

## Descriptive statements- METAL WORK

	Content Area	Competencies	Descriptive statements
1.	<p>Materials</p> <ul style="list-style-type: none"> <li>• Metals – ferrous and non-ferrous metals</li> <li>• Characteristics</li> <li>• Properties</li> <li>• Uses</li> </ul>	<p>I. Demonstrate knowledge of ferrous and non-ferrous metals</p> <p>II. Demonstrate knowledge of metallic characteristics, properties and uses</p>	<p>a. Differentiate between ferrous and non-ferrous metals</p> <p>b. Describe the basic compositions of steel, mild steel, medium carbon, high carbon, alloy steel, stainless steel, wrought iron and cast iron and discuss their application in the engineering industry.</p> <p>c. Explain the physical properties and applications of aluminium, zinc, copper, tin and lead</p> <p>d. Describe alloys</p> <p>e. Explain brass (muntz, cartridge, gilding metal), bronze (manganese, gunmetal, bell metal, aluminium bronze, phosphor bronze) and solder</p> <p>f. State uses of ferrous and non-ferrous metals</p> <p>g. Explain the properties of ferrous and non-ferrous metals</p>

2	<p>Safety</p> <ul style="list-style-type: none"> <li>• Personal and workshop safety,</li> <li>• Equipment safety,</li> <li>• Material safety</li> </ul>	<p>I. Demonstrate knowledge of personal, workshop and materials safety.</p> <p>II. Demonstrate skills in safe use of tools and equipment.</p> <p>III. Exhibit skills in appropriate use of materials.</p>	<p>a. Describe safety precautions</p> <p>b. List safety practices when using machine tools</p> <p>c. Describe how to avoid accidents to the craftsman</p> <p>d. Use materials appropriately to avoid hazard</p>
3	<p>Tools</p> <ul style="list-style-type: none"> <li>• Measuring and marking out</li> <li>• Cutting tools</li> <li>• Holding tools</li> </ul>	<p>I. Demonstrate knowledge of marking out, holding and cutting tools.</p> <p>II. Demonstrate skills in using cutting tools appropriately.</p> <p>III. Demonstrate skills in using holding tools appropriately.</p> <p>IV. Develop basic manipulative skills in the use of tools.</p>	<p>a. Identify measuring and marking out tools;</p> <p>b. Use cutting tools appropriately;</p> <p>c. Use holding tools appropriately;</p> <p>d. List the holding tools;</p> <p>e. Differentiate between measuring and marking out tools.</p>
4	<p>Bench work</p> <ul style="list-style-type: none"> <li>• Cutting processes</li> <li>• Scrapping</li> <li>• Chiseling</li> <li>• Filing</li> <li>• Thread cutting</li> </ul>	<p>I. Demonstrate knowledge of the cutting processes.</p> <p>II. Demonstrate skills in using the various cutting tools.</p>	<p>a. Identify the different cutting, scrapping, chiseling, filing, thread cutting and sawing tools;</p> <p>b. Use the scrapper appropriately;</p> <p>c. Perform chiseling activities;</p> <p>d. Cut internal and external thread;</p> <p>e. Cut sheet metal to given sizes using</p>

	<ul style="list-style-type: none"> <li>• Sawing</li> </ul>		<p>appropriate tools and machine;</p> <p>f. Describe the types of hacksaws;</p> <p>g. Draw and label the parts of the saws.</p>
5	<p>Manufacturing process</p> <ul style="list-style-type: none"> <li>• Forging or blacksmithing</li> <li>• Casting</li> </ul>	<p>I. Demonstrate understanding of forging or blacksmithing.</p> <p>II. Demonstrate knowledge of sand casting.</p> <p>III. Demonstrate knowledge of die casting.</p> <p>IV. Demonstrate skills in sand casting.</p> <p>V. Demonstrate skills in die casting.</p> <p>VI. Demonstrate skills in forging.</p>	<p>a. Define forging or blacksmithing;</p> <p>b. State the tools for forging;</p> <p>c. Explain the processes in die casting;</p> <p>d. Describe sand casting;</p> <p>e. Explain the defects in casting;</p> <p>f. List the tools for sand and die casting;</p> <p>g. Prepare a pattern for sand casting;</p> <p>h. Describe the steps in preparing a mould;</p> <p>i. Compare and contrast die and sand casting;</p> <p>j. Enumerate the equipment for melting and pouring.</p>
6	Machine tools and processes	<p>I. Demonstrate knowledge in machine tools.</p> <p>II. Demonstrate skills in machine tools.</p>	<p>a. Describe these machine equipment (power hacksaw, power drills, lathe, milling machines, grinding machines)</p> <p>b. State the uses of these equipment</p>

