ZIMBABWE

MINISTRY OF PRIMARY AND SECONDARY EDUCATION

METAL TECHNOLOGY AND DESIGN SYLLABUS

FORMS 1 - 4

2015 - 2022

Curriculum Development and Technical Services
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Harare

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2015
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- Captains of Industries
- Harare Institute of Technology
- United Nations Children’s Emergency Fund (UNICEF)
- United Nations Educational, Scientific and Cultural Organization (UNESCO)
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1.0 PREAMBLE

1.1 Introduction

The Metal Technology and Design syllabus is designed for forms 1-4 learners. Practical, theory and problem solving approach will be at the centre of implementing this syllabus. The syllabus embraces inclusivity in the learning and teaching of Metal Technology and Design. This approach encourages the acquisition of technical skills, knowledge and attitudes which are relevant to the requirements of trade and industry, further studies and self-reliance.

1.2 Rationale

The educational philosophy of the syllabus is concerned with the development of skills and ethical attributes (unhu/ubuntu/vumunhu) which will emphasize the learners’ role in making and shaping of their environment. This will encourage the learner to employ problem solving skills which will promote the application of scientific and mathematical principles acquired from other related subjects. The syllabus sets out to promote desirable enterprise, recreational and other life skills relevant in the contemporary society. The syllabus will enable learners to explore numerous Metal Technology and Design career opportunities. This will also encourage learners to value the use of multi-materials in a sustainable manner. The syllabus will also help in the value addition of abundant locally available raw materials. It will also allow flexibility in solving practical and technological problems encountered in real life situations.

The Metal Technology and Design syllabus enables learners to develop skills in:

- Problem solving
- Analytical thinking
- Decision making
- Leadership
- Planning and designing
- Enterprising
- Communication
- Creativity
- Value judgement
- Quality assurance

1.3 Summary of Content

This syllabus is intended to cover theory and practical activities in Metal Technology and Design.

It will focus on:

- Workshop safety and health
- Material science
- Use and maintenance of Metal Technology tools, machines and equipment
- Use of design as a problem solving technique
- Workshop calculations and Bill of Quantities
- Manufacturing techniques and systems
- Drawing and design
- Entrepreneurial Skills
- Use of computers in Design and Manufacturing (CAD/CAM)
- Use of hydraulics and pneumatics
- Electricity and Electronics
- Mechanisms and structures

Time Allocation

Twelve periods of 40 minutes per week should be allocated to adequately cover the syllabus. Two by two periods for theory, drawing and design and two blocks of four periods for practicals should be allocated. Learners should be engaged in at least:

- a minimum of two educational tours per year
- at least two exhibitions per year

1.4 Assumptions

The syllabus assumes that learners have:

- Used measuring equipment
- Used hand tools
- Knowledge of Health and safety
- Knowledge of the principles of drawing and design
- Knowledge of mechanisms and structures
- Numeracy and scientific principles
- ICT appreciation
- Knowledge of materials
- Electricity and electronics knowledge

1.5 Cross-cutting themes

Metal Technology as a learning area will encompass and have a universal thrust on the following cross cutting themes:

- Inclusivity
- Gender equity
- Teamwork
- Health and Safety
- Technology and innovation
Metal Technology and Design Syllabus Forms 1 - 4

2.0 PRESENTATION OF THE SYLLABUS

The Metal Technology and Design syllabus is a single document covering Forms 1-4. It contains the Preamble, Aims, Objectives, Syllabus Topics, Methodology, Scope and Sequence and Assessment.

3.0 AIMS

The syllabus should enable learners to:

3.1 appreciate importance of health and safety in the working environment
3.2 appreciate the use of appropriate tools, equipment and materials to produce desired results
3.3 prepare for life in the world of work in an indigenized economy and increasingly globalized and competitive environment
3.4 demonstrate desired practical competences necessary for community development
3.5 gain fundamental design and technological skills to solve real life problems
3.6 develop entrepreneurial skills
3.7 develop a maintenance and repair culture

4.0 OBJECTIVES

By the end of the syllabus, learners should be able to:

4.1 observe health and safety regulations
4.2 identify the appropriate tools and equipment required to perform a specific task
4.3 demonstrate effective and efficient use of tools and equipment
4.4 select appropriate materials for use on specific designs
4.5 display a culture of self-reliance
4.6 identify community-based problems
4.7 solve identified problems in the community using the design process
4.8 generate Bill of Quantities
4.9 evaluate the efficacy of a prototype
4.10 demonstrate competence in the maintenance and repair of tools and equipment

5.0 METHODOLOGY AND TIME ALLOCATION

5.1 Methodology

This syllabus is based on learner-centred and multi-sensory approaches in the teaching and learning of Metal Technology and Design. The principle of individualization should impact on the use of any of the suggested methods. Material Science, Engineering Science, Engineering Mathematics and Engineering Drawing should be an integral part of every practical exercise. The approaches should also create awareness of the issues of sustainability by involving learners in the collection of waste materials for reusing and recycling. The use of ICT (CAD/CAM) is encouraged.

5.2 Suggested Methods

• Discussion
• Project Work
• Group Work
• Experimentation/discovery problem solving
• Demonstration
• Visual Aid
• Question and Answer
• Industrial Visits
• Resource persons
• Team Teaching
• Exhibitions

6.0 TOPICS

6.1 Health and Safety
6.2 Hand Tools and their Applications
6.3 Material Science
6.4 Drawing and Design
6.5 Enterprising Education
6.6 Machines and Machining Processes
6.7 Workshop Calculations
6.8 Welding Technology
6.9 Sheet Metal Technology
6.10 Foundry Technology
6.11 Forge Technology
6.12 Electricity and Electronics
6.13 Technology Concepts
6.14 Beaten Metal Technology
6.15 Mechanical Joining Processes
6.16 Maintenance
6.17 Material Finishes
6.18 Computer Aided Design and Computer Aided Manufacturing
## 7.0 SCOPE AND SEQUENCE

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<td>• Workshop Health and Safety regulations</td>
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<td>• Types of non-metallic materials commonly used in workshops</td>
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<td>• Types of alloys and alloying elements and their properties</td>
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<td>• Protection of metals against corrosion</td>
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<td><strong>7.4 Drawing and Design</strong></td>
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<td>• Computer Aided Design</td>
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<td><strong>7.5 Enterprising Education</strong></td>
<td>• Concepts of Enterprising Education</td>
<td>• Types of businesses</td>
<td>• Production and business Ethics</td>
<td>• Intellectual property rights</td>
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<td>• Characteristics of an Entrepreneur</td>
<td>• Factors affecting small scale business growth</td>
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<td></td>
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<td>• Workshop Design and management</td>
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<td>• Risk Management in an enterprise</td>
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| 7.6 Machines and Machining Processes | • Health and Safety  
• Machines and their applications  
• Portable electrical hand tools | • Health and Safety  
• Machines and their applications  
• Portable electrical hand tools | • Health and Safety  
• Machines and their application  
• Care and maintenance of machine tools  
• Precision measuring instruments | • Health and Safety  
• Machines and their applications  
• Care and maintenance of machines  
• Mass production systems |
| 7.7 Workshop Calculations    | • Engineering calculations                                             | • Engineering calculations                                             | • Engineering calculations                                             | • Engineering calculations                                             |
| 7.8 Welding Technology       | • Welding Hazards  
• Tools and equipment  
• Types of welding | • Welding Hazards  
• Tools and equipment  
• Types of welding | • Welding hazards  
• Arc welding  
• Gas welding and cutting  
• Welding Processes  
• Welding symbols | • Welding hazards  
• Arc welding  
• Gas welding and cutting  
• Welding techniques  
• Welding symbols |
| 7.9 Sheet Metal Technology   | • Health and safety  
• Sheet metal types  
• Tools and equipment  
• Sheet metal joints  
• Safe edges | • Health and safety  
• Tools and equipment  
• Sheet metal joints  
• Safe edges | • Health and safety  
• Surface development | • Health and safety  
• Surface development |
| 7.10 Foundry Technology      | • Health and safety  
• Tools and equipment  
• Foundry processes | • Health and Safety  
• Tools and equipment  
• Foundry processes | • Foundry process and applications | • Foundry process and applications |
| 7.11 Forge Technology        | • Health and safety  
• Tools and equipment  
• Forge processes | • Health and Safety  
• Tools and equipment  
• Forge processes | • Health and safety  
• Application of forge operations | • Health and safety  
• Application of forge operations |
| 7.12 Electricity and Electronics | • Health and safety  
• Plugs and socket wiring  
• Application of electronics | • Health and safety  
• Circuit applications  
• Application of electronics | • Health and safety  
• Application of electronics | • Application of electronics |
| 7.13 Technology Concepts     | • Structures, mechanisms, hydraulics and pneumatics  
• Application of structures, mechanisms, hydraulics and pneumatics | • Application of structures, mechanisms, hydraulics and pneumatics  
• Application of structures, mechanisms, hydraulics and pneumatics in design solutions | • Application of structures, mechanisms, hydraulics and pneumatics in design solutions | • Application of structures, mechanisms, hydraulics and pneumatics in design solutions |
| 7.14 Beaten Metal Technology | • Material, equipment and processes  
• Polishing methods | • Mass production techniques  
• Polishing methods | • Mass production techniques  
• Polishing methods | • Mass production techniques  
• Polishing methods |
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<td>soft soldering</td>
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<td>locking devices</td>
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<td>hard soldering</td>
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<td>workshop maintenance</td>
<td>workshop management</td>
<td>workshop management</td>
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<td>types of finishes and their applications</td>
<td>metal finishes</td>
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<td>7.18 Introduction to Computer Aided Design</td>
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<td>introduction to CAD</td>
<td>drawing commands</td>
<td>3D forms</td>
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<td>and Manufacturing</td>
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### 8.0 COMPETENCY MATRIX

**FORM 1**

#### 8.1 TOPIC 1: HEALTH AND SAFETY

<table>
<thead>
<tr>
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<th>OBJECTIVES Learners should be able to:</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.1.1 Workshop Health and Safety Regulations | • state personal safety rules  
• observe personal safety rules when using tools and machines  
• explain the importance of safety in the workshop  
• classify types of fires and their extinguishers  
• perform fire drills  
• dispose waste material in an environmentally friendly way  
• apply first aid skills | • Health and Safety  
- Personal  
- Workshop  
- Tools  
- Basic machines  
- Fire drills  
- Classes of fire  
- First aid  
- Waste disposal | • Conducting fire drills regularly  
• Classifying types of fires and their extinguishers  
• Simulating first aid operations  
• Constructing waste bunkers and ensuring consistent use  
• Demonstrating the correct use of tools and machines | • First Aid kit  
• Safety posters  
• Fire-fighting equipment  
• Resource persons |

#### 8.2 TOPIC 2: HAND TOOLS AND THEIR APPLICATIONS

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES Learners should be able to:</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.2.1 Classification and Uses | • Identify the hand tools in each class distinguish between measuring and marking out tools  
• Demonstrate the correct use of hand tools | • Classification:  
• Measuring  
• Marking out  
• Cutting tools  
• Uses | • Discussing the classes of hand tools  
• Listing tools in each class  
• Making different artefacts using hand tools | • Print media  
• Samples of tools  
• ICT tools |
### 8.3 TOPIC 3: MATERIAL SCIENCE

