



2	Properties of metals and selection.	<p>2.1 Ferrous and non-ferrous metals (steel, aluminum, cast iron, copper and zinc, tin, alloy steel).</p> <p>2.2. Properties of metals (ductility, hardness, toughness, malleability, fusion and tenacity, brittleness, elasticity and plasticity).</p> <p>2.3. Sheet metal (aluminum, mild steel, brass)  - concept of sheet metal  - gauges of sheet metal</p> <p>2.4. Selection of suitable metals for specific jobs.</p>	2.1.1 Identification of ferrous and non-ferrous metals.
		2.5 Heat treatment of metals (hardening, annealing, normalizing, tempering and case- hardening, etc.)	2.5.1. Annealing, Hardening and Normalizing of metals
3	Tools and Equipment in Fabrication and Welding.	<p>3.1. Identification of tools and equipment for fabrication and welding.</p> <p>3.2. Equipment set-up for gas, arc welding and fabrication.</p> <p>3.3. Job holding devices for fabrication and welding.</p> <p>3.4. Measuring instruments, marking out and cutting tools.</p> <p>3.5. Identification of parts and accessories for gas and arc welding.</p> <p>3.6. Maintenance procedure for arc and gas (oxy-acetylene) welding equipments.</p> <p>3.7. Preparation of acetylene gas from carbide.</p> <p>3.8. Types of electrodes and their</p>	<p>3.1.1. Student to set up oxy – acetylene equipment</p> <p>3.4.1. Demonstration of the use of measuring, marking out and cutting tools.</p> <p>3.5.1. Demonstration of the preparation of ace-tylene gas from carbide.</p>

		<p>composition, their application, gauges of electrodes, selection of appropriate electrode for a specific job.</p> <p>3.9. Equipment for fault detection and trouble shooting in fabrication and welding.</p>	
4	Operations and Techniques in Welding and Fabrication.	4.1. Types of welding (Gas and Arc welding), explanation of the principles of gas and arc welding and their differences	
		<p>4.2. Description of a typical fabrication process.</p> <p>4.3. Types of joints, joint methods and application in welding and fabrication</p> <p>4.4. Classification of marking out techniques in welding and fabrications.</p> <p>4.5. Description of the use of templates for fabricated and welded assemblies.</p> <p>4.6. Welding techniques and application.</p> <p>4.7. Techniques in fabrication work - Description of folding techniques and its importance in fabrication work.</p>	<p>4.3.1. Demonstration of various jobs cutting techniques.</p> <p>4.6.1. Students to weld using both leftward and rightward methods.</p> <p>4.7.1. Students to work on wire-edge projects.</p>
5	<p>Fasteners</p> <p>(a) Classification of fasteners.</p> <p>(b) Rivet and its application</p> <p>(c) Bolt and nuts</p> <p>(d) Screws</p>	<p>5.1. Permanent fasteners.</p> <p>5.2. Temporary fasteners.</p> <p>5.3. Types of rivets.</p> <p>5.4. Uses of rivets.</p> <p>5.5. Description of bolts and nuts.</p> <p>5.6. Uses of bolts and nuts</p> <p>5.7. Classes of rivets and screws.</p>	<p>5.4.1. Students to produce rivets joints.</p> <p>5.5.1. Students to produce bolts and nuts.</p>
6	Forging Process - Introduction to forging	<p>6.1. Definition of forging</p> <p>6.2. Forging tools and equipment (furnace, swages, fullers,</p>	

