machinist Level 2

## Machinist

**Unit:** B1 Advanced Drawings

**Level:** Two

**Duration:** 28 hours

Theory: 28 hours

Practical: 0 hours

### Overview:

This unit is designed to introduce knowledge of views of drawings and their applications. It is also designed to introduce knowledge of industry symbols and markings and their applications. It introduces knowledge of geometric dimensions and tolerances and their applications.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
<b>1. Identify drawing views and describe their purpose and applications:</b>	<b>20%</b>
a. Isometric.	
b. Orthographic.	
c. Sectional.	
d. Auxiliary.	
<b>2. Identify and interpret industry symbols and markings and describe their applications:</b>	<b>30%</b>
a. Surface textures.	
b. Hidden (phantom) lines.	
c. Geometric dimensions and tolerances.	
d. Datums.	
e. Moldings, forgings and castings.	
<b>3. Explain the principles of geometric dimensioning and tolerancing.</b>	<b>30%</b>
<b>4. Perform basic drafting skills.</b>	<b>20%</b>

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## Machinist

**Unit:** B2 Mechanical Components

**Level:** Two

**Duration:** 7 hours

Theory: 4 hours

Practical: 3 hours

### Overview:

This unit of instruction is designed to introduce knowledge of mechanical components, their applications and procedures for use. It also includes knowledge of reconditioning.

### Mechanical Components

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
1. Define terminology associated with mechanical components.	5%
2. Identify hazards and describe safe work practices pertaining to mechanical components.	5%
3. Identify types of fasteners, retainers and locators and describe their characteristics and applications: a. Bonds. b. Nuts. c. Dowel pins. d. Washers. e. Studs. f. Snap rings.	5%
4. Identify head styles of threaded fasteners and describe their characteristics and applications.	5%
5. Identify techniques used to torque fasteners and describe their associated procedures.	5%
6. Identify nut and bolt designs and describe their characteristics and applications.	10%
7. Identify grades of nuts and bolts and describe their characteristics and applications.	5%
8. Identify types of keys, keyseats and keyways and describe their characteristics and applications: a. Square. b. Woodruff.	5%

- c. Flat/rectangular.
  - d. Gib.
  - e. Taper.
9. Explain the principles of stepped keys. 5%
  10. Describe the procedures used to hand broach keyways. 5%
  11. Identify types of bearings and bushings and describe their characteristics and applications. 20%
  12. Perform procedures used to hand broach keyways. 25%

### Reconditioning

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
1. Identify types of fits, clearances, tolerances and serviceable limits.	10%
2. Identify types of mechanical components, and describe their disassembly procedures: <ul style="list-style-type: none"> <li>a. Bearings.</li> <li>b. Seals.</li> <li>c. Threaded inserts.</li> <li>d. Adapters/bushings.</li> </ul>	15%
3. Describe the procedures used to repair or replace mechanical components. <ul style="list-style-type: none"> <li>a. Materials.</li> </ul>	15%
4. Identify types of equipment used in reconditioning and describe their procedures for use: <ul style="list-style-type: none"> <li>a. Pullers.</li> <li>b. Presses.</li> </ul>	15%
5. Identify types of materials used to fit and reassemble components and describe their applications and procedures for use: <ul style="list-style-type: none"> <li>a. Adhesives.</li> <li>b. Sealants.</li> <li>c. Lubricants and lubrication systems.</li> </ul>	15%
5. Describe the procedures used to fit and reassemble components.	15%
6. Identify the considerations and requirements for selecting machines and tooling to complete specified jobs.	15%

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## Machinist

**Unit:** B3 Heat Treatment

**Level:** Two

**Duration:** 11 hours

Theory: 7 hours

Practical: 4 hours

### Overview:

This unit is designed to introduce knowledge of basic heat treatment and its applications.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
1. Define terminology associated with heat treatment.	10%
2. Identify hazards and describe safe work practices pertaining to heat treatment.	10%
3. Identify methods used to determine the carbon content of steels.	10%
4. Describe the procedures used to determine properties of metals: a. Chemical. b. Physical. c. Mechanical.	10%
5. Identify the processes used in the heat treatment of metals and describe their appliances: a. Annealing. b. Hardening. c. Normalizing. d. Stress relieving. e. Tempering.	10%
6. Identify and interpret technical data used in the heat treatment of metals: a. Charts. b. Tables.	10%
7. Identify methods used for hardening steel and describe the properties of the steel produced by each: a. Water hardening. b. Oil hardening. c. Air hardening. d. Case hardening.	10%