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.3.1 History of Production of Metals in Zimbabwe. | • explain traditional processes of smelting iron ore.  
• state the traditional names of the furnaces used | • Traditional furnaces, tools and processes.  
• Raw materials | • Visiting archives and museums | • Resource persons  
• Models of traditional furnaces and tools  
• ICT tools |
| 8.3.2 Manufacture of Ferrous Metals | • describe the manufacture of iron and steel  
• list different types of furnaces  
• identify different types of materials | • Manufacture of iron, steel, cast iron and wrought iron | • Visiting steel processing industries  
• Watching videos on iron and steel production.  
• Drawing the different types of furnaces | • Videos  
• Print media  
• ICT tools |

### 8.4 TOPIC 4: DRAWING AND DESIGN

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.4.1 The Design Process | • identify different aspects of Design elements  
• apply design elements to solve design problems  
• define the term design  
• explain the importance of design  
• compile a design folio  
• make an artefact following the design process  
• test the artefact for functionality | • Stages of the design process  
- Situation  
- Design brief  
- Investigation  
- Possible solutions  
- Development of chosen solution  
- Mock up realization  
- Working drawings  
- Prototype realization  
- Testing  
- Evaluation of prototype | • Identifying the different types of design elements  
• Applying design elements on real practical activities  
• Defining the term design  
• Describing the stages of the design process  
• Working on a design problem  
• Producing the designed artefact  
• Testing the artefact for functionality  
• Watching videos | • ICT tools  
• Industrial visits  
• Sample design folios and prototypes  
• Videos |
### 8.5 TOPIC 5: ENTERPRISING EDUCATION

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<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.5.1 Concept of Enterprising Education | Learners should be able to: | • describe key characteristics of an entrepreneur  
• discuss the importance of starting a business enterprise  
• identify possible business opportunities related to Metal Technology in Zimbabwe | • Characteristics of an entrepreneur  
• Importance of starting your own business  
• Possible business areas related to Metal Technology  
• Identification of business opportunities | • Explaining characteristics of an entrepreneur  
• Discussing the importance of starting a business  
• Describing possible business areas learners can venture into  
• Visiting local business enterprises  
• Visiting local exhibition fairs | • Resource persons  
• Videos  
• Films  
• Entrepreneurs  
• Educational Tours |

### 8.6 TOPIC 6: MACHINES AND MACHINING PROCESSES

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<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.6.1 Health and Safety | Learners should be able to: | • observe all safety regulations pertaining to electrical machines  
• put on appropriate protective clothing | • Health and safety regulations related to electrical machines | • Demonstrating correct usage of machines while undertaking practical activities  
• Wearing of requisite protective clothing | • Protective clothing and equipment  
• Print media  
• Videos  
• Resource persons  
• Print media |
| 8.6.2 Machines and their Applications |  | • operate all machines correctly in practical activities  
• Pedestal drill parts and uses | • Hand drill parts and uses  
• Pedestal drill parts and uses | • Using machines in executing practical activities  
• Demonstrating correct use of basic machines | • Electrical equipment  
• Videos  
• Print media |

### 8.7 TOPIC 7: WORKSHOP CALCULATIONS

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<th>SUGGESTED RESOURCES</th>
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</thead>
</table>
| 8.7.1 Engineering Calculations | Learners should be able to: | • calculate allowances for:  
- riveting  
- wired edges  
- forming an eye | • Calculating allowances for:  
- rivets  
- wired edges  
- forming an eye | • Calculating allowance for:  
- rivets  
- wired edges  
- forming an eye | • Electronic calculators  
• Print media |
## 8.8 TOPIC 8: WELDING TECHNOLOGY

<table>
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<th>SUB TOPIC</th>
<th>OBJECTIVES Learners should be able to:</th>
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<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
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</thead>
</table>
| 8.8.1 Gas Welding Hazards  | • state the different types of welding hazards  
                          • demonstrate knowledge of safety considerations when gas welding | • Health and safety 
                          • Storage of oxy-acetylene gas cylinders 
                          • Detection of gas leaks | • Listing types of gas welding hazards 
                          • Stating safety rules when gas welding 
                          • Testing gas for leaks 
                          • Conducting Educational tours | • Gas welding equipment 
                          • Print Media 
                          • ICT tools 
                          • Educational tours |
| 8.8.2 Tools and Equipment  | • state the equipment used in gas welding  
                          • demonstrate the uses of different tools and equipment  
                          • distinguish between the two cylinders | • Gas welding equipment (oxy-acetylene)  
                          - application | • Identifying equipment used in gas welding 
                          • Welding artefacts using gas | • Oxy-acetylene equipment 
                          • Artefacts |

## 8.9 TOPIC 9: SHEETMETAL TECHNOLOGY

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<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
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</thead>
</table>
| 8.9.1 Health and Safety    | • demonstrate an understanding of personal health and safety  
                          • demonstrate the correct use of the first aid skills in case of an accident  
                          • dispose waste material in waste bunkers  
                          • demonstrate the correct use of tools | • Health and Safety  
                          - Personal 
                          - First Aid 
                          - Waste disposal 
                          - Tools and equipment | • Demonstrating the correct use of tools and equipment 
                          • Simulating First Aid operations 
                          • Dumping waste in designated areas | • First Aid Kit 
                          • Safety clothing 
                          • Waste bunkers |
| 8.9.2 Sheet Metal Types     | • identify the types of sheet metal  
                          • state the properties and uses of different types of sheet metal  
                          • demonstrate the proper use of tools | • Sheet metal types  
                          - Classification 
                          - Properties 
                          - Uses 
                          - Storage of sheet metal | • Identifying the types of sheet metals 
                          • Describing the properties of different sheet metals 
                          • Stating the uses of sheet metals | • Sheet metals 
                          • ICT tools 
                          • Videos |
<table>
<thead>
<tr>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED RESOURCES</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
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<td>Learners should be able to:</td>
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<td>way of storing sheet metal</td>
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<tr>
<td>• Demonstrating proper way of storing sheet metal</td>
<td>• Tools and equipment</td>
<td>• Tools and equipment used on sheet metal</td>
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<tr>
<td>• Watching videos</td>
<td>• ICT tools</td>
<td>• Demonstrating the correct uses of tools</td>
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<th>SUGGESTED NOTES AND ACTIVITIES</th>
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<td>8.9.3 Tools and Equipment</td>
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<tr>
<td>• identify the correct types of tools used in sheet metal technology</td>
<td>• Types of Tools and equipment</td>
<td>• Types of sheet metal joints</td>
</tr>
<tr>
<td>• demonstrate the correct use of the stated tools and equipment used</td>
<td>• Parts and uses of tools</td>
<td>• Lap joint</td>
</tr>
<tr>
<td>• identify parts of the tools and equipment used</td>
<td>• Illustrating tools and equipment</td>
<td>• Circular lap joint</td>
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<td>• Illustrating tools and equipment used on sheet metal</td>
<td>• Identifying the correct types of tools and equipment</td>
<td>• Seams – folded and grooved</td>
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<tr>
<td>• Demonstrating the correct uses of tools</td>
<td>• ICT tools</td>
<td>• Application of the joints</td>
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<td>8.9.4 Sheet Metal Joints</td>
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<tr>
<td>• Design and make artefacts involving the joints</td>
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</table>
### Topic 11: Forge Technology

<table>
<thead>
<tr>
<th>Sub Topic</th>
<th>Objectives</th>
<th>Content (Attitudes, Skills and Knowledge)</th>
<th>Suggested Notes and Activities</th>
<th>Suggested Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.11.1 Health and Safety</td>
<td>• Observe health and safety rules when forging</td>
<td>• Health and Safety: - Personal - First aid - Tools and equipment</td>
<td>• Observing health and safety measures when forging</td>
<td>• First Aid Kit</td>
</tr>
<tr>
<td></td>
<td>• Perform first aid procedures in case of an accident</td>
<td>• Conducting first aid skills in case of an accident</td>
<td>• Listing safety and health measures when using tools and equipment</td>
<td>• Protective clothing</td>
</tr>
<tr>
<td></td>
<td>• Demonstrate the correct use of tools and equipment</td>
<td>• Listing safety and health measures when using tools and equipment</td>
<td></td>
<td>• ICT tools</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Demonstrating the correct use of the different tools used in forge technology</td>
<td></td>
<td>• Forge furnace</td>
</tr>
</tbody>
</table>

| 8.11.2 Tools and Equipment | • Identify different tools used in forge technology                        | • Tools and equipment - Uses of the different tools and equipment                                      | • Producing products that involve the use of the forge tools                                | • Forge tools and equipment             |
|                            | • Illustrate the uses of the given tools                                   | • Producing products that involve the use of the forge tools                                          | • Watching videos                                                                          | • Sample artefacts                      |
|                            |                                                                           | • Demonstrating the correct use of the different tools used in forge technology                          |                                                                                                | • Videos                                |

### Topic 12: Electricity and Electronics

<table>
<thead>
<tr>
<th>Sub Topic</th>
<th>Objectives</th>
<th>Content (Attitudes, Skills and Knowledge)</th>
<th>Suggested Notes and Activities</th>
<th>Suggested Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.12.1 Health and Safety</td>
<td>• Demonstrate an appreciation of health and safety rules when working with electrical circuits</td>
<td>• Health and safety skills required when working with electrical circuits - Accident prevention - First Aid procedures</td>
<td>• Identifying possible dangers when working with electrical circuits - Discussing methods of preventing accidents in electrical work - Demonstrating First Aid procedures to treat a victim of electric shock</td>
<td>• First Aid kit</td>
</tr>
<tr>
<td></td>
<td>• Explain ways of preventing accidents when working with electrical circuits</td>
<td>• Identifying possible dangers when working with electrical circuits - Discussing methods of preventing accidents in electrical work - Demonstrating First Aid procedures to treat a victim of electric shock</td>
<td></td>
<td>• ICT tools</td>
</tr>
<tr>
<td></td>
<td>• Apply First Aid skills</td>
<td>• Identifying possible dangers when working with electrical circuits - Discussing methods of preventing accidents in electrical work - Demonstrating First Aid procedures to treat a victim of electric shock</td>
<td></td>
<td>• Print media</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Identifying possible dangers when working with electrical circuits - Discussing methods of preventing accidents in electrical work - Demonstrating First Aid procedures to treat a victim of electric shock</td>
<td></td>
<td>• Resource persons</td>
</tr>
</tbody>
</table>

| 8.12.2 Plugs and Sockets   | • Identify the colour coding for the live, neutral and earth cables       | • Colour coding of cables and terminals - Wiring of plugs and sockets - Tools and equipment:          | • Discussing colour coding for the electric cables - Identifying terminals on a 3-pin plug and sockets - Wiring sockets and 3 – pin plugs of machines in the metal technology | • ICT tools                             |
| Wiring                     | • Demonstrate ability to wire three pin plugs and sockets                 | • Discussing colour coding for the electric cables - Identifying terminals on a 3-pin plug and sockets - Wiring sockets and 3 – pin plugs of machines in the metal technology |                                                                                                | • Resource persons                      |
|                            |                                                                           | • Discussing colour coding for the electric cables - Identifying terminals on a 3-pin plug and sockets - Wiring sockets and 3 – pin plugs of machines in the metal technology |                                                                                                | • 3 pin plugs                           |
|                            |                                                                           | • Discussing colour coding for the electric cables - Identifying terminals on a 3-pin plug and sockets - Wiring sockets and 3 – pin plugs of machines in the metal technology |                                                                                                | • Electrical cables and sockets         |
|                            |                                                                           | • Discussing colour coding for the electric cables - Identifying terminals on a 3-pin plug and sockets - Wiring sockets and 3 – pin plugs of machines in the metal technology |                                                                                                | • Electrical tools and equipment       |
### 8.12 TOPIC 12: ELECTRICITY AND ELECTRONICS CONTD..