		<p>flatters and tongs).</p> <p>6.3. Forging process</p> <ul style="list-style-type: none"> <li>- upsetting.</li> <li>- drawing down</li> <li>- twisting</li> <li>- bending</li> <li>- forging an eye.</li> </ul>	6.3.1. Students to form an eye.
7	Preparation of welding surfaces and environment.	7.1. Preparation of welding surfaces by cleaning with wire brush, emery cloth, files, scrappers and	
		<p>grinding machine.</p> <p>7.2. Preparation of edges for welding e.g. single V, double V, fillets.</p> <p>7.3. Post surface preparation</p> <ul style="list-style-type: none"> <li>- cleaning surface with wire brush</li> <li>- oiling surface to protect from corrosion or rusting.</li> </ul> <p>7.4. Defect in welding surfaces (causes and remedies).</p> <p>7.5. Definition of welding environment</p> <ul style="list-style-type: none"> <li>- awkward, unventilated, flammable material</li> <li>- slippery floor (oil/grease on floor)</li> </ul> <p>7.6. Surface furnishing for fabrication and welding (painting, metal spraying, galvanizing and oiling).</p>	7.2.1. Preparation of single V surface for welding.
8	Practical Work/Project	<p>8.1. Marking of shapes (triangle, square and rectangle).</p> <p>8.2. Cutting and bending of triangles, square and rectangles.</p> <p>8.3. Soldering of sheet metals</p> <p>8.4. Welding of steel using arc welding.</p> <p>8.5. Welding of steel using gas welding.</p> <p>8.6. Fabrication of ferrous and non-ferrous metals into required</p>	

		<p>shapes.</p> <p>8.7 Suggested projects (students to produce the following):</p> <ul style="list-style-type: none"> <li>- named plate</li> <li>- trinket box</li> <li>- funnel</li> <li>- kitchen stool</li> <li>- car stopper</li> <li>- metal rake</li> </ul>	
		<ul style="list-style-type: none"> <li>- scoop</li> <li>- hinges</li> <li>- charcoal stove, etc.</li> </ul>	
9	Business Entrepreneurship Opportunity	<p>9.1. Definition of</p> <ul style="list-style-type: none"> <li>- entrepreneurship</li> <li>- employer</li> <li>- employee.</li> </ul> <p>9.2 Enterprises</p> <ul style="list-style-type: none"> <li>- small scale enterprise</li> <li>- medium scale enterprise</li> <li>- large scale enterprise</li> </ul> <p>9.3. Factors for setting a workshop (cost, site, weather, material, manpower, market, source of power, transportations.</p>	<p>9.3.1. Site visitations to existing enterprise (small, medium or large scale enterprise)</p>

### LIST OF FACILITIES AND MAJOR EQUIPMENT/MATERIALS REQUIRED:

<u>S/N</u>		<u>QTY</u>	<u>S/N</u>		<u>QTY</u>	<u>S/N</u>		<u>QTY</u>	<u>S/N</u>		<u>QTY</u>
<u>1</u>	<u>Hammers (various types)</u>	<u>20</u>	<u>17</u>	<u>Bending rollers</u>	<u>1</u>	<u>33</u>	<u>Combined set of cutting welding outfits</u>	<u>5</u>	<u>48</u>	<u>Bench grinding Machine</u>	<u>2</u>
<u>2</u>	<u>Try squares</u>	<u>20</u>	<u>18</u>	<u>Bench mounted cone roller</u>	<u>1</u>	<u>34</u>	<u>Regulators with flow meters</u>	<u>6</u>	<u>49</u>	<u>Electrode Holders</u>	<u>10</u>
<u>3</u>	<u>Chisels</u>	<u>15</u>	<u>19</u>	<u>Bench shares</u>	<u>2</u>	<u>35</u>	<u>Water to carbide generator</u>	<u>1</u>	<u>50</u>	<u>Electrode drying oven</u>	<u>1</u>
<u>4</u>	<u>Punches</u>	<u>15</u>	<u>20</u>	<u>Power hacksaw</u>	<u>1</u>				<u>51</u>	<u>Pillar Drilling Machine</u>	<u>2</u>
<u>5</u>	<u>Hand gloves</u>	<u>30</u>	<u>21</u>	<u>Vee blocks</u>	<u>5</u>	<u>36</u>	<u>Anvil</u>	<u>3</u>	<u>52</u>	<u>Smith open forge</u>	<u>1</u>
<u>6</u>	<u>Straight edges</u>	<u>20</u>	<u>22</u>	<u>Aprons</u>	<u>50</u>	<u>37</u>	<u>Swage block</u>	<u>1</u>	<u>53</u>	<u>Vice (bench)</u>	<u>20</u>