- 8. Identify methods used to heat treat metals and describe their associated procedures and equipment: 10%**
- a. Flame.
  - b. Furnace.
  - c. Induction.
- 9. Perform basic heat treatment and applications. 20%**

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## Machinist

**Unit:** B4 Introduction to Welding

**Level:** Two

**Duration:** 7 hours

Theory: 7 hours

Practical: 0 hours

### Overview:

This unit of instruction is designed to introduce knowledge of basic welding processes used in machining operations and their applications.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
1. Define terminology associated with basic welding.	10%
2. Identify hazards and describe safe work practices pertaining to basic welding processes.	20%
3. Interpret codes and regulations pertaining to welding: a. Training and certification requirements.	10%
4. Identify welding processes and describe their characteristics and applications.	20%
5. Identify types of welding equipment and describe their applications.	10%
6. Describe the procedures used to perform basic welding and heating applications: a. Bending. b. Tacking.	10%
7. Describe the procedures used to perform basic oxy-fuel cutting.	10%
8. Describe the procedures used to inspect and store welding equipment.	10%

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## Machinist

**Unit: B5 Power Saws**

**Level: Two**

**Duration: 7 hours**

Theory: 3 hours

Practical: 4 hours

### Overview:

This unit of instruction is designed to introduce knowledge of saws, their applications, maintenance and procedures for use.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
1. Define terminology associated with power saws.	10%
2. Identify hazards and describe safe work practices pertaining to power saws.	10%
3. Identify types of saws and attachments and describe their applications:	10%
a. Vertical.	
b. Horizontal.	
c. Reciprocating/power hacksaws.	
d. Cold circular.	
e. Abrasive cutoff.	
4. Identify types of sawing operations and describe their associated procedures.	10%
5. Identify types of blades and describe their parameters, applications and installation procedures.	10%
6. Identify potential problems during sawing operations and describe their causes and remedies.	10%
7. Calculate speed and feed requirements.	10%
8. Describe the procedures used to inspect and maintain power saws.	10%
9. Perform sawing operations.	20%

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## Machinist

**Unit:** B6 Contour Bandsaws

**Level:** Two

**Duration:** 7 hours

Theory: 2 hours

Practical: 5 hours

### Overview:

This unit of instruction is designed to introduce knowledge of power saws, their applications, maintenance and procedures for use.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
1. Define terminology associated with contour bandsaws.	5%
2. Identify hazards and describe safe work practices pertaining to contour bandsaws.	10%
3. Identify the components and accessories of contour bandsaws and describe their characteristics and applications.	5%
4. Identify types of blades and describe their characteristics and applications.	10%
5. Describe the procedures used to set up and operate contour bandsaws: a. Irregular shapes. b. Internal/external counters.	10%
6. Calculate speed and feed requirements.	10%
7. Describe the procedures used to butt weld bandsaw blades.	10%
8. Describe the procedures used to inspect and maintain contour band saws.	5%
9. Calculate the length of blade.	5%
10. Perform contour bandsaw operations.	30%

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## Machinist

**Unit: B7 Cutting Machine Tools**

**Level:** Two

**Duration:** 7 hours

Theory: 3 hours

Practical: 4 hours

### Overview:

This unit of instruction is designed to introduce knowledge of cutting machine tools, their applications and procedures for use. It is also designed to introduce knowledge of cutting tool geometry and its use.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
1. Define terminology associated with cutting machine tools.	5%
2. Identify hazards and describe safe work practices pertaining to cutting machine tools.	5%
3. Explain the principles of chip formation.	15%
4. Identify types of cutting machine tools and describe their characteristics and applications:	5%
a. Indexable insert.	
b. High speed steel (HSS).	
c. Braized Carbide.	
5. Identify types of cutting tool materials and describe their applications and procedures for use:	5%
a. Carbide.	
b. High speed steel (HSS).	
c. Ceramic.	
6. Explain tool geometry and its purpose.	15%
7. Describe the procedures used to sharpen cutting tools.	8%
8. Interpret the systems for the identification of carbide inserts/coatings and tool holders:	2%
a. American National Standards Institute (ANSI).	
b. International System of Units (SI).	
9. Describe the effect of carbide cutting tools on speed, feed and depth of cut.	5%

