Curriculum for
Tool and Die Making-1
(Certificate Level - 6 months)
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Tool and Die Making-1

Overall objective of the course

To enable students to produce sheet metal processing dies and imparting basic knowledge of re-sharpening the cutting tools.

Competencies gained after completion of the course

- Ability to understand drawings and to make the parts accordingly.
- Ability to select the speed, feed according to the materials to be machined.
- Ability to operate the conventional machine tools, such as lathe, drilling, milling and grinding.
- Ability to work on CNC machine tools, like lathe, vertical machining milling etc.
- Ability to acquire dexterity in non conventional machining, like wire cut.
- Ability to produce dies components.
- Ability to polish the die components.
- Ability to understand quality control procedures.
- Ability to understand heat treatment techniques.
- Ability to assemble and disassemble the dies.
- Ability to maintain the dies and tools.

Job opportunities available immediately and in the future

- Automobile Industry
- Machine tool industry
- Defence industry
- Agricultural equipment industry
- Home appliances industry

Curriculum Salient Points

<table>
<thead>
<tr>
<th>Duration of the Course</th>
<th>Six months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total working days:</td>
<td>132 (22 weeks)</td>
</tr>
<tr>
<td>One working day</td>
<td>6 working hours</td>
</tr>
<tr>
<td>Total Hours of the course:</td>
<td>792 hours</td>
</tr>
<tr>
<td>Level of the course;</td>
<td>Vocational</td>
</tr>
<tr>
<td>Entry Qualification:</td>
<td>Matric / equivalent</td>
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</table>
# Overview about the program – Curriculum for Tool & Die Making

<table>
<thead>
<tr>
<th>Module Title and Aim</th>
<th>Learning Units</th>
<th>Theory hours</th>
<th>Workplace hours</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Module 1: Foundation Essentials</strong></td>
<td>LU1 - Technical Drawing</td>
<td>6-hours</td>
<td>24-hours</td>
</tr>
<tr>
<td>Aim:</td>
<td>LU2 Measuring instruments</td>
<td>6-hours</td>
<td>12-hours</td>
</tr>
<tr>
<td></td>
<td>LU3-Materials for Dies &amp; Tools</td>
<td>6-hours</td>
<td>12-hours</td>
</tr>
<tr>
<td></td>
<td>LU4- CNC Programming</td>
<td>6-hours</td>
<td>30-hours</td>
</tr>
<tr>
<td><strong>Module 2: Machine Tools-I</strong></td>
<td>LU1- Lathe Machine</td>
<td>8-hours</td>
<td>42-hours</td>
</tr>
<tr>
<td>Aim:</td>
<td>LU2- CNC Lathe</td>
<td>10-hours</td>
<td>48-hours</td>
</tr>
<tr>
<td><strong>Module 3: Machine Tools-II</strong></td>
<td>LU1- Milling Machine</td>
<td>15-hours</td>
<td>48-hours</td>
</tr>
<tr>
<td>Aim:</td>
<td>LU2- CNC Milling Machine</td>
<td>15-hours</td>
<td>72-hours</td>
</tr>
<tr>
<td><strong>Module 4: Machine Tools-III</strong></td>
<td>LU1- Drilling Machine with DRO</td>
<td>6-hours</td>
<td>18-hours</td>
</tr>
<tr>
<td>Aim:</td>
<td>LU2- Grinding Machines</td>
<td>6-hours</td>
<td>36-hours</td>
</tr>
</tbody>
</table>

Developed in February 2012, Version 0.2
<table>
<thead>
<tr>
<th>Module 5: Wire Cut Machine</th>
<th>Aim: To enable the students to understand the use of wire cutting machine.</th>
<th>LU1- Wire Cut</th>
<th>6-hours</th>
<th>24-hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module 6: Tool and Die Making</td>
<td>Aim: To enable the students to produce die components, tools and assemble the die.</td>
<td>LU1- Die Making</td>
<td>18-hours</td>
<td>120-hours</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LU2- Tool Making</td>
<td>6-hours</td>
<td>42-hours</td>
</tr>
<tr>
<td>Module 7: Auxiliaries</td>
<td>Aim: To enable the students to apply the knowledge of the tolerances and skill of inspection. To apply the heat treatment techniques.</td>
<td>LU1- Engineering Limits &amp; Fits, and Surface Finish</td>
<td>12-hours</td>
<td>Nil</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LU2- Heat Treatment</td>
<td>12-hours</td>
<td>42-hours</td>
</tr>
<tr>
<td>Module 8: Maintaining Too and Dies</td>
<td>Aim: To enable the students to polish the die components and repair the dies and tools.</td>
<td>LU1- Polishing operations</td>
<td>6-hours</td>
<td>24-hours</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LU2- Maintenance of Dies &amp; Tools</td>
<td>6-hours</td>
<td>48-hours</td>
</tr>
</tbody>
</table>
Tool & Die Making-1 Curriculum Contents (Teaching and Learning Guide)