7	<p>Joining processes</p> <ul style="list-style-type: none"> <li>• Arc welding</li> <li>• Gas welding</li> <li>• Soldering and brazing</li> <li>• Fastening</li> <li>• Adhesive bonding</li> </ul>	<p>I. Understand joining processes in metal work.</p> <p>II. Demonstrate skills in joining processes in metal works.</p> <p>III. Understand skills in applying adhesives.</p>	<p>a. Explain welding;</p> <p>b. Differentiate between arc and gas welding processes;</p> <p>c. Differentiate between A.C and D.C. arc welding machines;</p> <p>d. Enumerate the equipment used in arc and gas welding (generators, regulators, blow pipes, nozzles, hoses, sconomizers, check valve);</p> <p>e. Describe the cylinders for gas welding;</p> <p>f. Describe tools for soldering and brazing;</p> <p>g. Describe the types of fluxes used in soldering;</p> <p>h. Tabulate advantages and disadvantages of gas welding and arc welding;</p> <p>i. Identify the welding flames and demonstrate how they are obtained in oxyacetylene welding;</p> <p>j. Explain hazards related to metal arc welding (arc eye, burning, radiation,</p>
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			<p>electric shock, toxic fumes);</p> <p>k. Classify fasteners under temporal and permanent joint;</p> <p>l. State the types of fasteners (screws, bolt and nut, riveting);</p> <p>m. Identify common rivets used in metal work and state their applications;</p> <p>n. State common faults in riveting (overlapping, cracked rivets, uneven ends);</p> <p>o. Describe surface preparation for adhesive bonding;</p> <p>p. Differentiate between dry and wet application of adhesives.</p>
8	<p>Heat treatment</p> <ul style="list-style-type: none"> <li>• Annealing</li> <li>• Normalizing</li> <li>• Hardening and tempering</li> <li>• Patenting</li> <li>• Age hardening</li> <li>• Case hardening</li> <li>• Stress relieve</li> </ul>	<p>I. Demonstrate knowledge of heat treatment.</p> <p>II. Demonstrate skills in heat treatment.</p>	<p>a. Define heat treatment;</p> <p>b. Describe the purpose of heat treating metals;</p> <p>c. Explain processes involved in annealing;</p> <p>d. Describe the normalizing process;</p> <p>e. Distinguish between normalizing and annealing;</p> <p>f. Select the appropriate quenchant for</p>

			<p>the particular heat treatment;</p> <p>g. Explain patenting;</p> <p>h. Differentiate between case and age hardening;</p> <p>i. Describe the importance of case hardening on artifact;</p> <p>j. Explain stress relieving as a heat treatment process;</p> <p>k. Explain the hardening and tempering process of steels;</p> <p>l. Perform the various heat treatment processes.</p>
9	Plastics	<p>I. Demonstrate understanding of plastics.</p> <p>II. Demonstrate skills in production of plastic artifacts.</p>	<p>a. State the sources of plastics;</p> <p>b. Differentiate between thermoplastics and thermosetting;</p> <p>c. Explain the process of extrusion;</p> <p>d. Prepare artifacts for press forming;</p> <p>e. Describe in injection moulding process;</p> <p>f. Enumerate the advantages of plastics over other materials.</p>
10	Finishes	<p>I. Demonstrate understanding</p>	<p>a. Explain finishes;</p>

		<p>of using finishes.</p> <p>II. Demonstrate skills in finishing.</p>	<p>b. Outline the types of finishes;</p> <p>c. Describe the importance of finishing an artifact;</p> <p>d. Define the terms blueing, electroplating and galvanizing;</p> <p>e. Describe the processes involved in blueing, electroplating and galvanizing.</p>
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**TABLE OF SPECIFICATION FOR METALWORK**

		<b>Course objectives/OUTCOMES (Depth of Knowledge)</b>				
<b>S/N</b>	<b>Content/Areas</b>	<b>LEVEL 1 (RECALL)</b>	<b>LEVEL 2 (SKILL/CONCEPT)</b>	<b>LEVEL 3 (STRATEGIC THINKING)</b>	<b>LEVEL 4 (EXTENDED THINKING)</b>	<b>TOTAL (%)</b>
1	<b>Materials</b>	1	2	3	3	<b>9</b>
2	<b>Safety</b>	1	1	2	1	<b>5</b>
3	<b>Tools</b>	1	2	3	3	<b>9</b>
4	<b>Bench work</b>	2	3	4	4	<b>13</b>
5	<b>Manufacturing process</b>	2	4	4	4	<b>14</b>
6	<b>Machine tools and processes</b>	2	4	4	4	<b>14</b>
7	<b>Joining processes</b>	2	4	4	4	<b>14</b>
8	<b>Heat treatment</b>	2	2	2	3	<b>9</b>
9	<b>Plastics</b>	1	2	2	2	<b>7</b>

10	<b>Finishes</b>	1	1	2	2	<b>6</b>
	<b>Total (%)</b>	<b>15</b>	<b>25</b>	<b>30</b>	<b>30</b>	<b>100</b>