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| **8.12.3 Application of Electronics**  | • examine the functions of the various components found in electronic devices  
  • design and make functional electronic devices | • Determine the uses of:  
  - Inductors  
  - Resistors  
  - Diodes and transistors in electronics  
  • Designing electronic devices | • Reconstructing electronic devices and determining the components and their uses  
  • Designing and making electronic devices | • Electronic devices  
  • ICT tools  
  • Resource persons  
  • Tools and equipment |

### 8.13 TOPIC 13: TECHNOLOGY CONCEPTS

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| **8.13.1 Structures, Mechanisms, Hydraulics and Pneumatics** | • define terms relating to mechanisms, structures, pneumatics and hydraulics  
  • illustrate the graphic symbol for the following types of motion, (reciprocating, oscillating, linear and rotary)  
  • produce articles that involve mechanisms | • Definition of key terms relating to mechanisms, structures, pneumatics and hydraulics  
  • Principles of hydraulics and pneumatics  
  • Input and output motion | • Defining key terms relating to mechanisms structures, pneumatics and hydraulics  
  • Defining input and output motion  
  • Designing and making simple artefacts with mechanisms  
  • Watching videos | • Sample artefacts  
  • ICT tools  
  • Model kits  
  • Videos |
## 8.14 Topic 14: Beaten Metal Technology

<table>
<thead>
<tr>
<th>Sub Topic</th>
<th>Objectives</th>
<th>Content</th>
<th>Suggested Notes and Activities</th>
<th>Suggested Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.14.1 Material, Equipment and Processes</td>
<td>Describe the properties of metals used in Beaten Metal Technology</td>
<td>Materials: - Aluminum - Copper - Brass - Mild steel</td>
<td>Describing the properties of materials used in beaten metal Technology</td>
<td>Sample artefacts, Print media, Tools and equipment</td>
</tr>
<tr>
<td></td>
<td>Illustrate tools and equipment used in beaten metal technology</td>
<td>Equipment: - Hammers and Mallets - Sand bags - Wooden blocks</td>
<td>Illustrating tools and equipment used in beaten metal technology</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Perform Beaten Metal Technology processes</td>
<td>Processes: - Hollowing/blocking - Sinking - Raising</td>
<td>Discussing beaten metal technology processes</td>
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<td></td>
<td></td>
<td></td>
<td>Producing artefacts using beaten metal technology processes</td>
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</tbody>
</table>

## 8.15 Topic 15: Joining Processes

<table>
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<tr>
<th>Sub Topic</th>
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<th>Content</th>
<th>Suggested Notes and Activities</th>
<th>Suggested Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.15.1 Permanent and Temporary Methods of Joining Metals</td>
<td>Identify permanent and temporary methods of joining metals</td>
<td>Types of methods - Permanent method - riveting - Temporary method - Bolts and nuts - Screws and screw and screw cutting</td>
<td>Riveting - Screwing - Using bolts and nuts - Watching videos</td>
<td>Tools and Equipment, Print media, Samples of products, Site visits, Videos</td>
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<tr>
<td></td>
<td>Perform correct riveting techniques</td>
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<td></td>
<td>Demonstrate ability to cut screw threads.</td>
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## 8.16 Topic 16: Maintenance

<table>
<thead>
<tr>
<th>Sub Topic</th>
<th>Objectives</th>
<th>Content</th>
<th>Suggested Notes and Activities</th>
<th>Suggested Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.16.1 Workshop Maintenance</td>
<td>Demonstrate proper care and storage of tools</td>
<td>Clean and healthy workshop environment</td>
<td>Storing tools properly in designated places</td>
<td>Maintenance schedules, Print media, Videos</td>
</tr>
<tr>
<td></td>
<td>Identify tools that require maintenance</td>
<td>Proper storage of tools and equipment</td>
<td>Identifying and attending to tools requiring maintenance</td>
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<td></td>
<td>Perform workshop</td>
<td>Tool care</td>
<td></td>
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</tbody>
</table>
### 8.16 TOPIC 16: MAINTENANCE

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES Learners should be able to:</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>repairing and cleaning routine</td>
<td>cleaning routine</td>
<td>• Cleaning the workshop regularly</td>
<td>Tools and equipment</td>
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<td></td>
<td></td>
<td></td>
<td>• Watching videos</td>
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</tbody>
</table>

### 8.17 TOPIC 17: MATERIAL FINISHES

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES Learners should be able to:</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.17.1 Types of Finishes and their Applications</td>
<td>• describe metal finishes</td>
<td>Metal finishes: - Oiling - Bluening - Draw filing - Purpose of finishes</td>
<td>Describing the term metal finishes Explaining the purpose of finishing artefacts Listing different types of finishes Applying different metal finishes</td>
<td>Tools and equipment Sample artefacts ICT tools</td>
</tr>
<tr>
<td></td>
<td>• explain the purpose of finishing artefacts</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>• identify different types of finishes</td>
<td></td>
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<tr>
<td></td>
<td>• apply different metal finishes</td>
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</tr>
</tbody>
</table>

### 8.18 TOPIC 18: INTRODUCTION TO COMPUTER AIDED DESIGN/COMPONENT AIDED MANUFACTURING (CAD/CAM)

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES Learners should be able to:</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.18.1 Introduction to CAD/CAM</td>
<td>• set out space page on a computer</td>
<td>Work space Paper setting Drawing commands</td>
<td>Setting out space page on a computer Setting paper size Identifying the drawing commands Using drawing commands to generate plane shapes Conducting educational tours Watching videos</td>
<td>CAD software Resource persons Educational tours Videos</td>
</tr>
<tr>
<td></td>
<td>• set paper size</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• identify the drawing commands</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>• use drawing commands to generate plane shapes</td>
<td></td>
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</tr>
</tbody>
</table>
### FORM 2

#### 8.0 COMPETENCY MATRIX

##### 8.1 TOPIC 1: HEALTH AND SAFETY

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES Learners should be able to:</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.1.1 Health and Safety | • demonstrate an understanding of personal health and safety  
• demonstrate the correct use of the First Aid skills in case of an accident  
• dispose waste material in bunkers  
• demonstrate the correct use of tools | • Health and Safety  
- Personal  
- First aid  
- Waste disposal  
- Tools | • Demonstrating the correct use of tools and machines  
• Simulating first aid operations  
• Dumping waste in designated areas | • First Aid kit  
• Safety clothing  
• ICT tools |
| 8.1.2 Basic Health and Safety Regulations | • demonstrate correct storage and handling of tools  
• demonstrate a high level of order in the workshop  
• apply knowledge of safety with gases | • Health and Safety  
- Storage and handling of tools  
- Orderliness  
- Safety with gases | • Showing proper storage and handling of tools  
• Demonstrating knowledge of safety with gases  
• Reporting disorderly conduct  
• Visiting industry | • Safety posters  
• Resource persons  
• Industrial tour  
• ICT tools |

##### 8.2 TOPIC 2: HAND TOOLS AND THEIR APPLICATIONS

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES Learners should be able to:</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.2.1 Classification and Uses | • sketch different types of hand tools  
• perform different operations using hand tools | • Classification:  
- Holding tools  
- Driving tools  
- Uses | • Drawing and labeling different types of hand tools  
• Classifying hand tools according to their uses  
• performing different operations using hand tools | • Requisite hand tools  
• Print media  
• ICT tools |
### 8.3 TOPIC 3: MATERIAL SCIENCE

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.3.1 Properties and Behavior of Commonly used Materials</td>
<td>Learners should be able to: explain different properties and behavior of commonly used materials</td>
<td>Properties of material: - mechanical - chemical - physical</td>
<td>Undertaking experiments in the workshop</td>
<td>Videos, Testing equipment, Samples of materials, ICT tools</td>
</tr>
<tr>
<td>8.3.2 Identification, Classification and Uses of Engineering Materials</td>
<td>• identify different types of materials used in the workshop • give examples of commercial products made out of different materials</td>
<td>Material composition • Appearance • Uses</td>
<td>Undertaking laboratory experiments • Performing visual inspection • Undertaking sound inspection</td>
<td>Samples of different materials, Testing equipment, Commercial products, ICT tools</td>
</tr>
<tr>
<td>8.3.3 Heat Treatment</td>
<td>• Describe various methods of heat treatment of metals</td>
<td>Heat Treatment Processes</td>
<td>Performing different heat treatment processes to attain desirable properties • Conducting educational tours</td>
<td>Heat treating furnaces, Thermocouple pyrometers, ICT tools, Educational tours</td>
</tr>
</tbody>
</table>

### 8.4 TOPIC 4: DRAWING AND DESIGN

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.4.1 Types of Projections used in Drawing</td>
<td>Learners should be able to: • draw diagrams in isometric, oblique, orthographic and perspective projections • convert 3 dimensional shapes to orthographic</td>
<td>Isometric projection • Oblique projection • Perspective projection • Orthographic projection</td>
<td>Drawing diagrams in: • Isometric projection • Oblique projection • Perspective projection • Orthographic • Converting 3 dimensional shapes into orthographic projection</td>
<td>Shaped isometric blocks, Isometric grid paper, Shaped oblique blocks, Simulations on computer, Videos</td>
</tr>
<tr>
<td>8.4.2 Design Process</td>
<td>• describe the principles of design • produce artefacts following the design process</td>
<td>Design process: • situation • Design brief • Investigation • Possible solutions</td>
<td>Identifying design principles • Conducting market research • Generating working</td>
<td>ICT tools, Industrial visits, Sample design folios, Sample prototypes, Videos</td>
</tr>
</tbody>
</table>
### 8.4 TOPIC 4: DRAWING AND DESIGN CONT'D..