**Module 1 Title:** Foundation Essentials  
**Objective of the Module:** Prepare the students to achieve the skills of interpreting the drawings for the programming of CNC machines, reading the measuring instruments & selecting the materials for tools and dies.  
**Duration:** 102 hours  
**Theory:** 24 hours  
**Practice:** 78 hours

<table>
<thead>
<tr>
<th>Learning Unit</th>
<th>Learning Outcomes</th>
<th>Learning Elements</th>
<th>Duration</th>
<th>Materials Required</th>
<th>Learning Place</th>
</tr>
</thead>
</table>
| LU1-TECHNICAL DRAWING             | Prepare the job according to the specifications         | Students will be able to: i) Know the technical drawing.  
                                    |                                                        | ii) Know types of drawings (pictorial & orthographic)  
                                    |                                                        | iii) Know the principal planes and quadrants.  
                                    |                                                        | iv) Know angle methods of projection.  
                                    |                                                        | v) Use the drawing instruments  
                                    |                                                        | vi) Draw orthographic views of at least five die components | Th. 6-hrs  
                                    |                                                        | Pr. 24-hrs                                           | Drawing sheets | Drawing hall      |
| LU2- MEASURING INSTRUMENTS         | Check the dimensions of the job                        | Students will be able to: i) Know the purpose of measuring instruments.  
                                    |                                                        | ii) Read traditional and digital vernier caliper, micrometer, height gauge, depth micrometer, dial test indicator, bevel protector.  
                                    |                                                        | iii) Check the accuracy of the components produced in the machine shop. | Th.6-hrs  
                                    |                                                        | Pr. 12-hrs                                           | Measuring instruments | Workshop          |
| LU3- MATERIALS FOR TOOLS AND DIES  | Select the material for the job                        | Students will be able to: i) Understand the common steels used in tool and die making & their mechanical properties.  
                                    |                                                        | ii) Identify the metals & die steels.  
                                    |                                                        | iii) Test the hardness of steel.  
                                    |                                                        | iv) Select the appropriate tool & die steels for the specific job | Th. 6-hrs  
                                    |                                                        | Pr. 12-hrs                                           | Instructional material | Class room Lab.   |
| LU4- CNC PROGRAMMING              | Set the machine & job                                  | Students will be able to: i) Know the control panel of the machine.  
                                    |                                                        | ii) Set the machine at home position.  
                                    |                                                        | iii) Set the work reference.  
                                    |                                                        | iv) Operate the CNC m/c according to various functions/programmes. | Th. 6-hrs  
                                    |                                                        | Pr. 30-hrs                                           | Instructional material | Class room Lab.   |
The tools, equipment and machinery for this module may include:-

LU1- Drawing tables and drawing instruments.
LU2- Traditional & digital: Vernier caliper, micrometer, height gauge, depth micrometer, dial test indicator, vernier bevel protractor, Tri-square, etc.
LU3- Samples of alloy steels, brass, aluminum, copper etc., and various die steels
LU4- CNC machines
**Module 2 Title:** Machine Tools 1  
**Objective of the Module:** This module will impart the complete knowledge of these machine tools and students will learn various lathe operations.  
**Duration:** 108 hours  
**Theory:** 18 hours  
**Practice:** 90 hours

<table>
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<tr>
<th>Learning Unit</th>
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<th>Learning Place</th>
</tr>
</thead>
</table>
| LU1- LATHE MACHINE | Perform operations on conventional lathe machine | Students will be able to:  
i) Know the purpose of the lathe m/c & its major parts.  
ii) Know the turning operations on it.  
iii) Understand the speed, feed, and depth of cut.  
iv) Select the cutting tool according to operation.  
v) Apply the various work holding devices i.e. 3-jaws chuck, 4-jaws chuck, collet chuck & face plate etc.  
vi) Perform turning, facing, taper turning, step turning drilling, boring & knurling operations etc. | Th. 8-hrs  
Pr. 42-hrs | Bars of various diameters | Workshop |
| LU2- CNC LATHE | Perform operations on CNC lathe machine | Students will be able to:  
i) Know the principal parts of CNC lathe & their working.  
ii) Know the x-axis & z-axis movements.  
iii) Know the machine codes.  
iv) Set the tools in sequence  
v) Run the programme on CNC lathe  
vi) Prepare the jobs according to the given programme | Th. 10-hrs  
Pr. 48-hrs | Bars of various diameters | Workshop |