**10. Identify types of carbide tool holding devices and describe their applications. 5%**

**11. Demonstrate cutting tool geometry and its use. 30%**

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## Machinist

**Unit:** B8 Precision Measurement II

**Level:** Two

**Duration:** 7 hours

Theory: 3 hours

Practical: 4 hours

### Overview:

This unit of instruction is designed to introduce knowledge of gauge blocks, their applications and procedures for use. It is also designed to introduce knowledge of angular measurement and its use.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
1. Identify types and grades of gauge blocks and describe their applications and procedures for use: a. Metric. b. Imperial.	10%
2. Calculate and perform gauge block build-ups.	30%
3. Identify types of wear blocks and describe their purpose and applications.	10%
4. Explain the principles of angular measurement.	10%
5. Identify universal bevel protractors and describe their applications and procedures for use.	10%
6. Identify sine bars and describe their applications and procedures for use.	10%
7. Identify compound sine plates and describe their applications and procedures for use.	10%
8. Describe procedures used to maintain and store gauge blocks.	10%

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## Machinist

**Unit:** B9 Advanced Conventional Lathe Operation

**Level:** Two

**Duration:** 71 hours

Theory: 14 hours

Practical: 57 hours

### Overview:

This unit of instruction is designed to introduce knowledge of turning contours and forms. It is also designed to introduce knowledge of advanced threading and multiple starts.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
1. Explain the principles of form turning.	5%
2. Identify types of form turning tools and describe their characteristics and applications.	5%
3. Describe the procedures used to turn forms.	5%
4. Describe the procedures used to set up, position work and turn eccentrics.	5%
5. Identify types of threads, and describe their purpose, characteristics and applications:	15%
a. Specialty:	
• Acme.	
• Buttress.	
• Tapered pipe.	
• Straight pipe.	
• UN threads.	
b. Multiple start.	
6. Identify methods used to cut multiple start threads and describe their associated procedure:	5%
a. Slotted drive or faceplate.	
b. Indexing of the spindle gear.	
c. Use of thread chasing dial.	
d. Compound rest method.	
7. Identify methods used to cut specialty threads and describe their associated procedures.	5%

- 8. Describe the procedures used to check and measure threads. 5%
- 9. Perform threading operations. 50%

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## Machinist

**Unit:** B10 Taper Turning

**Level:** Two

**Duration:** 17 hours

Theory: 7 hours

Practical: 10 hours

### Overview:

This unit of instruction is designed to introduce knowledge of tapers, their attachments and applications. It is also designed to introduce knowledge of taper turning operations.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
1. Define terminology associated with taper turning.	10%
2. Identify hazards and describe safe work practices pertaining to taper turning.	10%
3. Identify types of tapers and describe their applications:	10%
a. Morse.	
b. Taper pin.	
c. Pipe thread taper.	
d. Machine taper.	
4. Identify types of taper attachments and describe their applications and procedures for use:	10%
a. Plain.	
b. Telescopic.	
5. Calculate dimensions of tapers in metric and imperial.	10%
6. Identify methods used to turn tapers and describe their associated procedures:	
a. Taper attachment.	
b. Tailstock.	
c. Compound rest.	
7. Identify methods used to check tapers and describe their associated procedures:	20%
a. Plug gauge.	
b. Ring gauge.	
c. Sine bar.	
d. Layout lines.	
e. Dial indicator.	

