

# Tool and Die Maker Level 3

## **Tool and Die Maker**

**Unit:** C1 Basic Tool Design

**Level:** Three

**Duration:** 10 hours

Theory: 3 hours

Practical: 7 hours

### **Overview:**

This unit of instruction introduces the Tool and Die Maker Apprentice with the knowledge and skills necessary for basic tool design and apply information necessary for the construction of the workpiece.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
<b>1. Interpret information provided on blueprints:</b>	<b>10%</b>
a. Design considerations: <ul style="list-style-type: none"><li>• Shrinkage allowances.</li><li>• Machining allowances.</li><li>• Cooling stresses.</li><li>• Draft angles.</li><li>• Tolerances.</li><li>• Fillets and radii.</li></ul>	
b. Arrowless (Co-ordinate) Dimensioning: <ul style="list-style-type: none"><li>• Arrowless dimensioning applications:<ul style="list-style-type: none"><li>Numerical control.</li><li>Jig borer and jig grinder.</li></ul></li></ul>	
c. Zero positions: <ul style="list-style-type: none"><li>• Centre locations.</li><li>• Corner locations.</li><li>• Outside locations.</li><li>• Other locations within the workpiece.</li></ul>	
d. Datum and point to point: <ul style="list-style-type: none"><li>• Applications.</li><li>• Tolerance considerations.</li></ul>	
e. True-position dimensioning: <ul style="list-style-type: none"><li>• Geometric tolerancing.</li><li>• Symbols.</li></ul>	
<b>2. Identify and sketch various types of fasteners including head style and list their specifications:</b>	<b>10%</b>
a. Fasteners: <ul style="list-style-type: none"><li>• Head and point sizes.</li><li>• Fastener specifications.</li></ul>	

- Finished and semi-finished.
  - Types of threaded fasteners.
  - Styles of head recesses.
  - Types of nonthreaded fasteners.
- b. Other fasteners:
- Washers, nuts, pins, dowel pins.
  - Springs, rivets.

**3. Design tooling for a component: 20%**

- a. Principles of design:
- Concepts.
  - Components.
  - Detail drawings.
  - Assembly drawings.
  - Abbreviations.
  - Symbols.
    - D.I.N.
    - A.N.S.I.
    - CSA
  - Material list.
  - Conversions:
    - Imperial to SI.
    - SI to Imperial.

**4. Identify factors affecting job planning: 10%**

- a. Bill of material.
- b. Job planning.
- Correct sequence of machine operations.
  - Equipment requirements.
  - Tooling requirements.
  - Cutting time calculations.
  - Time to complete job.
  - Tolerance and surface finish considerations.

**5. Prepare a working drawing or a shop sketch. 50%**

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## Tool and Die Maker

**Unit:** C2 Trade Mathematics I

**Level:** Three

**Duration:** 24 hours

Theory: 24 hours

Practical: 0 hours

### Overview:

This unit consists of mathematical concepts and continues with drawing calculations applied trigonometry.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
1. <b>Identify algebraic and formula based calculations:</b> a. Ratio and proportion. b. Spring calculations. c. Bend allowances.	20%
2. <b>Identify clearance % calculations.</b>	20%
3. <b>Identify draw die calculations (bend allowances).</b>	20%
4. <b>Identify centre of gravity (centroids).</b>	20%
5. <b>Identify applied trigonometry:</b> a. Right triangles. b. Oblique triangles. c. Right triangles.	20%

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## **Tool and Die Maker**

**Unit:** C3 Trade Science I

**Level:** Three

**Duration:** 24 hours

Theory: 24 hours

Practical: 0 hours

### **Overview:**

This unit introduces the Tool and Die Maker Apprentice to the basic concepts of trade science. Apprentices will receive instruction in the basic concepts of strength of materials as well as the resolution of simple static forces.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
<b>1. Identify and describe strength of materials:</b>	<b>50%</b>
a. The concept of force.	
b. Stress in materials.	
c. Effects of stress.	
d. Calculation of stress and strain in manufacturing situations.	
<b>2. Identify and describe statics:</b>	<b>50%</b>
a. Levers.	
b. Torque.	
c. Moments of force.	
d. Resolving simple static forces.	

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## Tool and Die Maker

**Unit:** C4 Comparison Measurement

**Level:** Three

**Duration:** 7 hours

Theory: 3 hours

Practical: 4 hours

### Overview:

This unit of instruction is designed to provide the Tool and Die Maker Apprentice with a variety of methods of precision measurement. The unit also covers areas of jig boring and fixture design that are not included in the National Occupational Analysis. Material covered includes: comparators, coordinate measuring system and coordinate locating system.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
<b>1. Describe comparators, their applications, accuracy and procedures.</b>	<b>30%</b>
<b>2. Use comparators:</b>	<b>40%</b>
a. Dial indicators, their applications, accuracy and procedures.	
b. Mechanical and electronic comparators, their applications, advantages and procedures for use.	
c. Optical comparators, their applications, advantages and procedures for use.	
d. Mechanical-optical comparators, their applications, advantages and procedures for use.	
e. Pneumatic comparators, their applications, advantages and procedures for use.	
f. Air gauges, their applications, advantages and procedures for use.	
g. Comparators, their characteristics and applications.	
<b>3. Describe coordinate locating system:</b>	<b>30%</b>
a. Coordinates used.	
b. Purpose, advantages and procedure for prefiguring coordinates.	
c. Proper method for setup of the machine and location of the workpiece.	
d. Procedures for boring holes.	
e. Procedure for measurement of holes.	
f. Procedure for inspection of holes.	