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
|            | Learners should be able to: | - Development of chosen solution  
- Mock up realization  
- Working drawings  
- Prototype realization  
- Testing  
- Evaluation of prototype | drawings  
- Compiling the design folio  
- Producing the designed artefacts  
- Testing the designed artefacts for functionality  
- Watching videos | ICT tools  
- Industrial visits  
- Sample design folios  
- Sample prototypes  
- Videos |
|           | • test the designed artefacts for functionality |                                      |                              |                     |

### 8.5 TOPIC 5: ENTERPRISING EDUCATION

#### 8.5.1 Factors Affecting Small – scale business

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.5.1     | Learners should be able to: | • identify factors affecting small scale business  
• name different forms of business ownership  
• design a layout for a manufacturing workshop | • Identifying factors affecting small scale businesses  
• Discussing forms of business ownership  
• Designing a layout of a manufacturing workshop  
• Visiting small scale businesses in the community | Resource persons  
- Formal workshop floor plans  
- Actual business enterprises  
- ICT tools |
|           | • Small scale business  
• Factors affecting small scale business growth  
• Types of businesses ownership  
- Sole trader  
- Partnership  
- Franchise  
• Workshop layout for a manufacturing business | | | |
|           | • Design a layout for a manufacturing workshop | | | |
### 8.6 TOPIC 6: MACHINES AND MACHINING PROCESSES

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.6.1     | Machines and their Application | • operate machines correctly when producing practical projects | • Hand drills, parts and uses  
• Pedestal drill, parts and uses  
• Angle grinder, parts and uses  
• Pedestal grinder, parts and uses  
• Power hacksaw, parts and uses | • Operating the listed machines in executing practical activities  
• Demonstrating correct use of the machines | • Electrical equipment  
• Videos  
• Drilling machines, power saws and grinders |

### 8.7 TOPIC 7: WORKSHOP CALCULATIONS

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.7.1     | Engineering Calculations | • calculate bill of quantities  
• calculate spindle speed  
• calculate cutting speed | • Bill of Quantities  
• Spindle speed  
• Cutting speed | • Calculating bill of quantities  
• Calculating spindle speed  
• Calculating cutting speed | • Electronic calculators  
• ICT tools |

### 8.8 TOPIC 8: WELDING TECHNOLOGY

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.8.1     | Arc Welding Tools and Equipment | • observe health and safety regulations when arc welding  
• identify the equipment used in arc welding  
• demonstrate use of arc welding equipment | • Arc Welding hazards  
• Arc welding tools and equipment | • Listing equipment used in arc welding  
• Drawing and labeling arc welding tools and equipment  
• Producing artefacts using arc welding  
• Watching videos | • Arc welding tools and equipment  
• ICT tools  
• Print Media  
• Videos |
### 8.8 TOPIC 8: WELDING TECHNOLOGY CONTD..

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES Learners should be able to:</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.8.2 Arc Welding Positions</td>
<td>• discuss types of arc welding positions</td>
<td>• Arc welding positions</td>
<td>• Stating arc welding positions</td>
<td>• Arc welding equipment</td>
</tr>
<tr>
<td></td>
<td>• demonstrate arc welding positions</td>
<td>• Application of arc welding positions</td>
<td>• Applying arc welding skills when producing artefacts</td>
<td>• ICT tools</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Watching videos</td>
<td>• Protective clothing</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>• Visiting industry</td>
<td>• Site visits</td>
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<td></td>
<td></td>
<td>• Educational tours</td>
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<td>• Videos</td>
</tr>
</tbody>
</table>

### 8.9 TOPIC 9: SHEETMETAL TECHNOLOGY

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES Learners should be able to:</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.9.1 Tools and Equipment</td>
<td>• sketch sheetmetal tools and equipment</td>
<td>• Tools and equipment:</td>
<td>• Drawing and labeling of tools and equipment</td>
<td>• ICT tools</td>
</tr>
<tr>
<td></td>
<td>• demonstrate the correct use of sheet metal technology tools and equipment</td>
<td>- stakes</td>
<td>• Applying sheetmetal tools and equipment to produce artefacts</td>
<td>• Sheetmetal technology tools</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- tinsnips</td>
<td>• Industrial visits</td>
<td>• Educational Tours</td>
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<td>- hammers</td>
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<td>- mallets</td>
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<td>- folding bars</td>
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<td>- seam set</td>
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<td>- bench shears</td>
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<td></td>
<td></td>
<td>- guillotine</td>
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<tr>
<td>8.9.4 Sheetmetal Joints and Safe Edges</td>
<td>• explain the importance of safe edges in sheetmetal technology</td>
<td></td>
<td></td>
<td>• Sheetmetal</td>
</tr>
<tr>
<td></td>
<td>• make artefacts involving the stated joints and safe edges</td>
<td></td>
<td></td>
<td>• ICT tools</td>
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<td>• Sample artefacts</td>
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<td>Sheet Metal Edge Treatment</td>
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<td></td>
<td>• Safe edges:</td>
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<td></td>
<td>• Application of safe edges</td>
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</tbody>
</table>

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**Content**: Metal Technology and Design Syllabus  Forms 1 - 4

**Page**: 19

**Notes and Activities**: Stating, Applying, Watching, Visiting

**Resources**: Arc welding equipment, ICT tools, Protective clothing, Site visits, Educational tours, Videos
## 8.11 TOPIC 11: FORGE TECHNOLOGY

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.11.1 Health and Safety</td>
<td>Learners should be able to:</td>
<td>• observe health and safety rules when forging&lt;br&gt;• justify the role of health and safety when using forge tools and equipment</td>
<td>• Health and Safety: &lt;br&gt;  - personal&lt;br&gt;  - tools and equipment&lt;br&gt;• Performing forge operations in a safe working environment&lt;br&gt;• Observing health and safety when using forge tools and equipment</td>
<td>• First Aid kit&lt;br&gt;• Protective clothing&lt;br&gt;• ICT tools</td>
</tr>
<tr>
<td>8.11.2 Forge Technology Processes</td>
<td>Learners should be able to:</td>
<td>• describe different processes of forging&lt;br&gt;• produce items that involve the use of forge technology processes</td>
<td>• Forge technology processes&lt;br&gt;• Explaining forging processes&lt;br&gt;• Producing products that involve the use of various forge technology processes</td>
<td>• Forge tools and equipment&lt;br&gt;• Sample products&lt;br&gt;• ICT tools&lt;br&gt;• Educational visits</td>
</tr>
</tbody>
</table>

## 8.12 TOPIC 12: ELECTRICITY AND ELECTRONICS

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.12.1 Health and Safety</td>
<td>Learners should be able to:</td>
<td>• observe health and safety rules when working with electricity&lt;br&gt;• apply first aid procedures</td>
<td>• Accident prevention&lt;br&gt;• First Aid skills&lt;br&gt;• Explaining methods of preventing accidents when working on electric and electronic circuits&lt;br&gt;• Administering first aid to a victim of electric shock</td>
<td>• Print media&lt;br&gt;• First Aid kit&lt;br&gt;• Resource persons&lt;br&gt;• ICT tools</td>
</tr>
<tr>
<td>8.12.2 Application of Electronics</td>
<td>Learners should be able to:</td>
<td>• explain the use of components used in electronics&lt;br&gt;• design and make electronic devices to satisfy given needs</td>
<td>• Electronic components&lt;br&gt;• Production of electronic devices&lt;br&gt;• Analyzing electronic components&lt;br&gt;• Designing and making electronic devices to satisfy their own needs&lt;br&gt;• Watching videos</td>
<td>• Electronic devices&lt;br&gt;• ICT tools&lt;br&gt;• Resource persons&lt;br&gt;• Videos</td>
</tr>
</tbody>
</table>
### 8.13 TOPIC 13: TECHNOLOGY CONCEPTS

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES Learners should be able to:</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.13.1 Application of Structures, Mechanisms, Pneumatics and Hydraulics | • identify different types of levers  
• draw labelled diagrams to show three classes of levers  
• give examples of their application  
• calculate the mechanical advantage of the levers  
• demonstrate the application of hydraulics and pneumatics | • Types of levers  
• Principles of hydraulics and pneumatics  
• Application  
• Calculations | • Listing different types of levers  
• Drawing and labeling diagrams showing the three classes of levers  
• Discussing application of levers  
• Calculating the mechanical advantage of levers  
• Designing and making gadgets which combine levers, hydraulics and pneumatics  
• Industrial visits  
• Watching videos | • ICT tools  
• Educational Tours  
• Videos  
• Model kits |

### 8.14 TOPIC 14: BEATEN METAL TECHNOLOGY

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES Learners should be able to:</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.14.1 Mass Production Techniques | • state types of Beaten Metal Technology mass production techniques  
• perform beaten metal technology mass production techniques | • Types of beaten metal technology mass production techniques | • Listing beaten metal technology mass production techniques  
• Discussing uses of jigs and fixtures  
• Applying jigs and fixtures to enhance mass production  
• Watching videos  
• Visiting industries | • Tools and equipment  
• Jigs and fixtures  
• ICT tools  
• Educational tours  
• Videos |
| 8.14.2 Polishing Methods | • Polish produced artefacts using the buffing method | • Buffing | • Polishing produced artefacts using the buffing method | • ICT tools  
• Tools and equipment |
### 8.15 TOPIC 15: METAL JOINING PROCESSES

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.15.1 Permanent Methods | Learners should be able to: | • Describe the soft and hard soldering cycle  
• Illustrate the tools and equipment used in soft and hard soldering  
• Distinguish between hard and soft soldering  
• Perform soft and hard soldering | • Soft soldering  
• Hard soldering | • Illustrating tools and equipment for soldering  
• Describing soldering cycles  
• Distinguishing between hard and soft soldering  
• Performing soldering processes  
• Watching videos | • Tools and equipment  
• Print media  
• Sample artefacts  
• Videos |

### 8.16 TOPIC 16: MAINTENANCE

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.16.1 Workshop Maintenance | Learners should be able to: | • Demonstrate proper care and storage of tools  
• Identify tools that require maintenance  
• Perform workshop cleaning routine | • Clean and healthy workshop environment  
• Proper storage of tools and equipment  
• Tool care | • Storing tools properly in designated places  
• Identifying and attending to tools and equipment requiring maintenance  
• Cleaning the workshop regularly  
• Watching videos | • Workshop tools  
• ICT tools  
• Print media  
• Videos |

### 8.17 TOPIC 17: MATERIAL FINISHES

<table>
<thead>
<tr>
<th>TOPIC</th>
<th>OBJECTIVES</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.17.1 Types of Finishes and their Applications | Learners should be able to: | • Identify types of finishes  
• Describe types of finishes  
• Apply the finishes  
• Clean the equipment after use | • Finishes:  
- painting  
- lacquering  
- blackening  
- motting  
- plasticizing | • Identifying and describing types of finishes  
• Stating the uses of the finishes  
• Applying the finishes  
• Watching videos | • Samples artefacts  
• Tools and equipment for finishing  
• ICT tools  
• Videos  
• Educational tours |
### 8.17 TOPIC 17: MATERIAL FINISHES CONT'D.