**The tools, equipment and machinery for this module may include:-**

**LU1-**  
Conventional lathe machine with accessories, single point cutting tools, drill sets, knurling tools power saw, vernier calipers, micrometers, safety gear & equipment  
**LU2-**  
CNC lathe machine, CNC cutting tools, vernier calipers, micrometer, safety gear
**Module 3 Title:** Machine Tools 2  
**Objective of the Module:** This module will enable the students to understand the conventional milling m/c and CNC vertical machining center, their cutters and operations. They will get the skills of the various milling operations.  
**Duration:** 150 hours  
**Theory:** 30 hours  
**Practice:** 120 hours

<table>
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<th>Duration</th>
<th>Materials Required</th>
<th>Learning Place</th>
</tr>
</thead>
</table>
| LU1- MILLING MACHINES | Perform operations on conventional milling machines | Students will be able to:  
- i) Know the purpose of the milling machine & the movement of various parts.  
- ii) Know the use of various milling cutters.  
- iii) Understand the speed, feed, and depth of cut.  
- iv) Apply the various work holding devices i.e., rotary table, dividing head, machine vice & universal vice.  
- v) Apply various milling attachments.  
- vi) Perform various milling operations i.e., face milling, profile milling, pocket milling, slitting etc. | Th. 15-hrs  
Pr.  48-hrs | Plates of various thickness | Workshop |
| LU2- CNC VERTICAL MACHINING CENTER | Perform operations on CNC vertical machining center | Students will be able to:  
- i) Know the principal parts of CNC milling machine & their working.  
- ii) Know the principal axis of CNC milling m/c i.e., the x-axis, y-axis & z-axis.  
- iii) Know the milling machine codes.  
- iv) Set the job & machine.  
- v) Set the tools in sequence for a particular job.  
- vi) Run the programme on CNC milling machine.  
- vii) Prepare the jobs according to the given programme.  
- viii) Adjust the tool wear compensation. | Th.15-hrs  
Pr.  72-hrs | Plates of various thickness | Workshop |

The tools, equipment and machinery for this module may include:-

**LU1-** Universal milling machine with all standard accessories and attachments, milling cutters, micrometer, vernier caliper, dial test indicator, power saw, general hand tools, safety gear and equipment.  
**LU2-** CNC vertical machining center & cutters, lever gauge, power saw, micrometer, vernier caliper, dial test indicator, general hand tools, safety gear and equipment.
**Module 4 Title:** Machine Tools 3  
**Objective of the Module:** To operate drilling machine with digital read out (DRO) attachment, surface grinding machine and cylindrical machine to perform different operations.  
**Duration:** 66 hours  
**Theory:** 12 hours  
**Practice:** 54 hours

<table>
<thead>
<tr>
<th>Learning Unit</th>
<th>Learning Outcomes</th>
<th>Learning Elements</th>
<th>Duration</th>
<th>Materials Required</th>
<th>Learning Place</th>
</tr>
</thead>
</table>
| LU1- DRILLING MACHINE | Perform operations on drilling machine with DRO attachment | Students will be able to:  
  i) Know the purpose of drilling machine.  
  ii) Know the use of standard drills, reamers, counterbores, countersinks & spot facing tools.  
  iii) Perform the drilling operations.  
  iv) Perform counter boring, counter sinking, spot facing, and reaming operations. | Th. 6-hrs Pr. 18-hrs | Plates of various thickness & drills | Workshop |
| LU2- GRINDING MACHINE | Perform operations on surface and cylindrical grinding machines | Students will be able to:  
  i) Know the purpose of the grinding machine.  
  ii) Perform the surface grinding & cylindrical grinding operations.  
  iii) Perform grinding of holes using grinding bits. | Th. 6-hrs Pr. 36-hrs | Bars of various diameters. Plates of various thickness & grinding wheels | Workshop |

**The tools, equipment and machinery for this unit may include:-**

- **LU1-** Drilling machine with digital read out (DRO), standard drill sets, center drills, counter boring tool, counter sinking tool, spot facing tool, and reamers.
- **LU2-** Surface grinding machine, cylindrical grinding machine with all standard attachments, bench grinder, various grinding wheels, tool kit, safety goggles.
Module 5 Title: Wire cut machine  
Objective of the Module: To enable the students to understand the use of wire cut machine.  
Duration: 30 hours  Theory: 6 hours  Practice: 24 hours

