ZIMBABWE

MINISTRY OF PRIMARY AND SECONDARY EDUCATION

METAL TECHNOLOGY AND DESIGN SYLLABUS

FORMS 1 - 4

2015 - 2022

Curriculum Development and Technical Services
P.O. BOX MP 133
Mount Pleasant
Harare

ACKNOWLEDGEMENTS

The Ministry of Primary and Secondary Education wishes to acknowledge the following for their valued contribution in the production of this syllabus:

- Panelists for Metal Technology and Design
- Government Departments : Psychomotor Activities
- Belvedere Technical Teachers' College
- Zimbabwe School Examinations Council (ZIMSEC)
- University of Zimbabwe Department of Technical Education
- University Teaching and Learning Centre, University of Zimbabwe
- Captains of Industries
- Harare Institute of Technology
- United Nations Children's Emergency Fund (UNICEF)
- United Nations Educational, Scientific and Cultural Organization (UNESCO)

CONTENTS

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

- Intellectual property rights for indigenous innovations
- Environmental issues
- Value addition

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:
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

TOPIC	FORM 1	FORM 2	FORM 3	FORM 4
7.1 Health and Safety	• Workshop Health and Safety regulations	• Workshop Health and Safety regulations	• Health and Safety when using machines and chemicals	• Occupational Health and Safety Acts
7.2 Hand Tools and their Applications	• Classification and uses	• Classification and uses	• Grinders	
7.3 Material Science	• History of production of metals in Zimbabwe • Manufacture of ferrous metals • Heat treatment of metals	• Properties and behavior of commonly used materials • Identification, classification and uses of engineering materials • Heat treatment of metals	• Types of non- metallic materials commonly used in workshops • Types of plastics	• Types of non-metallic materials commonly used in workshops • Properties of non-metallic materials • Types of alloys and alloying elements and their properties • Protection of metals against corrosion.
7.4 Drawing and Design	• Design process	• Types of projections used in drawing • Design process	• Engineering Drawing • Design process • Computer Aided Design	• Application of Engineering Drawing • Design process • Introduction to Computer and Aided Design (CAD). • Intellectual property rights
7.5 Enterprising Education	• Concepts of Enterprising Education • Characteristics of an Entrepreneur	• Types of businesses • Factors affecting small scale business growth • Workshop Design and management • Risk Management in an enterprise	• Production and business Ethics • Marketing strategies • Quality Control and assurance • Workshop Design and management.	• Bookkeeping and accounting • Risk management in an enterprise • Setting up a business enterprise

7.0 SCOPE AND SEQUENCE CONTD..

TOPIC	FORM 1	FORM 2	FORM 3	FORM 4
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	• 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	• Foundry process and applications
7.11 Forge Technology	• Health and safety • Tools and equipment	• Health and Safety • 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 in design solutions	• Application of structures, mechanisms, hydraulics and pneumatics in design solutions
7.14 Beaten Metal Technology	• Material, equipment and processes	• Mass production techniques • Polishing methods	• Mass production techniques • Polishing methods	

7.0 SCOPE AND SEQUENCE CONTD..

TOPIC	FORM 1	FORM 2	FORM 3	FORM 4
7.15 Metal Joining Methods	• Permanent and temporary methods • Riveting • Bolts and nuts	• Permanent methods • Soft soldering • Hard soldering	• Application of screw threads • Locking devices	
7.16 Maintenance	• Workshop maintenance	• Workshop maintenance	• Workshop management	• Workshop management
7.17 Material Finishes	• Types of finishes and their applications	• Types of finishes and their applications	• Metal finishes	• Types of finishes and their applications
7.18 Introduction to Computer Aided Design and Computer Aided Manufacturing	• Introduction to CAD	• Introduction to CAD	• Drawing commands	• 3D forms

8.0 COMPETENCY MATRIX

FORM 1

8.1 TOPIC 1: HEALTH AND SAFETY

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
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

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
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

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
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

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
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

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.5.1 Concept of Enterprising Education	• 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

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.6.1 Health and Safety	• 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	• 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

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.7.1 Engineering Calculations	• 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

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
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

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
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	• 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