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES Learners should be able to:</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Tools and equipment</td>
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</tr>
</tbody>
</table>

### 8.18 TOPIC 18: INTRODUCTION TO COMPUTER AIDED DESIGN AND MANUFACTURING (CAD/CAM)

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES Learners should be able to:</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.18.1 Drawing Tools | • identify CAD drawing tools  
• use CAD drawing tools to generate plane shapes | • Drawing tools | • Identifying the CAD drawing tools  
• Using CAD drawing tools to generate shapes  
• Watching videos  
• Conducting educational tours. | • ICT tools  
• CAD/CAM software  
• Resource persons  
• Videos  
• Educational tours |
| 8.18.2 Layers    | • use different line weights in CAD  
• use different line colours in CAD | • Layers  
• Line weight  
• Line colour | • Using different line weights in CAD  
• Using different line colours | • ICT tools  
• CAD software  
• Resources persons |
### FORM 3

#### 8.0 COMPETENCY MATRIX

**8.1 TOPIC 1: HEALTH AND SAFETY**

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES Learners should be able to:</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.1.1 Health and Safety when using machines and chemicals | - state safety rules when using machines  
- apply knowledge of safety when using machines  
- demonstrate knowledge of handling dangerous liquids and gases | - Safe use of machines:  
  - lathe  
  - milling  
  - grinder  
  - power saw  
  - drill  
  - Handling dangerous liquids and gases | - Listing safety rules when using machines  
- Discussing safety precautions associated with the use of dangerous liquids and gases | - Print Media  
- Machines |

#### 8.2 TOPIC 2: HAND TOOLS AND THEIR APPLICATIONS

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES Learners should be able to:</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.2.1 Grinding Machines | - list the different types of grinders  
- explain the functions of the different types of grinders and hand drilling machines  
- demonstrate the use of grinders | - Application of grinders  
  - application | - Stating different types of grinders  
- Operating the different types of grinding machines  
- Polishing the surface of finished artefacts | - Grinders  
- ICT tools  
- Videos  
- Samples of polished artefacts |
### 8.3 TOPIC 3: MATERIAL SCIENCE

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.3.1 Types of Non Metallic Materials commonly used in workshop | • name the different types of materials commonly used in workshops  
• demonstrate the use of non-metallic materials | • Wood  
• Leather  
• Fabric  
• Resin  
• Ceramics  
• Plastics  
• Rubber | • Collecting samples of different products made from different materials  
• Using different types of non-metallic materials to make artifacts  
• Conducting educational tours. | • Commercial products  
• ICT tools |
| 8.3.2 Types of Plastics | • state two main groups of plastics  
• explain the basic differences between the two groups of plastics | • Thermosetting plastics  
• Thermoplastics | • Undertaking experiments in the workshop to identify different working properties of plastics  
• Undertaking educational tours | • Testing equipment  
• ICT tools  
• Educational tours |

### 8.4 TOPIC 4: DRAWING AND DESIGN

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.4.1 Engineering Drawing | • assemble given components  
• section correctly given views  
• draw orthographic views of given elevations  
• convert isometric views into orthographic projections | • Assembly drawing  
• Sectioning  
• Orthographic projection:  
- 1<sup>st</sup> angle projection  
- 3<sup>rd</sup> angle projection | • Assembling given components  
• Sectioning correctly the given elevations  
• Drawing of orthographic elevations  
• Watching Videos | • Sectioned machine components  
• Videos |
| 8.4.2 Design Process | • apply the design process to solve practical problems  
• compile design folios | • Design process stages:  
- situation  
- design brief  
- market research | • Making of models and prototypes  
• Testing models or mock ups | • Videos  
• Resource persons  
• ICT tools |
### 8.4 TOPIC 4: DRAWING AND DESIGN CONT'D.

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
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<td></td>
<td>Learners should be able to:</td>
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<tr>
<td></td>
<td>• produce designed artefacts</td>
<td>- possible solutions</td>
<td>• Visiting local exhibition fairs</td>
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<tr>
<td></td>
<td>• test the designed artefacts for functionality</td>
<td>- development of possible solutions</td>
<td>• Participating in exhibitions</td>
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<td></td>
<td></td>
<td>- mock up evaluation</td>
<td>• Watching videos</td>
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<tr>
<td></td>
<td></td>
<td>- working drawing</td>
<td>• Compiling design folios</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- prototype realization</td>
<td>• Producing the designed artefacts</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>- testing and evaluation</td>
<td>• Testing artefacts for functionality</td>
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</tbody>
</table>

### 8.5 TOPIC 5: ENTERPRISING EDUCATION

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
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<td>Learners should be able to:</td>
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<td></td>
<td>• explain the importance of observing business ethics</td>
<td>• Ethical issues</td>
<td>• Explaining the importance of observing business ethics</td>
<td>Resource reasons</td>
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<tr>
<td></td>
<td></td>
<td>- Customer care</td>
<td>• Discussing ethical issues to be observed in business</td>
<td>ICT tools</td>
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<tr>
<td></td>
<td></td>
<td>- Product quality</td>
<td>• Visiting local business enterprises</td>
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<td>- Pricing</td>
<td>• Watching videos</td>
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<tr>
<td></td>
<td></td>
<td>- Environmental issues</td>
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<tr>
<td>8.5.1</td>
<td>Business Ethics</td>
<td></td>
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<tr>
<td>8.5.2</td>
<td>Marketing Strategies</td>
<td>• Use of:</td>
<td>• Defining marketing techniques/strategies</td>
<td>Resource persons</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- flyers</td>
<td>• Discussing the importance of marketing techniques/strategies</td>
<td>ICT tools</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- bill boards</td>
<td>• Watching videos</td>
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<td>- posters</td>
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<td>• Value addition</td>
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<td></td>
<td>• Role of marketing</td>
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<td></td>
<td>• Labels and packaging</td>
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</tbody>
</table>

- Sample of competitive products
- ICT tools
- Standards Association of Zimbabwe (SAZ)
- Videos
### 8.5 TOPIC 5: ENTERPRISING EDUCATION CONTD..

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.5.3 Quality Control   | Learners should be able to:             | • explain the importance of quality control in a small scale business | • Explaining the importance of quality control in business  
• Discussing the advantages of quality control  
• Watching videos  
• Educational tours | • Sample of competitive products  
• ICT tools  
• Standards Association of Zimbabwe (SAZ)  
• Videos |

### 8.6 TOPIC 6: MACHINES AND MACHINING PROCESSES

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.6.1 Health and Safety | Learners should be able to:             | • observe health and safety regulations when operating machines in the workshop  
• dispose of waste material correctly to avoid environmental damage  
• Health and safety regulations related to machines  
• Appropriate protective attire  
• Waste material disposal  
• Scrap bins for keeping metal off-cuts  
• Observing safety regulations while operating machines  
• Wearing of protective clothing while operating machines  
• Disposing waste material correctly into the designated places or containers  
• Visiting local manufacturing industries  
• Watching videos | • Protective clothing and equipment  
• Safety posters  
• Machinery  
• Educational Tours  
• Videos |
| 8.6.2 Machines and their Applications | Learners should be able to: | • Perform the following:  
- lathe operations  
- milling operations  
• Lathe machine, parts and uses  
• Milling machine, parts and uses  
• Undertaking milling and lathe operations  
• Visiting industries  
• Watching videos | • Lathe and milling machines  
• Videos  
• Educational tours |
### 8.6 TOPIC 6: MACHINES AND MACHINING PROCESSES CONT'D.

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.6.3 Care and Maintenance of Machine tools</td>
<td>Learners should be able to:</td>
<td>• lubricate machines regularly&lt;br&gt;• clean machines after using them&lt;br&gt;• Regular maintenance of machinery in the workshop&lt;br&gt;• Cleaning and oiling of machines</td>
<td>• Lubricating machines regularly&lt;br&gt;• Cleaning machines after use</td>
<td>• Lubricants, equipment and cleaning materials</td>
</tr>
<tr>
<td>8.6.4 Precision Measuring Instruments</td>
<td>• measure accurately using a micrometer&lt;br&gt;• measure accurately using vernier calipers&lt;br&gt;• mark out correctly using a vernier height gauge</td>
<td>• Micrometers, parts and uses&lt;br&gt;• Vernier calipers, parts and uses&lt;br&gt;• Vernier height gauges, parts and uses</td>
<td>• Measuring using a micrometer&lt;br&gt;• Measuring using a vernier caliper&lt;br&gt;• Marking out heights correctly&lt;br&gt;• Visiting industries</td>
<td>• Vernier calipers&lt;br&gt;• Vernier height gauge&lt;br&gt;• Micrometers&lt;br&gt;• Videos&lt;br&gt;• Educational Tours</td>
</tr>
</tbody>
</table>

### 8.7 TOPIC 7: WORKSHOP CALCULATIONS

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.7.1 Engineering Calculations</td>
<td>Learners should be able to:</td>
<td>• calculate mechanical advantage&lt;br&gt;• calculate velocity ratio&lt;br&gt;• calculate efficiency&lt;br&gt;• convert mass into weight&lt;br&gt;• calculate density&lt;br&gt;• calculate volume&lt;br&gt;• Mechanical advantage&lt;br&gt;• Velocity ratio&lt;br&gt;• Efficiency&lt;br&gt;• Weight&lt;br&gt;• Mass&lt;br&gt;• Density&lt;br&gt;• Volume</td>
<td>• Calculating mechanical advantage&lt;br&gt;• Calculating velocity ratio&lt;br&gt;• Calculating efficiency&lt;br&gt;• Converting mass into weight&lt;br&gt;• Calculating density and volume</td>
<td>• Electronic calculators&lt;br&gt;• ICT tools</td>
</tr>
</tbody>
</table>
### 8.8 TOPIC 8: WELDING TECHNOLOGY

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES Learners should be able to:</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.8.1 Welding Techniques | • observe health and safety regulations when welding  
• analyze the different types of welding techniques  
• interpret welding symbols  
• perform the different types of welding techniques  
• identify welding defects and possible remedies | • Health and Safety  
• Techniques:  
  - Arc welding  
  - Gas welding  
• Welding symbols (Blue print reading)  
• Application  
• Welding faults | • Demonstrating health and safety regulations when welding  
• Explaining the different types of welding symbols  
• Applying welding techniques to assemble component parts  
• Identifying welding defects and suggesting solutions  
• Industrial visits  
• Watching videos | • Welding equipment  
• Protective clothing  
• ICT tools  
• Educational tour  
• Resource persons  
• Videos |

### 8.9 TOPIC 9: SHEETMETAL TECHNOLOGY

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES Learners should be able to:</th>
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<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.9.1 Health and Safety | • explain the importance of personal health and safety  
• demonstrate the correct use of the first aid skills in case of an accident  
• explain the purpose of designated dumping sites | • Health and Safety:  
  - personal  
  - First Aid  
  - Tools and equipment  
  - Waste disposal | • Identifying causes of accidents when working with sheet metal  
• Demonstrating the correct use of First Aid kit  
• Dumping waste in designated areas | • First Aid kit  
• Resource persons  
• ICT tools  
• Print media |
| 8.9.2 Surface Developments | • calculate the surface areas of prisms and cylinders  
• draw parallel developments of prisms and cylinders | • Surface development:  
  - Parallel line development of cylinders and prisms  
  - Calculating surface areas of cylinders and prisms | • Drawing of surface developments  
• Producing artefacts from surface developments templates | • Drawing equipment  
• Sheet metal  
• Tools and equipment |
## 8.10 TOPIC 10: FOUNDRY TECHNOLOGY