<table>
<thead>
<tr>
<th>Learning Unit</th>
<th>Learning Outcomes</th>
<th>Learning Elements</th>
<th>Duration</th>
<th>Materials Required</th>
<th>Learning Place</th>
</tr>
</thead>
</table>
| LU1- WIRE CUT  | Perform operations on wire cut machine | Students will be able to:  
  i) Know the purpose of the wire cut machine.  
  ii) Understand the parameters related to wire cut machine, select tool path for wire cutting operation.  
  iii) Set the job on the machine.  
  iv) Adjust the current for desired finish of job.  
  v) Cut regular and irregular outline on metallic sheets observing the safety precautions. | Th. 6-hrs Pr. 24-hrs | Sheets of various thicknesses | Workshop |

The tools, equipment and machinery for this unit may include:-

LU1-  
  i) Wire cut machine, tungsten wire, and standard accessories.  
  ii) Safety gear and equipment.  
  iii) Measuring tools.
Module 6 Title: Tool and Die Making  
Objective of the Module: To enable the students to produce die components, tools and assemble the die.
Duration: 186 hours  Theory: 24 hours  Practice: 162 hours

<table>
<thead>
<tr>
<th>Learning Unit</th>
<th>Learning Outcomes</th>
<th>Learning Elements</th>
<th>Duration</th>
<th>Materials Required</th>
<th>Learning Place</th>
</tr>
</thead>
</table>
| LU1- DIE MAKING | Produce die components, & assemble them to evolve at a complete set of die | Students will be able to:  
   i) Understand the function of a die.  
   ii) Know the various types of sheet metal dies and their difference e.g., Blanking, Forming, Draw, piercing and trimming dies.  
   iii) Understand the main components of a die i.e., die punch, blank holder, stripper plate, top & bottom plate, guiding system.  
   iv) Assemble the components of the die.  
   v) Disassemble the various dies for maintenance. | Th. 18-hrs  Pr. 120-hrs | Plates of various thicknesses & bars of various diameters. | Workshop |
| LU2- TOOL MAKING | Grind cutting angles on single point & multiple point cutting tools | Students will be able to:  
   i) Understand the various single points & multiple point cutting tools.  
   ii) Understand the cutting tool angles.  
   iii) Recognize the various tools and their angles with respect to operations and material being cut.  
   iv) Grind the angles on single point cutting tools & multiple point cutting tools. | Th. 6-hrs  Pr. 42-hrs | Single point cutting tools for lathe & shaper machines.  
   Milling cutters, drills, reamers etc. | Workshop |

The tools, equipment and machinery for this unit may include:-

LU1-  
   i) Spanners, screw drivers, set of Allen keys, set of files, needle files (diamond), disc grinder with grinding discs, pin grinding m/c & pin grinding wheels, mallet, bench vice, rotary burrs, bench work stations (one bench per four students), safety goggles etc.
LU2-  
   ii) Universal tool & grinding machine with standard accessories, abrasive wheels, safety goggles.
Module 7 Title: Auxillaries

Objective of the Module: To enable the students to apply the knowledge of the tolerances and skill of inspection. To apply the heat treatment techniques.

Duration: 66 hours  Theory: 24 hours  Practice: 42 hours

<table>
<thead>
<tr>
<th>Learning Unit</th>
<th>Learning Outcomes</th>
<th>Learning Elements</th>
<th>Duration</th>
<th>Materials Required</th>
<th>Learning Place</th>
</tr>
</thead>
<tbody>
<tr>
<td>LU1- ENGINEERING LIMITS, FITS &amp; TOLERANCES</td>
<td>Maintain the quality of the mating parts of dies</td>
<td>Students will be able to: i) Understand the limits, fits &amp; tolerances. ii) Know the purpose of applying the limits &amp; fits on the die components. iii) Practice of calculating tolerances.</td>
<td>Th. 12-hrs</td>
<td>Instructional material</td>
<td>Workshop</td>
</tr>
<tr>
<td>LU2- HEAT TREATMENT</td>
<td>To enhance the life of the die components</td>
<td>Students will be able to: i) Know the purpose of the heat treatment. ii) Understand the various heat treatment processes. iii) Perform the stress relieving, hardening, quenching, tempering processes.</td>
<td>Th. 12-hrs</td>
<td>Bars and plates</td>
<td>Workshop</td>
</tr>
</tbody>
</table>