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## **Tool and Die Maker**

**Unit:** C5 Grinding Operations I

**Level:** Three

**Duration:** 12 hours

Theory: 0 hours

Practical: 12 hours

### **Overview:**

This unit of instruction is designed to provide the Tool and Die Maker apprentice with the knowledge and understanding of advanced grinding operations.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
1. Interpret information provided on blueprints.	25%
2. Perform safety procedures for grinder setup and operation.	25%
3. Perform procedures required to set up and perform advanced grinding operations.	25%
4. Troubleshoot problems during advanced grinding operations.	25%

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## Tool and Die Maker

**Unit:** C6 Basic Die Making (Theory)

**Level:** Three

**Duration:** 61 hours

Theory: 61 hours

Practical: 0 hours

### Overview:

This unit of instruction is designed to provide the Tool and Die apprentice with the knowledge and understanding of basic tool and die making practices. The unit of instruction will consist of safety. Two types of safety: worker safety and protection of dies. Various topics include the following: press types, blanking and piercing, calculations: area, tonnage, shear strength, press types and 14 steps to die design.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
<b>1. Identify safety concerns:</b>	<b>20%</b>
a. Two types of safety. <ul style="list-style-type: none"><li>• Worker safety.</li><li>• Press controls.</li><li>• Safety attachments.</li><li>• Punch press guarding.</li><li>• Operator training.</li><li>• Protection of dies.</li></ul>	
<b>2. Identify press types:</b>	<b>10%</b>
a. Press types, motions, actions and die cushions.	
<b>3. Identify shut height, die space requirements:</b>	<b>10%</b>
a. Requirements.	
b. Calculations.	
c. Die space requirement.	
<b>4. Identify blanking and piercing (Introductory):</b>	<b>20%</b>
a. Simple dies: <ul style="list-style-type: none"><li>• Blanking.</li><li>• Piercing</li></ul>	
b. Progressive dies.	
c. Compound dies.	
d. Bending dies.	
e. Forming dies: <ul style="list-style-type: none"><li>• Forming process.</li></ul>	
f. Draw dies.	



- g. Deep draw dies.
- h. Cut-off dies.
- i. Scrap disposal.
- j. Trimming dies.
- k. Embossing dies.
- l. Coining dies.
- m. Perforating dies.
- n. Steel rule dies.
- o. Zinc and aluminum die cast dies.
- p. Accessories:
  - Feeders.

**5. Identify calculations: 25%**

- a. Material considerations.
- b. Process planning.
- c. Use of commercial (off the shelf) components.
- d. Stripping requirements.
- e. Material stretch factors.
- f. Clearance calculations.
- g. Hold down pressures.
- h. Spring back calculations.
- i. Press tonnage calculations.
- j. Die life.

**5. Identify the 14 steps to die design: 10%**

- a. The scrap strip.
- b. The die block.
- c. The blanking punch.
- d. Piercing punches.
- e. Punch plate.
- f. Pilots.
- g. Gauges.
- h. Finger stop.
- i. Automatic stop.
- j. Stripper.
- k. Fasteners.
- l. The die set.
- m. Dimensions and notes.
- n. Bill of material.

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## **Tool and Die Maker**

**Unit:** C7 Basic Die Making (Practical)

**Level:** Three

**Duration:** 102 hours

Theory: 0 hours

Practical: 102 hours

### **Overview:**

This unit of instruction is designed to provide the Tool and Die apprentice with practical understanding of basic tool and die making practices. The unit of instruction will consist of a number of projects.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
1. <b>Familiarization project:</b> a. Vise or sine bar.	<b>30%</b>
2. <b>Disassembly.</b>	<b>30%</b>
3. <b>Design and build a project:</b> a. Two-stage, i.e., piercing and blanking.	<b>40%</b>

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## Tool and Die Maker

**Unit:** C8 Computer Numerical Control (CNC) II Program Code

**Level:** Three

**Duration:** 40 hours

Theory: 0 hours

Practical: 40 hours

**Overview:**

This unit of instruction is designed to introduce control programming, CAD and CAM. It also introduces programming and making parts.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
1. Define terminology associated with control programming.	4%
2. Identify the quality control work practices pertaining to control programming.	6%
3. Define terminology associated with CAD.	10%
4. Identify the quality control work practices pertaining to CAD.	10%
5. Define terminology associated with CAM.	10%
6. Identify the quality control work practices pertaining to CAM.	10%
7. Practicum.	50%

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