8. Demonstrate methods used to turn tapers and associated procedures.

30%

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## Machinist

**Unit:** B11 Conventional Milling Machine Operation

**Level:** Two

**Duration:** 71 hours

Theory: 14 hours

Practical: 57 hours

### Overview:

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

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
1. Identify hazards and describe safe work practices pertaining to vertical milling machines.	5%
2. Describe the considerations used to determine speed, feed and depth of cut for vertical milling machine operations.	2%
3. Calculate speed, feed and depth of cut.	3%
4. Identify potential set up problems and describe their causes and remedies.	3%
5. Describe the procedures used to align vertical milling machine heads.	2%
6. Align vertical milling machine heads.	2%
7. Describe the procedures used to align workpieces.	2%
8. Align workpieces.	3%
9. Describe the procedures used to set up vertical milling machines to perform basic milling operations.	3%
10. Identify the considerations and requirements used for selecting tools and accessories for milling operations.	3%
11. Describe the procedures used to perform milling operations on vertical milling machines:	10%
a. Contouring.	
b. Pocketing.	
c. Boring.	
d. Reaming.	

- e. Grooving.
- f. Surfacing.
- g. Drilling.
- h. Tapping.
- i. Countersinking.
- j. Counterboring.
- k. Chamfering.
- l. Spotfacing.
- m. Dovetailing.

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|---|------------|
| <b>12. Describe the procedures used to mill profiles using milling machines.</b>  | <b>3%</b>  |
| <b>13. Describe the procedures used to perform gear cutting operations on milling machines.</b>                           | <b>2%</b>  |
| <b>14. Describe the procedures used to inspect and maintain milling machines.</b>   | <b>2%</b>  |
| <b>15. Identify types of rotary tables and describe their construction, applications and procedures for use.</b>          | <b>3%</b>  |
| <b>16. Identify types of dividing heads and describe their characteristics and applications.</b>                          | <b>2%</b>  |
| <b>17. Explain the principles and perform calculations involved in indexing.</b>  | <b>3%</b>  |
| <b>18. Identify milling cutter failures and describe their causes and remedies.</b>                                       | <b>2%</b>  |
| <b>19. Identify techniques used to troubleshoot vertical milling operations and describe their associated procedures.</b> | <b>5%</b>  |
| <b>20. Perform procedures used to set up vertical milling machines to perform basic milling operations.</b>               | <b>40%</b> |

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## Machinist

**Unit:** B12 Introduction to Grinding Machines

**Level:** One

**Duration:** 7 hours

Theory: 3 hours

Practical: 4 hours

### Overview:

This unit of instruction is designed to introduce knowledge of grinding machines, their applications and procedures for use. In addition, it will introduce knowledge of offhand (bench) grinding operations. It will introduce knowledge of special (form) grinding operations.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
1. Define terminology associated with grinding machines.	10%
2. Identify hazards and describe safe work practices pertaining to grinding machines.	10%
3. Identify types of work holding devices and describe their applications.	10%
4. Identify types of grinding machines and accessories and describe their applications: a. Pedestal. b. Surface. c. Cylindrical. d. Centreless. e. Tool and cutter grinder.	20%
5. Describe the procedures used to perform offhand (bench) grinding operations.	10%
6. Perform offhand (bench) grinding operations.	20%
7. Describe the procedures used to perform special (form) grinding operations.	10%
8. Perform procedures for changing and dressing a grinding wheel.	10%

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## Machinist

**Unit:** B13 Computer Numerical Control (CNC) I Machine - Tools

**Level:** Two

**Duration:** 33 hours

Theory: 33 hours

Practical: 0 hours

### Overview:

This unit of instruction is designed to introduce knowledge of CNC machines-tools, their accessories, attachments and applications. It is also designed to introduce control programming, CAD and CAM.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
1. Define terminology associated with CNC machine-tools.	10%
2. Interpret the hazards and describe safe work practices pertaining to CNC machine-tools.	20%
3. Describe the advantages of using CNC machine-tools.	10%
4. Identify CNC axes and describe the relationship between them.	10%
5. Identify types of CNC machine-tools and describe their characteristics and applications.	10%
6. Identify types of accessories and tool changes used with CNC machine-tools and describe their applications.	10%
7. Identify types of tool holders and work holding devices used with CNC machine-tools and describe their applications.	10%
8. Introduction to control programming CAD.	10%
9. Introduction to control programming CAM.	10%

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