8.9 TOPIC 9: SHEETMETAL TECHNOLOGY CONTD..

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
	way of storing sheet metal	• Demonstrating proper way of storing sheet metal • Watching videos		
8.9.3 Tools and Equipment	• identify the correct types of tools used in sheet metal technology • demonstrate the correct use of the stated tools • identify parts of the tools and equipment used	• Types of Tools and equipment • Parts and uses of tools equipment	• Illustrating tools and equipment used on sheet metal • Demonstrating the correct uses of tools	• Tools and equipment • ICT tools
8.9.4 Sheet Metal Joints	• identify the different types of sheet metal technology joints • design and make artefacts involving the joints	• Types of sheet metal joints - Butt joint - Lap joint - Circular lap joint - Seams – folded and grooved • Application of the joints	• Discussing the application of different types of joints • Designing and making artefacts involving the joints	• Sheet Metals • Sheet Metal tools • ICT tools

8.11 TOPIC 11: FORGE TECHNOLOGY

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.11.1 Health and Safety	• Observe health and safety rules when forging • perform first aid procedures in case of an accident • demonstrate the correct use of tools and equipment	• Health and Safety: - Personal - First aid - Tools and equipment	• Observing health and safety measures when forging • Conducting first aid skills in case of an accident • Listing safety and health measures when using tools and equipment	• First Aid Kit • Protective clothing • ICT tools • Forge furnace
8.11.2 Tools and Equipment	• identify different tools used in forge technology • illustrate the uses of the given tools	• Tools and equipment • Uses of the different tools and equipment	• Demonstrating the correct use of the different tools used in forge technology • Producing products that involve the use of the forge tools • Watching videos	• Forge tools and equipment • Sample artefacts • Videos

8.12 TOPIC 12: ELECTRICITY AND ELECTRONICS

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.12.1 Health and Safety	• demonstrate an appreciation of health and safety rules when working with electrical circuits • explain ways of preventing accidents when working with electrical circuits • apply First Aid skills	• Health and safety skills required when working with electrical circuits • Accident prevention • First Aid procedures	• 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	• First Aid kit • ICT tools • Print media • Resource persons
8.12.2 Plugs and Sockets Wiring	• identify the colour coding for the live, neutral and earth cables • demonstrate ability to wire three pin plugs and sockets	• 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 • Resource persons • 3 pin plugs • Electrical cables and sockets • Electrical tools and equipment

8.12 TOPIC 12: ELECTRICITY AND ELECTRONICS CONTD..

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
			workshop	
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

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
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, pneumatic 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

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.14.1 Material, Equipment and Processes	• describe the properties of metals used in Beaten Metal Technology • illustrate tools and equipment used in beaten metal technology • perform Beaten Metal Technology processes	• Materials: - Aluminum - Copper - Brass - Mild steel • Equipment: - Hammers and Mallets - Sand bags - Wooden blocks • Processes: - Hollowing/blocking - Sinking - Raising	• Describing the properties of materials used in beaten metal Technology • Illustrating tools and equipment used in beat metal technology • Discussing beaten metal technology processes • Producing artefacts using beaten metal technology processes	• Sample artefacts • Print media • Tools and equipment

8.15 TOPIC 15: JOINING PROCESSES

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.15.1 Permanent and Temporary Methods of joining Metals	• Identify permanent and temporary methods of joining metals • Perform correct riveting techniques • Demonstrate ability to cut screw threads.	• Types of methods • Permanent method - riveting • Temporary method - Bolts and nuts - Screws and screw and screw cutting	• Riveting • Screwing • Using bolts and nuts • Watching videos	• Tools and Equipment • Print media • Samples of products • Site visits • Videos

8.16 TOPIC 16: MAINTENANCE

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.16.1 Workshop Maintenance	• demonstrate proper care and storage of tools • identify tools that require maintenance • perform workshop	• Clean and healthy workshop environment • Proper storage of tools and equipment • Tool care	• Storing tools properly in designated places • Identifying and attending to tools requiring maintenance	• Maintenance schedules • Print media • Videos

8.16 TOPIC 16: MAINTENANCE

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
	cleaning routine		• Cleaning the workshop regularly • Watching videos	

8.17 TOPIC 17 : MATERIAL FINISHES

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

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

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.18.1 Introduction to CAD/CAM	• set out space page on a computer • set paper size • identify the drawing commands • use drawing commands to generate plane shapes	• Work space • Paper setting • Drawing commands	• 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	• CAD software • Resource persons • Educational tours • Videos

FORM 2

8.0 COMPETENCY MATRIX

8.1 TOPIC 1: HEALTH AND SAFETY

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
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

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
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

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

8.4 TOPIC 4: DRAWING AND DESIGN

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

8.4 TOPIC 4: DRAWING AND DESIGN CONTD..

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
	• test the designed arte-facts for functionality	- 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

8.5 TOPIC 5: ENTERPRISING EDUCATION

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.5.1 Factors Affecting Small – scale business	• identify factors affecting small scale business • name different forms of business ownership • design a layout for a manufacturing workshop	• Small scale business • Factors affecting small scale business growth • Types of businesses ownership - Sole trader - Partnership - Franchisee • Workshop layout for a manufacturing business	• 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

8.6 TOPIC 6: MACHINES AND MACHINING PROCESSES

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
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

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
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

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
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..