The tools, equipment and machinery for this unit may include:-

LU1- Nil
LU2- Muffle furnace, quenching oils and safety gear
Module 8 Title: Maintaining Tools and Dies  
Objective of the Module: To enable the students to polish the die components and repair the dies and tools. 
Duration: 84 hours  Theory: 12 hours  Practice: 72 hours

<table>
<thead>
<tr>
<th>Learning Unit</th>
<th>Learning Outcomes</th>
<th>Learning Elements</th>
<th>Duration</th>
<th>Materials Required</th>
<th>Learning Place</th>
</tr>
</thead>
</table>
| LU1- POLISHING OPERATIONS          | Polish the various punches & die blocks.               | Students will be able to:  
  i) Know the purpose of the polishing operation.  
  ii) Know the techniques for polishing die & punch.  
  iii) Perform polishing operations using polishing mediums i.e., polishing stones, emery papers & emery pastes etc. | Th. 6-hrs | Die blocks & punches     | Workshop        |
| LU2- MAINTENANCE OF TOOLS & DIES   | Repair the dies and regrind the tools                  | Students will be able to:  
  i) Identify the defects of tools and dies.  
  ii) Analyse the defects.  
  iii) Suggest the remedial measures.  
  iv) Repair & regrind the die block.  
  v) Replace the defective components. | Th. 6-hrs | Used and defective dies  | Workshop        |

The tools, equipment and machinery for this unit may include:-

LU1- Polishing stones, emery papers, and emery pastes of different grades.  
LU2- Spanners, screw drivers, set of Allen keys, set of files, needle files (diamond), disc grinder with grinding discs, pin grinding m/c & pin grinding wheels, mallet, bench vice, rotary burrs, bench work stations (one bench per four students), safety goggles etc.
## Assessment

### Module 1: Foundation Essentials

<table>
<thead>
<tr>
<th>Learning Units</th>
<th>Theory hours</th>
<th>Workplace hours</th>
<th>Recommended formative assessment</th>
<th>Recommended Methodology</th>
<th>Scheduled Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>LU1- TECHNICAL DRAWING</td>
<td>6 hrs</td>
<td>24 hrs</td>
<td>i) Know the technical drawing. br ii) Know types of drawings (pictorial &amp; orthographic) br iii) Know the principal planes and quadrants. br iv) Know angle methods of projection. br v) Use the drawing instruments br vi) Draw orthographic views of at least five die components</td>
<td>i) Oral questioning br ii) Short Q/A br iii) Short Q/A br iv) Short Q/A br v) Demonstration br vi) Demonstration</td>
<td></td>
</tr>
<tr>
<td>LU2- MEASURING INSTRUMENTS</td>
<td>6 hrs</td>
<td>12 hrs</td>
<td>i) Know the purpose of measuring instruments. br ii) Read traditional and digital vernier caliper, micrometer, height gauge, depth micrometer, dial test indicator, bevel protector. br iii) Check the accuracy of the components produced in the machine shop.</td>
<td>i) Oral questioning br ii) Demonstration br iii) Demonstration</td>
<td></td>
</tr>
<tr>
<td>LU3- MATERIALS FOR TOOLS AND DIES</td>
<td>6 hrs</td>
<td>12 hrs</td>
<td>i) Understand the common steels used in tool and die making &amp; their mechanical properties. br ii) Identify the metals &amp; die steels. br iii) Test the hardness of steel. br iv) Select the appropriate tool &amp; die steels for the specific job</td>
<td>i) Oral questioning br ii) Demonstration br iii) Demonstration br iv) Short Q/A</td>
<td></td>
</tr>
<tr>
<td>LU4- CNC PROGRAMMING</td>
<td>6 hrs</td>
<td>30 hrs</td>
<td>i) Know the control panel of the machine. br ii) Set the machine at home position. br iii) Set the work reference. br iv) Operate the CNC m/c according to various functions/programmes.</td>
<td>i) Oral questioning br ii) Demonstration br iii) Demonstration br iv) Demonstration</td>
<td></td>
</tr>
</tbody>
</table>
The following operations are included in the units:-

LU1- Interpretation of drawing and practice of the drawings.
LU2- Practice of reading the measuring instruments.
LU3- Identification of different materials.
LU4- Programme writing

The tools, equipment and machinery for this module may include:-

LU1- Drawing tables and drawing instruments.
LU2- Traditional & digital: Vernier caliper, micrometer, height gauge, depth micrometer, dial test indicator, vernier bevel protractor, Tri-square, etc.
LU3- Samples of alloy steels, brass, aluminum, copper etc., and various die steels
LU4- CNC machines