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES Learners should be able to:</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.10.1 Health and Safety  | - demonstrate the importance of personal health and safety in foundry  
- use first aid kit effectively in case of an accident  
- demonstrate safe ways of operating the foundry tools and equipment                                                                                                            | - Health and safety:  
  - personal safety  
  - first aid  
  - Foundry tools and equipment                                                                                                                                  | - Practising personal health and safety when undertaking foundry work  
  - Demonstrating the correct use of First Aid kit  
  - Watching videos                                                                                                                                                    | - First Aid kit  
  - Health and safety clothing  
  - Foundry tools and equipment  
  - ICT tools  
  - Videos                                                                                                                                                    |
| 8.10.2 Tools and Equipment| - identify the different tools used in Foundry Technology  
- show the correct uses of the identified tools                                                                                                                                                                                      | - Tools and equipment and their uses                                                                                                                       | - Drawing of the different tools used in foundry  
  - Demonstrating the correct uses of tools when moulding.                                                                                                           | - Tools  
  - Moulding sand  
  - Safety clothing  
  - ICT tools                                                                                                                                                    |
| 8.10.3 Foundry Processes  | - design patterns for different artefacts  
- identify the properties of moulding sand  
- follow steps involved in casting                                                                                                                                                                                                     | - Foundry steps  
  - pattern making  
  - core making  
  - mould making  
  - metal pouring  
  - inspection                                                                                                                                  | - Designing patterns of different shapes  
  - Stating the properties of moulding sand  
  - Following steps in casting  
  - Industrial visits  
  - Watching videos                                                                                                                                           | - Moulding sand  
  - Tools  
  - ICT tools  
  - Sample patterns and moulds  
  - Educational tours                                                                                                                                         |

## 8.11 TOPIC 11: FORGE TECHNOLOGY

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES Learners should be able to:</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.11.1 Health and Safety  | - demonstrate an appreciation of health and safety when dealing with hot metals  
- wear protective clothing when forging  
- respond immediately to any accidents in the forge room                                                                                                                | - Health and safety considerations  
  - Tools and equipment                                                                                                                                             | - Executing health and safety drills  
  - Wearing protective clothing  
  - Responding immediately to accidents  
  - Watching videos                                                                                                                                                | - First Aid Kit  
  - ICT tools  
  - Videos                                                                                                                                                    |
### 8.11 TOPIC 11: FORGE TECHNOLOGY CONTD..

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
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<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.11.2 Application of Forge Technology Operations</td>
<td>• apply knowledge of the forging processes to produce different products</td>
<td>• Application of forge technology operations</td>
<td>• Producing products that involve different forge processes • Incorporating forge processes in the realization of their designs • Watching videos</td>
<td>• Forge technology tools and equipment • ICT tools • Artefacts • Videos</td>
</tr>
</tbody>
</table>

### 8.12 TOPIC 12: ELECTRICITY AND ELECTRONICS

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.12.1 Health and Safety</td>
<td>• observe personal health and safety • demonstrate the correct uses of first aid skills in case of an accident • select appropriate firefighting equipment to deal with electrical fires</td>
<td>• Personal health and safety • First aid procedures • Electric fire</td>
<td>• Simulating First Aid operations • Demonstrating safety measures when using electrical components • Selecting appropriate firefighting equipment</td>
<td>• First Aid kit • Print media • Resource persons • Fire extinguishers</td>
</tr>
<tr>
<td>8.12.2 Application of Electronics</td>
<td>• design a circuit for a gadget</td>
<td>• Application of electronics</td>
<td>• Designing an electric circuit for operating a gadget • Exhibiting designed artefacts</td>
<td>• ICT tools • Resource persons • Electronic components</td>
</tr>
</tbody>
</table>
### 8.13 TOPIC 13: TECHNOLOGY CONCEPTS

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES Learners should be able to:</th>
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<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.13.1 Application of Structures, Mechanisms, Hydraulics and Pneumatics in Design Solutions | • apply principles of moments to solve design problems by way of calculating unknown distances or weight  
• illustrate with the aid of sketches how motion can be transmitted from one parallel shaft to the other  
• describe with the aid of sketches how pulleys and belts can be used to change direction of motion and change speed | • Moments:  
- definition  
- calculations  
• Motion  
• Push and pull  
• Parallel  
• Transfer of motion:  
- pulleys  
- gears  
- sprocket and chain  
- linkages  
- crank mechanisms  
- cams | • Defining principles of moments to solve design problems  
• Sketching diagrams which show how motion can be transmitted  
• Illustrating with diagrams how pulleys and belts can be used to change direction of motion and change speed  
• Watching videos | • ICT tools  
• Print media  
• Videos  
• Model kits |

### 8.14 TOPIC 14: BEATEN METAL TECHNOLOGY

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES Learners should be able to:</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.14.1 Mass Production Techniques | • design jigs and fixtures used for mass production  
• demonstrate the role of jigs, fixtures and spinning lathe in production | • Jigs and fixtures  
• Spinning lathe | • Designing jigs and fixtures  
• Visiting industries  
• Discussing the role of jigs, fixtures and spinning lathe in production | • Relevant tools and equipment  
• Jigs and fixtures  
• ICT tools  
• Educational tours |
### 8.14 TOPIC 14: BEATEN METAL TECHNOLOGY CONTD..

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES Learners should be able to:</th>
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<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.14.2 Polishing Methods</td>
<td>• produce high quality finishes on beaten metal technology artefacts</td>
<td>• Beaten metal technology finishes</td>
<td>• Listing processes used to finish Beaten Metal Technology artefacts</td>
<td>• Equipment and material</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Polishing completed</td>
<td>• Sample artefacts</td>
</tr>
</tbody>
</table>

### 8.15 TOPIC 15: METAL JOINING PROCESSES

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES Learners should be able to:</th>
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<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.15.1 Application of Screw Threads | • Illustrate different forms of screw threads.  
• explain the uses of different forms of screw threads  
• cut different forms of screw threads | • Forms of threads  
• Uses of different forms of screw threads  
• Cutting various forms of screw threads | • illustrating different forms of screw threads  
• explaining the uses of different forms of screw threads  
• cutting different forms of screw threads  
• watching videos | • Tools and equipment  
• Samples of tread forms  
• Videos  
• Print media |
|                           |                                                                                                         |                                                                                                           |                                                                                                 |                                            |
| 8.15.2 Application of Temporary Methods | • sketch locking devices  
• state the functions of different locking devices  
• demonstrate the use of various locking devices | • Locking devices:  
- Washers  
- Locking pins  
- Locking nuts  
- Key and keyways | • Illustrating the use of locking devices  
• Selecting appropriate locking devices for particular joints | • Sample locking devices  
• ICT tools |
### 8.16 TOPIC 16: MAINTENANCE

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES Learners should be able to:</th>
<th>CONTENT  (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.16.1 Workshop Management | • describe principles of workshop management  
• list factors influencing workshop management   | • Principles of workshop management  
• Factors affecting workshop management      | • Listing principles of workshop management  
• Stating factors that influence workshop management  
• Watching videos  
• Researching on effective workshop management  
• Conducting educational tours  
• Watching videos | • ICT tools  
• Resource persons  
• Industrial visits  
• Educational tours  
• Videos |

### 8.17 TOPIC 17: MATERIAL FINISHES

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES Learners should be able to:</th>
<th>CONTENT  (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.18.1 Metal Finishes | • prepare surfaces using machines  
• polish surfaces using machines   | • Preparation and polishing of surfaces using machines | • Preparing surfaces for finishing using machines  
• Polishing prepared surfaces  
• Watching videos | • ICT tools  
• Videos  
• Tools and equipment |

### 8.18 TOPIC 18: INTRODUCTION TO COMPUTER AIDED DESIGN AND MANUFACTURING

<table>
<thead>
<tr>
<th>KEY CONCEPT</th>
<th>OBJECTIVES Learners should be able to:</th>
<th>CONTENT  (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.18.1 Drawing Commands | • generate 2D diagrams using drawing commands  
• manufacture artefacts   | • Drawing commands  
• Manufacture of designed components      | • Generating diagrams using drawing commands  
• Manufacturing artefacts  
• Watching videos | • ICT tools  
• CAD/CAM software  
• Resource persons  
• Videos |
### FORM 4

#### 8.0 COMPETENCY MATRIX

**8.1 TOPIC 1: HEALTH AND SAFETY**

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES</th>
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<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.2.1 Occupational Health and Safety Act</td>
<td>Learners should be able to:</td>
<td>outline the rules and regulations in the Act governing Health and Safety</td>
<td>Acts governing health and safety</td>
<td>Identifying rules and regulations in the Act governing Health and Safety</td>
</tr>
</tbody>
</table>

**8.2 TOPIC 2: MATERIAL SCIENCE**

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
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<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.2.1 Properties of Non Metallic Materials</td>
<td>Learners should be able to:</td>
<td>describe various properties of non-metallic materials used in the workshop</td>
<td>Properties of non-metallic materials: - mechanical - electrical - physical - chemical</td>
<td>Undertaking workshop experiments to determine working properties, Watching videos</td>
</tr>
<tr>
<td>8.2.2 Types of Alloys and Alloyning Elements</td>
<td>Learners should be able to:</td>
<td>identify different types of alloys commonly used in the workshop</td>
<td>Types of Alloys - Ferrous and Non Ferrous - brass - steel - bronze - duralumin - gunmetal - soft solder</td>
<td>Collecting different samples of alloys, Conducting experiments in the workshop, Conducting educational tours</td>
</tr>
</tbody>
</table>
### 8.2 TOPIC 2: MATERIAL SCIENCE

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
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<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.2.2 Types of Alloys and</td>
<td>Learners should be able to:</td>
<td>- soft solder</td>
<td>• Collecting different samples of alloys</td>
<td>• Samples of commercial products</td>
</tr>
<tr>
<td>Alloying Elements</td>
<td>• explain how metals are protected from corrosion</td>
<td>- silver solder</td>
<td>• Conducting experiments in the workshop</td>
<td>• Educational tours</td>
</tr>
<tr>
<td></td>
<td>• explain conditions that cause metals to corrode</td>
<td>- gilding metal</td>
<td>• Conducting educational tours</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• pewter</td>
<td>• Corrosion</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Corrosion</td>
<td>• Methods of metal protection against corrosion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.2.3 Protection of Metals</td>
<td>• explain how metals are protected from corrosion</td>
<td>• Conducting experiments using various metals</td>
<td>• Videos</td>
<td></td>
</tr>
<tr>
<td>against Corrosion</td>
<td>• explain conditions that cause metals to corrode</td>
<td>• Visiting industries involved in processes of protecting metal surfaces</td>
<td>• Existing structures which are corroding</td>
<td></td>
</tr>
</tbody>
</table>

### 8.3 TOPIC 3: DRAWING AND DESIGN

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
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<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.3.1 Application of Engineering Drawing</td>
<td>Learners should be able to:</td>
<td>• Generation of working drawings</td>
<td>• Generating standard working drawings</td>
<td>• Drafting equipment</td>
</tr>
<tr>
<td></td>
<td>• produce standard working drawings</td>
<td>• Calculation of materials</td>
<td>• Calculating the Bill of Quantities</td>
<td>• ICT tools</td>
</tr>
<tr>
<td></td>
<td>• calculate the quantities of materials using given working drawings</td>
<td>• Generation of possible solutions to a practical problem</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.3.2 Design Process</td>
<td>• apply the design process to solve practical problems</td>
<td>• Design process stages:</td>
<td>• Making of models and prototypes</td>
<td>• Videos</td>
</tr>
<tr>
<td></td>
<td>• compile design folios</td>
<td>- Situation</td>
<td>• Testing models or mock ups</td>
<td>• Resource persons</td>
</tr>
<tr>
<td></td>
<td>• produce designed artefacts</td>
<td>- Design brief</td>
<td></td>
<td>• ICT tools</td>
</tr>
<tr>
<td></td>
<td>• Situation</td>
<td>- Market research</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Design brief</td>
<td>- Possible solutions</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Market research</td>
<td>• Making of models and prototypes</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Possible solutions</td>
<td>• Testing models or mock ups</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 8.3 TOPIC 3: DRAWING AND DESIGN CONT'D.

