

Tool and Die Maker Level 2

Tool and Die Maker

Unit: B2 Read and Interpret Drawings II

Level: Two

Duration: 32 hours

Theory: 32 hours

Practical: 0 hours

Overview:

This unit of instruction introduces the Tool and Die Maker Apprentice with the knowledge and skills necessary to read and interpret engineering drawings and apply information necessary for the construction of the work piece. Material covered includes:

Sketching of drawings
Views of drawings
Dimensioning

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Describe the various views, their purpose and use:	25%
a. Isometric	
b. Orthographic	
c. Sectional	
2. Describe and interpret industrial drawing symbols and markings:	25%
a. Surface textures	
b. Violations of true projections	
c. Auxiliary views	
d. Phantom lines	
e. Positional dimension	
f. Geometric tolerances	
g. Moldings and castings	
3. Describe the various types of sectional views and their applications	25%
4. Describe procedures used for geometric tolerancing	25%

Tool and Die Maker

Unit: C2 Trade Mathematics II

Level: Two

Duration: 24 hours

Theory: 24 hours

Practical: 0 hours

Overview:

This unit introduces the Tool and Die Maker Apprentice to the principles of trade mathematics and is designed to meet the requirements of the Tool and Die Maker Apprentice course. It consists of application of concepts and continues with computed measure of plane and three dimensional objects.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Apply basic arithmetic and algebra	50%
a. Whole numbers, fractions and decimals	
b. Equations and formulas	
2. Identify computed measure	50%
a. Perimeter calculations of plane figures	
• Simple geometric figures	
• Complex geometric figures	
• Shop related applications	
• Simple geometric figures	

Tool and Die Maker

Unit: D2 Trade Science II

Level: Two

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.

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

Tool and Die Maker

Unit: E2 Precision Measurement

Level: Two

Duration: 20 hours

Theory: 5 hours

Practical: 15 hours

Overview:

This unit of instruction is designed to provide the Tool and Die Maker Apprentice with the knowledge and understanding of precision measurement. Material covered includes:

Inside-, depth-, and height measuring instruments
Gauge blocks and vernier bevel protractors
Squares and surface plates
Angular measurement

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Identify inside-, depth-, and height measuring instruments	25%
2. Use inside-, depth-, and height measuring instruments	25%
<ul style="list-style-type: none"> a. Inside-measuring instruments <ul style="list-style-type: none"> • Direct-reading instruments <ul style="list-style-type: none"> Inside micrometer calipers Inside micrometers • Transfer type instruments <ul style="list-style-type: none"> Telescopic gauges • Dial bore gauges b. Depth measurement <ul style="list-style-type: none"> • Micrometer depth gauge • To measure with a micrometer depth gauge • Vernier depth gauges c. Height measurement <ul style="list-style-type: none"> Vernier height gauge <ul style="list-style-type: none"> To measure with a vernier height gauge and dial indicator To measure heights using gauge blocks Precision height gauge Depth and height gauges 	
3. Identify gauge blocks and vernier bevel protractors	25%

4. Use gauge blocks and vernier bevel protractors

25%

- a. Gauge block manufacture
 - Uses
- b. Gauge block sets
 - Inch standard gauge blocks
 - Metric gauge blocks
 - Accuracy
 - The effect of temperature
 - Gauge block buildups
 - To wring blocks together
 - Care of gauge blocks
- c. Angular measurement
 - The universal bevel protractor
 - To read a vernier protractor
 - The sine bar
 - The compound sine plate or table
- d. Gauge blocks
 - Various types of gauge blocks and their characteristics:
 - Grades
 - Tolerance
 - Accuracy
 - Materials
 - Uses of gauge blocks:
 - Applications
 - Set sizes and number of blocks
 - Procedures used to maintain, store and wring a gauge block
 - Procedures used to calculate and perform gauge block build-ups
 - Uses of wear blocks
 - Types of gauge block sets
 - Factors that can affect gauge blocks and their impact:
 - Temperature
 - Contaminants
 - Maintenance
 - Applications
 - Calculations
 - Tool makers buttons, their applications and procedures for use
 - Sine bars, their applications and procedures for use
 - Height build-ups, their applications, use, and calculation
- e. Identify angular measurement
 - Principles of angular measurement
 - Angle gauge blocks
 - Universal bevel protractor:
 - Parts
 - Applications
 - Divisions
 - Procedures for use
 - Reading
 - Sine bar:
 - Parts
 - Applications
 - Divisions
- f. Squares
 - Machinist's combination square

- Precision squares
- Bevelled-edge squares
- Toolmakers' surface plate square
- Cylindrical squares
- Adjustable squares
- Adjustable micrometer square
- Straight edges

Tool and Die Maker

Unit: F3 Precision Layout

Level: Two

Duration: 10 hours

Theory: 3 hours

Practical: 7 hours

Overview:

Planning, measuring and layout skills are essential to produce high quality work with efficiency in the Tool and Die Maker Trade. This unit advances the apprentice's knowledge of precision measurement techniques and presents a systematic approach to planning machining tasks. Material covered includes:

Job planning
Precision layout
Inspection and measurement

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Describe job planning	10%
2. Perform job planning	20%
a. Advanced blueprint specifications: <ul style="list-style-type: none">• Tolerance• Finish requirements	
b. Operations to be performed in priority sequence	
c. Cutting time calculations	
d. Machines and tooling required to complete the work	
e. Layout dimensions and reference points	
f. Angles, arcs, and location from reference point	
3. Describe precision layout	10%
4. Perform precision layout	25%
a. Precision measuring tools, their application and procedures for use: <ul style="list-style-type: none">• Universal bevel protractor• Sine bar• Sine plate• Precision height gauge• Concentricity test equipment	

- b. Appropriate cutting tools, equipment and work holding devices
- c. Sine bar calculations
- d. Procedures used to perform a precision layout using a sine bar, gauge blocks and a precision height gauge

5. Describe inspection and measurement 10%

6. Interpret and perform inspection and measurement 25%

Tool and Die Maker

Unit: G2 Contour Bandsaw Operations

Level: Two

Duration: 10 hours

Theory: 2 hours

Practical: 8 hours

Overview:

This unit of instruction is designed to provide the Tool and Die Maker Apprentice with the knowledge and skills necessary to use and care of power saws and cut-off machines.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Describe procedures used to perform various sawing operations for all saw types	20%
2. Perform procedures used to perform various sawing operations for all saw types:	20%
a. Stock cutting	
b. Internal and external contour sawing	
c. Notching and slotting	
d. Radius cutting and splitting	
e. Angular cutting	
f. Friction sawing	
3. Describe potential problems during sawing operations, their causes and remedies	20%
4. Troubleshoot potential problems during sawing operations, their causes and remedies	20%
5. Describe preventative maintenance procedures for sawing equipment	20%
a. Procedure to cut saw blades	
b. Procedure to weld saw blades	
c. Procedure for blade welding	
d. Procedure for annealing	

Tool and Die Maker

Unit: H3 Lathe Operations II

Level: Two

Duration: 10 hours

Theory: 3 hours

Practical: 7 hours

Overview:

This unit of instruction is designed to provide the Tool and Die Maker Apprentice with the knowledge of lathe operations. Material will include:

Machinability of metals
Cutting Tools
Tapers and taper turning

Objectives and Content:

**Percent of
Unit Mark (%)**

1. Identify specialty cutting tools

20%

- a. Characteristics, applications, advantages and disadvantages of:
 - Diamond cutting tools
 - Ceramic cutting tools
 - Cermet cutting tools
- a. Procedures and precautions involved in the use of:
 - Diamond cutting tools
 - Ceramic cutting tools
 - Cermet cutting tools
- c. Identify and interpret the selection charts for carbide tool inserts for tooling problems and probable causes:
 - Carbide cutting tools
 - Diamond cutting tools
 - Ceramic cutting tools
 - Cermet cutting tools

2. Identify cutting-tools

20%

- a. Cutting-tool materials
 - High-speed steel toolbits
 - Cast alloy toolbits
 - Cemented-carbide toolbits
 - Coated carbide toolbits

- Ceramic toolbits
- Cermet toolbits
- Diamond toolbits
- Cubic boron nitride toolbits
- b. Cutting-tool nomenclature
- c. Lathe toolbit angles and clearances
 - Positive rake angle
 - Negative rake angle
- d. Cutting-tool shape
- e. Tool life
- f. Principles of machining
 - Turning
 - Drilling
 - Boring

3. Identify thread and thread cutting operations

20%

- a. Threads and their applications
- b. Thread parts and terminology
 - Screw thread
 - Internal and external threads
 - Major and minor diameter
 - Pitch diameter
 - Number of threads
 - Pitch
 - Lead
 - Root
 - Crest
 - Flank
 - Depth of thread
 - Angle of thread
 - Helix or lead angle
 - Right and left hand threads
- c. Different thread forms and their characteristics:
 - ISO metric
 - Unified
 - ACME
 - National Pipe thread
 - Brown and Sharpe worm
 - Brown and Sharpe Fine
 - Square and modified square
 - International Metric
 - Stub ACME
 - Buttress
- d. Thread fit terms, classifications and symbols used for imperial and metric threads:
 - Fit allowance
 - Tolerance
 - Limits
 - Nominal and actual size
 - Tolerance grades
 - Allowance symbols and numbers
- e. Thread formula that apply to the following thread forms and parts of a thread:
 - 60 degree V thread
 - American National

- Unified
- Metric
- Minor diameter
- Crest width
- Number thread size
- Tap drill size
- Pitch of the thread
- Pitch diameter
- Root width
- Lead
- Depth