Critical aspects:-

- Extensive drawing practice
- Correct reading of drawing
- Onerous attention to handle the measuring instruments and their applications
- Accuracy in taking the measurements
- Perception of materials/metals
Module 2: Machine Tools 1

<table>
<thead>
<tr>
<th>Learning Units</th>
<th>Theory hours</th>
<th>Workplace hours</th>
<th>Recommended formative assessment</th>
<th>Recommended Methodology</th>
<th>Scheduled Dates</th>
</tr>
</thead>
</table>
| LU1- LATHE MACHINE | 8 hrs | 42 hrs | i) Know the purpose of the lathe m/c & its major parts. 
ii) Know the turning operations on it. 
iii) Understand the speed, feed, and depth of cut. 
iv) Select the cutting tool according to operation. 
v) Apply the various work holding devices i.e. 3-jaws chuck, 4-jaws chuck, collet chuck & face plate etc. 
vi) Perform turning, facing, taper turning, step turning, drilling, boring & knurling operations etc. | i) Oral questioning 
ii) Short Q & A 
iii) Short Q & A 
iv) Demonstration 
v) Demonstration | | | |
| LU2- CNC LATHE | 10 hrs | 48 hrs | i) Know the principle parts of CNC lathe & their working. 
ii) Know the x-axis & z-axis movements. 
iii) Know the machine codes. 
iv) Set the tools in sequence 
v) Run the programme on CNC lathe 
vi) Prepare the jobs according to the given programme | i) Oral questioning 
ii) Short Q & A 
iii) Short Q & A 
iv) Short Q & A 
v) Demonstration 
v) Demonstration | | | |

The following operations are included in the units:-

LU1- Facing, Taper turning, knurling, boring, eccentric turning, parallel turning, Thread cutting, drilling, reaming and profile turning. 
LU2- Facing, Taper turning, knurling, boring, eccentric turning, parallel turning, Thread cutting and drilling.

The tools, equipment and machinery for this module may include:-

LU1- Conventional lathe machine with accessories, single point cutting tools, Drill sets, knurling tools power saw, vernier calipers, micrometer, safety gear & equipment 
LU2- CNC lathe machine, CNC cutting tools, vernier calipers, micrometer, safety gear
Critical aspects:-

- Writing the program
- Selecting the program
- Setting the program
- Accuracy of data fed to the program
- Safety procedures
## Module 3: Machine Tools 2

<table>
<thead>
<tr>
<th>Learning Units</th>
<th>Theory hours</th>
<th>Workplace hours</th>
<th>Recommended formative assessment</th>
<th>Recommended Methodology</th>
<th>Scheduled Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>LU1- MILLING MACHINES</td>
<td>15 hrs</td>
<td>48 hrs</td>
<td>i) Know the purpose of the milling machine &amp; the movement of various parts.</td>
<td>i) Oral questioning</td>
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<td>ii) Know the use of various milling cutters.</td>
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<td>iii) Understand the speed, feed, and depth of cut.</td>
<td>ii) Short Q &amp; A</td>
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<td>iv) Apply the various work holding devices i.e., rotary table, dividing head, machine vice &amp; universal vice.</td>
<td>iii) Short Q &amp; A</td>
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<td>v) Apply various milling attachments.</td>
<td>iv) Demonstration</td>
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<td>vi) Perform various milling operations i.e., face milling, profile milling, pocket milling, slitting etc.</td>
<td>v) Demonstration</td>
<td></td>
</tr>
<tr>
<td>LU2- CNC VERTICAL MACHINING CENTER</td>
<td>15 hrs</td>
<td>72 hrs</td>
<td>i) Know the principal parts of CNC machining center &amp; their working.</td>
<td>i) Oral questioning</td>
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<td>ii) Know the principal axis of CNC machining center i.e., the x-axis, y-axis &amp; z-axis.</td>
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<td>iii) Know the machine codes.</td>
<td>ii) Short Q &amp; A</td>
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<td>iv) Set the job &amp; machine.</td>
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<td>v) Set the tools in sequence for a particular job.</td>
<td>iii) Short Q &amp; A</td>
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<td>vi) Run the programme on CNC machining center.</td>
<td>iv) Demonstration</td>
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<td>vii) Prepare the jobs according to the given programme.</td>
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<td>viii) Adjust the tool wear compensation.</td>
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</tbody>
</table>

The following operations are included in the units:-

LU1- Face milling, profile milling, pocket milling, slitting.
LU2- Setting the datum, setting the milling cutters in sequence, face milling, profile milling, pocket milling, slitting.