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
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<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.3.2 Design Process          | • apply the design process to solve practical problems  
• compile design folios  
• produce designed artefacts  
• test the designed artefacts for functionality | - Mock up evaluation  
- Working drawing  
- Prototype realization  
- Testing and evaluation | • Visiting local exhibition fairs  
• Watching videos  
• Compiling design folios  
• Producing the designed artefacts  
• Testing artefacts for functionality |  |
| 8.3.3 Computer Aided Design   | • set out space page on a computer  
• set paper size  
• identify the drawing commands  
• use of drawing commands to generate shapes | - Space page  
- Paper setting  
- Drawing commands | • Setting out space page on a computer  
• Setting paper size  
• Identifying the drawing commands  
• Using drawing commands to draw shapes  
• Visiting local exhibition fairs | • Computers and CAD software  
• Resource persons  
• Videos |
| 8.3.4 Intellectual Property Rights | • patent design innovations  
• describe processes of registering patents | • Patent registration process  
• Management of patent rights | • Visiting patent offices  
• Inviting resource persons | • Resource persons  
• Patent Act  
• Trade Mark Act  
• Copyright and Neighbouring Rights Act |
## 8.4 TOPIC 4: ENTERPRISING EDUCATION

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
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<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.4.1 Bookkeeping and Accounting | Learners should be able to: | • explain the importance of record keeping in a business enterprise  
• explain the role of accounting in business | • Record keeping  
• Importance of effective bookkeeping and accounting | • Collecting different types of records used in accounting  
• Explaining importance of effective accounting  
• Generating accounting records | • Resource persons  
• Videos  
• Practicing business persons |
| 8.4.2 Risk Management in an Enterprise | | • describe the process of risk management  
• explain methods of minimizing risk in a business | • Process of risk management  
• Customer risk  
• Personnel risk | • Discussing process of risk management  
• Explaining methods of minimizing risk in business  
• Discussing case studies on risk | • Resource persons  
• Videos |
| 8.4.3 Setting up a Business Enterprise | | • describe the process of setting up a successful small scale business enterprise | • Generation of a business proposal | • Describing process of setting up a small business  
• Writing of a business proposal as a practical assignment  
• Visiting local industries | • Resource persons  
• Educational Tours |

## 8.5 TOPIC 5: MACHINES AND MACHINING PROCESSES

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
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<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
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<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.5.1 Health and Safety | Learners should be able to: | • observe all safety regulations when operating machines in the workshop | • Health and safety regulations related to machines | • Visiting local industries  
(formal and informal) | • ICT tools  
• Educational tours |
### 8.5 TOPIC 5: MACHINES AND MACHINING PROCESSES CONTD..

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES Learners should be able to:</th>
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<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.5.2 Machines and their Applications | • machine designed components of prototypes on the milling and lathe machine  
• perform basic principles of programming Computer Numerical Controlled (CNC) machines | • Machining processes on the lathe  
• Machining processes on the milling machine  
• Introduction to CNC lathe and milling machines | • Machining processes on the lathe and milling machine while working on prototypes  
• Visiting industries, and institutions of technology in the country  
• Programming (basic principles) | • Resource persons  
• Lathe machines  
• Milling machine  
• Computer Numerical Controlled machines (CNC)  
• Videos  
• Educational tours |
| 8.5.3 Mass Production Systems | • design simple jigs and fixtures  
• use jigs and fixtures in production  
• discuss the role of automation in production | • Jigs and fixtures  
• Automation | • Designing jigs and fixtures  
• Applying jigs and fixtures in production  
• Discussing the role of automation in production  
• Visiting local industries | • Resource persons  
• Jigs and fixtures  
• Videos  
• Educational tours |

### 8.6 TOPIC 6: WORKSHOP CALCULATIONS

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES Learners should be able to:</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.6.1 Engineering Calculations | • define friction  
• state laws of friction  
• explain methods of minimizing friction  
• calculate frictional forces  
• determine tolerances for different fits  
• determine tool taper angle | • Friction  
• Laws of friction  
• Methods of minimizing friction  
• Calculating frictional force  
• Limits and fits  
• Taper ratio | • Defining friction  
• Stating laws of friction  
• Explaining methods of minimizing friction  
• Calculating frictional forces  
• Calculating taper turning ratio  
• Machining to given tolerances | • Calculators  
• Tolerance charts |
### 8.6 TOPIC 6: WORKSHOP CALCULATIONS CONTD..

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
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</thead>
</table>
| 8.5.3 Mass Production Systems | • design simple jigs and fixtures  
• use jigs and fixtures in production  
• discuss the role of automation in production | • Jigs and fixtures  
• Automation | • Designing jigs and fixtures  
• Applying jigs and fixtures in production  
• Discussing the role of automation in production  
• Visiting local industries | • Resource persons  
• Jigs and fixtures  
• Videos  
• Educational tours |

### 8.7 TOPIC 7: WELDING TECHNOLOGY

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.7.1 Welding Hazards | • state hazards associated with welding  
• differentiate between back fire and flash back | • Health and safety  
• Back fire and flash back | • Demonstrating knowledge of safety rules associated with welding  
• Distinguishing between back fire and flash back | • ICT tools  
• Welding equipment  
• Protective attire and equipment |
| 8.7.2 Welding Processes | • explain different types of welding processes  
• perform the different types of welding techniques  
• display ability to perform spot welding  
• perform gas cutting operations | • Types:  
- Tungsten Inert Gas welding (TIG)  
- Metal Inert Gas Welding (MIG)  
- Carbon Arc Welding (CAW)  
- Spot welding  
• Gas cutting | • Explaining the different welding techniques  
• Executing the different techniques  
• Conducting educational tours  
• Demonstrating spot welding  
• Performing gas cutting operations  
• Watching videos | • ICT tools  
• Educational tours  
• Resource persons  
• Welding equipment |
### 8.8  TOPIC 8: SHEETMETAL TECHNOLOGY

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.8.1 Health and Safety | Learners should be able to:                     | • explain the importance of personal health and safety  
                                 |                                                 | • Health and Safety	  
                                 |                                                 | - personal  
                                 |                                                 | - First Aid  
                                 |                                                 | - tools and equipment  
                                 |                                                 | • Waste disposal:  
                                 |                                                 | - Classification of waste  
                                 |                                                 | • Identifying causes of accidents when working with sheet metal  
                                 |                                                 | • Demonstrating the correct use of First Aid kit  
                                 |                                                 | • Dumping waste in designated areas  
                                 |                                                 | • First Aid kit  
                                 |                                                 | • ICT tools  
                                 |                                                 | • Print media  
| 8.8.2 Surface Developments | • calculate the surface areas of:  
                                 |                                                 | • Radial development of:  
                                 |                                                 | - right cones  
                                 |                                                 | - truncated cones  
                                 |                                                 | • Calculating surface areas  
                                 |                                                 | • Drawing of radial line surface developments  
                                 |                                                 | • Producing artefacts out of the radial line developments  
                                 |                                                 | • Drawing equipment  
                                 |                                                 | • Sheet metal  
                                 |                                                 | • Tools and equipment  
                                 |                                                 | • ICT tools  
|                         | - right cones  
                                 |                                                 | • Produce equipment  
                                 |                         | - truncated cones  
                                 |                                                 | • ICT tools  
                                 |                         | • Print media  
|                         | - draw radial developments of right cones and truncated cones  
                                 |                                                 | • ICT tools  

### 8.10  TOPIC 1; FOUNDRY TECHNOLOGY

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.10.1 Basic Foundry Processes and Applications | Learners should be able to:                     | • cast simple artefacts  
                                 |                                                 | • Foundry processes and applications  
                                 |                                                 | • Cast different artefacts from given patterns  
                                 |                                                 | • Fettling  
                                 |                                                 | • Producing simple artefacts through casting  
                                 |                                                 | • Performing finishing touch to castings  
                                 |                                                 | • Conducting educational tours  
                                 |                                                 | • Tools  
                                 |                                                 | • Sand  
                                 |                                                 | • Videos  
                                 |                                                 | • Site visits  
                                 |                                                 | • Educational tours  
                                 |                                                 | • ICT tools  
                                 |                                                 | • Print media  

### 8.11 TOPIC 11: FORGE TECHNOLOGY

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES Learners should be able to:</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.11.1 Health and Safety</td>
<td>• display an appreciation of health and safety rules when forging</td>
<td>• Personal health and safety:</td>
<td>• Identifying causes of accidents in forge technology</td>
<td>• First Aid kit&lt;br&gt;• Fire extinguisher&lt;br&gt;• ICT tools</td>
</tr>
<tr>
<td></td>
<td>• explain methods of accident prevention in forge technology</td>
<td>• Tools and equipment&lt;br&gt;• Accident prevention&lt;br&gt;• First aid procedures</td>
<td>• Discussing accidents which may occur during use of forge technology tools and equipment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• outline procedures to be taken for attending to an accident victim</td>
<td></td>
<td>• Simulating an accident scene</td>
<td></td>
</tr>
<tr>
<td>8.11.2 Application of Forge Operations</td>
<td>• apply forging processes to produce products</td>
<td>• Application of forge operations:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Producing artefacts that include forging processes</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>• Conducting educational tours</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>• Exhibiting artefacts</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 8.13 TOPIC 13: ELECTRICITY AND ELECTRONICS

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES Learners should be able to:</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.13.1 Application of Electronics</td>
<td>• demonstrate an appreciation of the role of electronics in everyday life&lt;br&gt; • design and make electronic devices for use by the community&lt;br&gt; • market their devices&lt;br&gt; • repair basic electronic gadgets</td>
<td>• Design and make electronic devices&lt;br&gt; • Marketing the devices&lt;br&gt; • Repairing</td>
<td>• Determining the role of electronics in everyday life&lt;br&gt; • Designing and making electronic devices to meet societal needs&lt;br&gt; • Repairing electronic gadgets</td>
<td>• Tools and equipment&lt;br&gt; • Sample artefacts&lt;br&gt; • Educational Tours&lt;br&gt; • Exhibitions</td>
</tr>
</tbody>
</table>
### 8.13 TOPIC 13: ELECTRICITY AND ELECTRONICS CONTD..