<u>7</u>	<u>Trammel drivers</u>	<u>5</u>	<u>23</u>	<u>O<sub>2</sub> CYLINDERS</u>	<u>3</u>	<u>38</u>	<u>Chipping hammers</u>	<u>10</u>	<u>54</u>	<u>Bench type grinding Machine</u>	<u>2</u>
<u>8</u>	<u>Left and right snips</u>	<u>20</u>	<u>24</u>	<u>Transformers with rectifiers</u>	<u>5</u>	<u>39</u>	<u>Flatters</u>	<u>5</u>	<u>55</u>	<u>Double ended buffer and polisher</u>	<u>1</u>
<u>9</u>	<u>Straight snips</u>	<u>15</u>	<u>25</u>	<u>Hand shield and Head caps</u>	<u>10 each</u>	<u>40</u>	<u>Mole grip</u>	<u>5</u>	<u>56</u>	<u>Blow pipes (low and high pressure)</u>	<u>2</u>
<u>10</u>	<u>Rule, Scriber and dividers</u>	<u>20 each</u>	<u>26</u>	<u>Gas welding goggles</u>	<u>10</u>	<u>41</u>	<u>Sledge Hammers</u>	<u>5</u>	<u>57</u>	<u>Files assorted</u>	<u>100</u>
<u>11</u>	<u>Hand nibbling machine</u>	<u>5</u>	<u>27</u>	<u>Double cylinder Trolley</u>	<u>5</u>	<u>42</u>	<u>Plain goggles</u>	<u>20</u>	<u>58</u>	<u>Acetylene Cylinder</u>	<u>3</u>
<u>12</u>	<u>Wire brushes</u>	<u>50</u>	<u>28</u>	<u>Oxygen regulators</u>	<u>5</u>	<u>43</u>	<u>G – clamp</u>	<u>5</u>	<u>50</u>	<u>Parallel Clamp</u>	<u>5</u>
<u>13</u>	<u>Pliers-assorted</u>	<u>20</u>	<u>29</u>	<u>Acetylene regulators</u>	<u>5</u>	<u>44</u>	<u>First-aid box</u>	<u>2</u>	<u>60</u>	<u>Toolmakers clamp</u>	<u>5</u>
<u>14</u>	<u>Tongs Assorted</u>	<u>15</u>	<u>30</u>	<u>Hoses, Clips and all attachments accessories</u>	<u>10</u>	<u>45</u>	<u>Magnetic clamp</u>	<u>2</u>	<u>61</u>	<u>Mallets</u>	<u>5</u>
<u>15</u>	<u>Hacksaws and blades</u>	<u>60</u>	<u>31</u>	<u>DC generators with all connections</u>	<u>5</u>	<u>46</u>	<u>Self grip pliers</u>	<u>5</u>	<u>62</u>	<u>Work bench</u>	<u>10</u>
<u>16</u>	<u>Guillotine</u>	<u>1</u>	<u>32</u>	<u>AC Transformers</u>	<u>5</u>	<u>47</u>	<u>Folding bars</u>	<u>2</u>	<u>63</u>	<u>Fire Extinguisher</u>	<u>4</u>
									<u>64</u>	<u>Sand bucket</u>	<u>4</u>
									<u>65</u>	<u>Cramp Folding Machine</u>	<u>20</u>
									<u>66</u>	<u>Riveting Pliers</u>	<u>5</u>
									<u>67</u>	<u>Riveting set</u>	<u>2</u>

## RECOMMENDED BOOKS

<b>S/NO.</b>	<b>BOOKS</b>	<b>AUTHOR</b>
1	Welding and Fabrication	W. Kenyon
2	The Science and Practice of Welding	A. C. Davis
3	Fabrication and Welding	F. J. M. Smith
4	Basic Welding	P. Somsy
5	The Theory and Practice of Metalwork	George Love
6	Metal Craft Theory and Practice	John R. Bedford

7	Metalwork Motivate Series	J. K. N. Sackey & S. K. Amoakohene
8	Metalwork Technology	G. H. Thomas
9	Workshop Processes and Materials	J. V. Courtney
10	Ilesanmi Metalwork for Senior Secondary School Books 1 – 3	Adejuyigbe S. B. and S. K. Akinlosose
11	Practical Welding Motivate Series	S. W. Gibson and B. K. Amoako-Awuah