4. Perform thread cutting operations 20%

- a. Procedure used to transpose lathe gears for threading
- b. Procedures used to sharpen tools and set up lathe accurately for threading
- c. Procedures used to sharpen tools and set up lathe accurately for threading thread chasing dial
- d. Purpose for resetting a threading tool
- e. Procedure used to reset a threading tool
- f. Various methods and associated procedures used to measure and gauge threads
- g. Procedures used to measure and gauge threads:
 - Thread ring gauges
- l.
 - Thread plug gauges
 - Snap gauges
 - Three wire method
 - Thread monitor

5. Identify tapers and taper turning 20%

- a. Methods and associated procedures used for taper turning using the tailstock:
 - Offsetting the tailstock
- b. Types of taper attachments, their characteristics and applications
- c. Telescopic taper attachments:
 - Advantages
 - Disadvantages
 - Procedures for use
- d. Compound rest:
 - Characteristics
 - Set up
 - Procedures for use
- e. Procedures used to measure tapers:
 - Metric
 - Imperial
- f. Advantages of using a taper micrometer
- g. Procedure used to fit an external taper

Tool and Die Maker

Unit: I2 Milling Operations II

Level: Two

Duration: 60 hours

Theory: 5 hours

Practical: 55 hours

Overview:

This unit of instruction is designed to introduce the Tool and Die Maker Apprentice to milling machine setups, carbide cutting tools/specialty tools and the indexing or dividing head.

Objectives and Content:	Percent of Unit Mark (%)
1. Perform milling machine setup	40%
2. Identify carbide cutting tools/specialty tools	30%
a. Manufacture, composition, applications and advantages of carbides: <ul style="list-style-type: none">• Materials• Blending• Composition• Presintering• Sintering• Safety precautions	
b. Types of carbide tools, their advantages and disadvantages: <ul style="list-style-type: none">• Brazed tip• Indexable inserts	
c. Characteristics of the various types of carbide tools	
d. Grading of carbides and factors affecting it	
e. Nomenclature related to carbide tooling: <ul style="list-style-type: none">• Front or end relief (clearance)• Side relief (clearance) side cutting edge angle• Rose radius• Side rack• Back rack• Negative/positive carbide insert geometry	
f. Procedures used for machining with carbides	
g. Characteristics, applications, advantages and disadvantages of:	

- Diamond cutting tools
- Ceramic cutting tools
- Cermet cutting tools
- h. Procedures and precautions involved in the use of:
 - Diamond cutting tools
 - Ceramic cutting tools
 - Cermet cutting tools
- i. Identify the selection charts for carbide tool inserts for tooling problems and probable causes:
 - Carbide cutting tools
 - Diamond cutting tools
 - Ceramic cutting tools
 - Cermet cutting tools
- j. Describe the factors affecting speed, feed and depth of cut

3. Identify the indexing or dividing head

30%

- a. Index head parts
- b. Methods of indexing
 - Direct indexing
 - Simple indexing
 - Index plate and sector arms
 - Angular indexing
 - Differential indexing
 - Indexing for divisions
 - Angular indexing with the wide-range divider
- c. Linear graduating

Tool and Die Maker

Unit: K2 Surface Grinders & Accessories

Level: Two

Duration: 10 hours

Theory: 10 hours

Practical: 0 hours

Overview:

This unit of instruction introduces the Tool and Die Maker Apprentice to surface grinders, their set up and operating procedures. Material covered includes:

Surface grinders
Work holding devices

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Identify abrasives, their characteristics and applications	40%
2. Describe a surface grinder	20%
a. Principles of the grinding process	
b. Types of surface grinders, their characteristics and applications	
c. Procedures used to test a grinding wheel on a surface grinding wheel flange	
d. Procedures used to mount and balance a grinding wheel	
e. Procedures and precautions used for truing and dressing a grinding wheel	
3. Describe Work Holding Devices	40%
a. Types of magnetic chucks, their operating principles and characteristics	
b. Magnetic chuck accessories and their applications:	
• Adapter plate	
• Magnetic chuck blocks	
• Sine chuck	
• Magna-vise clamps	
• Double-face tape	
• Special fixtures	
c. Procedures used to align grinder heads, tables and fixtures	

Tool and Die Maker

Unit: K3 Surface Grinding Operations I

Level: Two

Duration: 10 hours

Theory: 0 hours

Practical: 10 hours

Overview:

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

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Perform procedures for mounting workpieces	10%
2. Perform safety procedures for grinder setup and operation	20%
3. Perform procedures required to set up and perform grinding operations on a surface grinder: a. Cut off parts b. Grind surfaces and shapes	10%
4. Perform procedures for dressing a convex radius on a grinding wheel	20%
5. Troubleshoot problems during grinding operations	20%
6. Balance a grinding wheel	20%