The tools, equipment and machinery for this module may include:-

LU1- Universal milling machine with all standard accessories and attachments, milling cutters, micrometer, vernier caliper, dial test indicator, power saw, general hand tools, safety gear and equipment.
LU2- CNC vertical machining center & cutters, lever gauge, power saw, micrometer, vernier caliper, dial test indicator, general hand tools, safety gear and equipment.
Critical aspects:-

- Writing the program
- Selecting the program
- Setting the program
- Accuracy of data fed to the program
- Safety procedures
Module 4: Machine Tools 3

<table>
<thead>
<tr>
<th>Learning Units</th>
<th>Theory hours</th>
<th>Workplace hours</th>
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</thead>
</table>
| LU1- DRILLING MACHINE | 6 hrs        | 18 hrs         | i) Know the purpose of drilling machine.  
ii) Know the use of standard drill, reamers, counter-bores, countersinks & spot facing tools.  
iii) Perform the drilling operation.  
iv) Perform counter boring, counter sinking, spot facing, and reaming operations. | i) Oral questioning  
ii) Short Q & A  
iii) Demonstration  
iv) Demonstration |                 |
| LU2- GRINDING MACHINE | 6 hrs        | 36 hrs         | i) Know the purpose of the grinding machine.  
ii) Perform the surface grinding & cylindrical grinding operations.  
iii) Perform grinding of holes using grinding bits. | i) Oral questioning  
ii) Demonstration  
iii) Demonstration |                 |

The following operations are included in the units:-

LU1-  
i) Drilling operations using various drill sizes.  
ii) Counter boring, counter sinking, spot facing, reaming.

LU2-  
i) Grinding operations on surface grinding machine and cylindrical grinding machine.  
ii) Grinding of external cylindrical surfaces.  
iii) Grinding holes using grinding bits.

The tools, equipment and machinery for this module may include:-

LU1- Drilling machine with digital read out (DRO), standard drill sets, center drills, counter boring tool, counter sinking tool, spot facing tool, and reamers.

LU2- Surface grinding machine, cylindrical grinding machine with all standard attachments, bench grinder, various grinding wheels, tool kit, safety goggles.
Critical aspects:-

- Selection of appropriate drill size
- Setting the rpm with respect to drill size and the material of job
- Use of the coolant
- Selection of an appropriate grinding wheel
- Setting of machine parameters
- Personal safety gear during the operation is essential
## Module 5: Wire cut

<table>
<thead>
<tr>
<th>Learning Units</th>
<th>Theory Days/hours</th>
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</thead>
<tbody>
<tr>
<td>LU1- WIRE CUT</td>
<td>6 hrs</td>
<td>24 hrs</td>
<td>i) Know the purpose of the wire cut machine.</td>
<td>i) Oral questioning</td>
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<td>ii) Understand the parameters related to wire cut machine, select tool path for wire cutting operation.</td>
<td>ii) Short Q &amp; A</td>
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<td>iii) Set the job on the machine.</td>
<td>iii) Demonstration</td>
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<td>iv) Adjust the current for desired finish of job.</td>
<td>v) Demonstration</td>
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<td>v) Cut regular and irregular outline on metallic sheets observing the safety precautions.</td>
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</tbody>
</table>

The following operations are included in the units:-

LU1- i) Wire cutting operations

The tools, equipment and machinery for this module may include:-

LU1- i) Wire cut machine, tungsten wire, with standard accessories.
    ii) Safety gear and equipment.
    iii) Measuring tools.

Critical aspects:-

LU1-
- Correct setting of machine parameters
- Accuracy of the programme
- Interpretation of drawings
- Safety procedure
### Module 6: Tool & Die Making

<table>
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</table>
| LU1- DIE MAKING| 12 hrs            | 90 hrs               | i) Understand the function of a die.  
ii) Know the various types of sheet metal dies and their difference e.g., Blanking, Forming, Draw, piercing and trimming dies.  
iii) Understand the main components of a die i.e., die punch, blank holder, stripper plate, top & bottom plate, guiding system.  
v) Disassemble the various dies for maintenance. | i) Oral questioning  
ii) Short Q & A  
iii) Short Q & A  
v) Demonstration |                  |
| LU2- TOOL MAKING| 6 hrs             | 42 hrs               | i) Understand the various single points & multiple point cutting tools.  
ii) Understand the cutting tool angles.  
iii) Recognize the various tools and their angles with respect to operations and material being cut.  
v) Grind the angles on single point cutting tools & multiple point cutting tools. | i) Short Q & A  
ii) Oral questioning  
iii) Short Q & A  
v) Demonstration |                  |

The following operations are included in the units:-

**LU1-**  
i) Assembling of dies.

**LU2-**  
i) Grinding of angles on tool blanks and re-sharpening of tools.

The tools, equipment and machinery for this module may include:-

**LU1-**  
i) Spanners, screw drivers, set of Allen keys, set of files, needle files (diamond), disc grinder with grinding discs, pin grinding m/c & pin grinding wheels, mallet, bench vice, rotary burrs, bench work stations (one bench per four students), safety goggles etc.