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Learners should be able to:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Formulating marketing strategies for the devices</td>
<td>• Watching videos</td>
<td>• Educational tours</td>
</tr>
</tbody>
</table>

### 8.14.1 Application of Structures, Mechanisms, Hydraulics and Pneumatics in Design Solutions

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.14.1</td>
<td>Application of Structures, Mechanisms, Hydraulics and Pneumatics in Design Solutions</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Learners should be able to:</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>• define the qualities of a well-designed structure</td>
<td>• Structures and their application</td>
<td>• Discussing the qualities of a well-designed structure</td>
<td>• ICT tools</td>
</tr>
<tr>
<td>• list the main groups of structures and examples of their applications</td>
<td>• Pneumatic and hydraulics</td>
<td>• Identifying the main groups of structures and examples of application</td>
<td>• Site visits</td>
</tr>
<tr>
<td>• describe how hydraulic system works</td>
<td>• Simple actuating cylinder</td>
<td>• Explaining how a simple hydraulic system works</td>
<td>• Videos</td>
</tr>
<tr>
<td>• give examples of hydraulics application</td>
<td>• Simple hydraulic system</td>
<td>• Visiting relevant sites</td>
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<tr>
<td></td>
<td>• Calculations</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- ICT tools
- Site visits
- Videos
## 8.15 TOPIC 15: BEATEN METAL TECHNOLOGY

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES</th>
<th>CONTENT</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.15.1 Material, Equipment and Processes</td>
<td>Learners should be able to:</td>
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<tr>
<td></td>
<td>• Describe the properties of metals used in beaten metal technology</td>
<td>• Materials:</td>
<td>• Describing the properties of materials used in beaten metal technology</td>
<td>• Sample artefacts</td>
</tr>
<tr>
<td></td>
<td>• Illustrate tools and equipment used in beaten metal technology</td>
<td>- Aluminum</td>
<td>• Illustrating tools and equipment used in beaten metal technology</td>
<td>• Print media</td>
</tr>
<tr>
<td></td>
<td>• Perform beaten metal technology process</td>
<td>- Copper</td>
<td>• Discussing beaten metal technology processes</td>
<td>• Tools and equipment</td>
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<tr>
<td></td>
<td></td>
<td>- Brass</td>
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<td></td>
<td></td>
<td>- Mild steel</td>
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<td></td>
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<td></td>
<td></td>
<td>- Equipment:</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>- Hammers and mallets</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>- Sand bags</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>- Wooden blocks</td>
<td></td>
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<td></td>
<td></td>
<td>- Processes</td>
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<td></td>
<td>- Hollowing/blocking</td>
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<td>- Sinking</td>
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<td></td>
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<td>- Raising</td>
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</tbody>
</table>

## 8.16 TOPIC 16: METAL JOINING PROCESSES

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES</th>
<th>CONTENT</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.16.1 Permanent and Temporary Methods of joining Metals</td>
<td>Learners should be able to:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Identify permanent and temporary methods of joining methods</td>
<td>• Types of methods:</td>
<td>• Riveting</td>
<td>• Tools and equipment</td>
</tr>
<tr>
<td></td>
<td>• Perform correct riveting techniques</td>
<td>- Permanent method</td>
<td>• Screwing</td>
<td>• Print media</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Riveting</td>
<td>• Using bolts and nuts</td>
<td>• Samples of products</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Temporary method</td>
<td>• Watching videos</td>
<td>• Site visits</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Videos</td>
</tr>
</tbody>
</table>
### 8.17 TOPIC 17: MAINTENANCE

<table>
<thead>
<tr>
<th>SUB TOPIC</th>
<th>OBJECTIVES</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.17.1 Workshop Management | Learners should be able to: | • demonstrate good workshop management  
• demonstrate ability to control workshop operations | • Good workshop practice and management  
• Practicing good workshop management  
• Educational tour | • Resource persons  
• ICT tools  
• Educational tour |

### 8.18 TOPIC 18: MATERIAL FINISHES

<table>
<thead>
<tr>
<th>TOPIC</th>
<th>OBJECTIVES</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.18 Material Finishes | Learners should be able to: | • describe industrial finishing processes  
• demonstrate simple electro plating experiment  
• carryout the fluidizing process | • Industrial finishes:  
• Galvanizing  
• Electroplating  
• Fluidizing  
• Terne plating  
• Tin plating  
• Anodizing  
• Nickel plating  
• Chrome plating | • Describing finishing processes  
• Conducting simple electro plating and fluidizing on finished products  
• Conducting educational tours  
• Watching videos | • ICT tools  
• Print media  
• Resource persons  
• Educational tours  
• Videos |

### 8.19 TOPIC 19: COMPUTER AIDED DESIGN AND MANUFACTURING

<table>
<thead>
<tr>
<th>TOPIC</th>
<th>OBJECTIVES</th>
<th>CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)</th>
<th>SUGGESTED NOTES AND ACTIVITIES</th>
<th>SUGGESTED RESOURCES</th>
</tr>
</thead>
</table>
| 8.19.1 3D Forms | Learners should be able to: | • draw 3D diagrams using drawing commands and tools  
• identify other 3D software  
• manufacture artefacts | • 3D forms  
• Other 3D software  
• Manufacture of designed components | • Drawing 3D diagrams using drawing commands and tools  
• Identifying and using other 3D software  
• Watching videos  
• Conducting educational tours | • ICT tools  
• CAD/CAM software  
• Resource persons  
• Videos  
• Educational tours |
## 9.4 SPECIFICATION GRID

<table>
<thead>
<tr>
<th>ASSESSMENT OBJECTIVES</th>
<th>PAPER 1 Theory/Drawing</th>
<th>PAPER 2 Practical</th>
<th>PAPER 3 – Continuous Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.10.1</td>
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<td>8.10.2</td>
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<td>8.10.3</td>
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<td>8.10.6</td>
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<td>8.10.12</td>
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<td>8.10.14</td>
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<td>8.10.15</td>
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<tr>
<td>Weighting</td>
<td>30%</td>
<td>30%</td>
<td>40%</td>
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### Objectives/Components

<table>
<thead>
<tr>
<th></th>
<th>Paper 1</th>
<th>Paper 2</th>
<th>Paper 3 Continuous Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge with understanding</td>
<td>50</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Practical skills and their application</td>
<td>20</td>
<td>50</td>
<td>30</td>
</tr>
<tr>
<td>Decision making and judgement</td>
<td>30</td>
<td>30</td>
<td>50</td>
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<tr>
<td>Total</td>
<td>100%</td>
<td>100%</td>
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</tr>
</tbody>
</table>

## 9.0 METAL TECHNOLOGY AND DESIGN

Forms 1-4 Metal Technology and Design will be assessed through continuous and summative assessment methods. The syllabus scheme of assessment is based on the principle of inclusivity. Arrangements and learning conditions as well as appropriate modification must be transparent in both continuous and summative assessments methods to allow access and receipt of accurate performance measurement of abilities by candidates with special needs.

Learners will be required to write one timed practical test per term which should be recorded as continuous assessment marks in March, July and November. The subject teacher will set, mark and record the practical test marks using a marking guide provided by ZIMSEC. ZIMSEC will also provide a template for the assessment of soft skills. Teachers will be required to provide a file for each learner where each of the test items and marked scripts will be kept. In addition, teachers will also be required to create a file where test question papers and marking guides for each test administered as well as recorded marks will be kept. ZIMSEC will monitor the process.

At the end of each school term, school heads will submit continuous assessment marks for all their learners to
ZIMSEC for data capture update. Candidates will also be required to submit continuous assessment marks for projects at the end of the year in Form 1 to Form 4 worked on from the month of February to end of October in tandem with guidelines provided by ZIMSEC. The projects will be marked by ZIMSEC.

9.1 ASSESSMENT OBJECTIVES

By the end of the syllabus learners will be able to:

9.10.1 use available resources sustainably
9.10.2 use CAD/CAM in solving real life problems
9.10.3 apply designing skills to solve problems in their communities
9.10.4 demonstrate the ability to apply Metal Technology and Design concepts to accomplish given tasks
9.10.5 identify tools, equipment and materials used in Metal Technology and Design
9.10.6 observe health and safety measures in the metal and related industry
9.10.7 conduct experiments to determine strength, durability and quality of materials involved in the production of metal technology artefacts
9.10.8 manufacture suitable artefacts from a given situation/problem
9.10.9 define terms in Metal Technology and Design
9.10.10 Interpret and evaluate designs in Metal Technology and Design
9.10.11 calculate bill of quantities for the production of particular artefacts
9.10.12 join metals using a variety of techniques
9.10.13 perform Sheet Metal Technology and Forge Technology
9.10.14 demonstrate the maintenance of hand tools and equipment in the workshop
9.10.15 communicate their ideas by means of sketching and drawing

9.3 SCHEME OF ASSESSMENT

Continuous and summative assessment will be carried out in the theory, practical and design components of the syllabus. The weighting of the components are as follows:

| Summative Assessment | 60% |
| Continuous Assessment | 40% |

<table>
<thead>
<tr>
<th>Assessment mode</th>
<th>Theory, Drawing and Design</th>
<th>Practical</th>
<th>Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summative</td>
<td>20</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>Continuous</td>
<td>10</td>
<td>20</td>
<td>10</td>
</tr>
</tbody>
</table>

SUMMATIVE ASSESSMENT

Paper 1: Theory, Drawing and Design
The paper consists of 3 sections i.e. Section A, Section B and Section C

SECTION A
Four compulsory structured questions on Theory and Drawing will be answered

SECTION B
Two questions will be answered out of 6 questions on Metal Technology

SECTION C
One compulsory question will be answered on Design and Drawing

TIME: 3 hours
WEIGHTING: 30%

PAPER 2: PRACTICAL
A practical test piece based on Metal Technology application will be set. Candidates will be required to work from dimensioned diagrams, written descriptions or scaled drawings.

Time: 3 hours 15 minutes
Weighting 30%
PAPER 3: DESIGN

Assessment of learner performance in Metal Technology and Design 100%

Continuous Assessment 40%

Profile

Practical Tests 10%

Exit profile

Project (20 %)

Practical Assignments 10%

Continuous Mark Assessment = 40%

Summative Assessment 60%

Problem solving 25%

Structured test 25%

Product Design 10%

Examination Mark = 60%

Final Marks 100%