**LU2-**  
i) Universal tool & grinding machine with standard accessories, abrasive wheels, safety goggles.
Critical aspects:-

LU1-
- Safety procedure
- Safe handling of the dies
- Selection of tools
- Interpretation of drawing
- Conformity to specification
- Alignment and fits of the components

LU2-
- Setting of job
- Interpretation of drawing
- Conformity to specification
- Proper selection of grinding wheel
- Safety procedures
### Module 7: Auxiliaries

<table>
<thead>
<tr>
<th>Learning Units</th>
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</table>
| LU1- ENGINEERING LIMITS, FITS AND SURFACE FINISH | 12 hrs            | 0 hrs                | i) Understand the limits, fits & tolerances.  
ii) Know the purpose of applying the limits & fits on the die components.  
iii) Practice of calculating tolerances. | i) Oral questioning  
ii) Oral questioning  
iii) Short Q & A |                |
| LU2- HEAT TREATMENT | 12 hrs            | 42 hrs               | i) Know the purpose of the heat treatment.  
ii) Understand the various heat treatment processes.  
iii) Perform the stress relieving, hardening, quenching, tempering process. | i) Oral questioning  
ii) Short Q & A  
iii) Demonstration |                |

The following operations are included in the units:-  
LU1- Nil  
LU2- Carburizing, tempering, annealing etc.

The tools, equipment and machinery for this module may include:-  
LU1- Nil  
LU2- Muffle furnace, quenching oils and safety gear

Critical aspects:-  
LU1- Nil  
LU2-  
- Maintenance of correct temperatures  
- Positioning of work piece during heat treatment
Module 8: Maintaining Tools & Dies

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>LU1- POLISHING OPERATIONS</td>
<td>6-hrs</td>
<td>Pr. 24-hrs</td>
<td>Students will be able to: i) Know the purpose of the polishing operation. ii) Know the techniques for polishing die &amp; punch. iii) Perform polishing operations using polishing mediums i.e., polishing stones, emery papers &amp; emery pastes etc.</td>
<td>i) Oral questioning</td>
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</tr>
<tr>
<td>LU2- MAINTENANCE OF TOOLS &amp; DIES</td>
<td>6 hrs</td>
<td>48 hrs</td>
<td>Students will be able to: i) Identify the defects of tools and dies. ii) Analyse the defects. iii) Suggest the remedial measures. iv) Repair &amp; regrind the die block. v) Replace the defective components.</td>
<td>i) Short Q &amp; A ii) Short Q &amp; A iii) Report writing iv) Demonstration v) Demonstration</td>
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</tbody>
</table>

The following operations are included in the unit:-
LU1- Filing, lapping, buffing, grinding & honing.
LU2- Turning, drilling, milling, welding & grinding

The tools, equipment and machinery for this unit may include:-
LU1- Polishing stones, emery papers, and emery pastes of different grades.
LU2- Spanners, screw drivers, set of Allen keys, set of files, needle files (diamond), disc grinder with grinding discs, pin grinding m/c & pin grinding wheels, mallet, bench vice, rotary burrs, bench work stations ( one bench per four students), safety goggles etc.

Critical aspects:-

LU1- & LU2
- Polishing of items.
- Identifications of faults.
- Precision of repair.
- Safety procedures.
Supportive notes

The candidate will be required to:

- Orally, or by other methods of communications, answer the questions asked by the assessor.
- Identify superiors who can be approached for the collection of competency evidence.
- Present evidence related to the units.

During assessment the candidate will:

- Demonstrate safe work practices at all times.
- Communicate information about processes, events or tasks being undertaken to ensure a safe and efficient working environment.
- Take the responsibility for the quality of his/her own work.
- Plan task and review task requirements at appropriate time.
- Relate to all stakeholders according to accepted conventions.
- Perform all tasks in accordance with standard operating procedures.
- Perform all tasks to specifications.
- Use accepted data collection techniques, practices, and processes in line with workplace procedures.

Resources required for assessment include:

All material, tools, equipment and machinery listed within the modules.
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