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

8.9 TOPIC 9: SHEETMETAL TECHNOLOGY

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

8.11 TOPIC 11: FORGE TECHNOLOGY

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

8.12 TOPIC 12: ELECTRICITY AND ELECTRONICS

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

8.13 TOPIC 13: TECHNOLOGY CONCEPTS

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
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

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
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

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.15.1 Permanent Methods	• 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

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.16.1 Workshop Maintenance	• 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

TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.17.1 Types of Finishes and their Applications	• identify types of finishes • describe types of finishes • apply the finishes • clean the equipment after use	• Finishes: - painting - lacquering - blackening - motling - 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 CONTD..

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
		• Tools and equipment	• Conducting educational tours	

8.18 TOPIC 18: INTRODUCTION TO COMPUTER AIDED

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
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

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
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 APPLICA-

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
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

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
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 • Rexin • 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

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
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: - 1st angle projection - 3rd 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 CONTD..

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

8.5 TOPIC 5: ENTERPRISING EDUCATION

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

8.5 TOPIC 5: ENTERPRISING EDUCATION CONTD..

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

8.6 TOPIC 6: MACHINES AND MACHINING PROCESSES

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.6.1 Health and Safety	• 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	• 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 CONTD..

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

8.7 TOPIC 7: WORKSHOP CALCULATIONS

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.7.1 Engineering Calculations	• calculate mechanical advantage • calculate velocity ratio • calculate efficiency • convert mass into weight • calculate density • calculate volume	• Mechanical advantage • Velocity ratio • Efficiency • Weight • Mass • Density • Volume	• Calculating mechanical advantage • Calculating velocity ratio • Calculating efficiency • Converting mass into weight • Calculating density and volume	• Electronic calculators • ICT tools

8.8 TOPIC 8: WELDING TECHNOLOGY

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
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

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
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

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
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

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
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..

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.11.2 Application of Forge Technology Operations	• apply knowledge of the forging processes to produce different products	• Application of forge technology operations	• Producing products that involve different forge processes • Incorporating forge processes in the realization of their designs • Watching videos	• Forge technology tools and equipment • ICT tools • Artefacts • Videos

8.12 TOPIC 12: ELECTRICITY AND ELECTRONICS

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

8.13 TOPIC 13: TECHNOLOGY CONCEPTS

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
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

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
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..

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.14.2. Polishing Methods	• produce high quality finishes on beaten metal technology artefacts	• Beaten metal technology finishes	• Listing processes used to finish Beaten Metal Technology artefacts • Polishing completed	• Equipment and material • Sample artefacts

8.15 TOPIC 15: METAL JOINING PROCESSES

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
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

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
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

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
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

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
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

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.2.1 Occupational Health and Safety Act	• outline the rules and regulations in the Act governing Health and Safety	• Acts governing health and safety	• Identifying rules and regulations in the Act governing Health and Safety	• Occupational Health and Safety Act • Resource persons • Print media

8.2 TOPIC 2: MATERIAL SCIENCE

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.2.1 Properties of Non Metallic Materials	• describe various properties of non- metallic materials used in the workshop	• Properties of non-metallic materials: - mechanical - electrical - physical - chemical	• Undertaking workshop experiments to determine working properties. • Watching videos	• Testing equipment • Videos
8.2.2 Types of Alloys and Alloying Elements	• identify different types of alloys commonly used in the workshop • explain the various properties of the alloys • state the different types of alloying elements for each alloy • give practical applications of the alloys	Types of Alloys • Ferrous and Non Ferrous - brass - steel - bronze - duralumin - gunmetal - soft solder	• Collecting different samples of alloys • Conducting experiments in the workshop • Conducting educational tours	• Samples of commercial products • Educational tours

8.2 TOPIC 2: MATERIAL SCIENCE

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

8.3 TOPIC 3: DRAWING AND DESIGN

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.3.1 Application of Engineering Drawing	• produce standard working drawings • calculate the quantities of materials using given working drawings	• Generation of working drawings • Calculation of materials • Generation of possible solutions to a practical problem	• Generating standard working drawings • Calculating the Bill of Quantities	• Drafting equipment • ICT tools
8.3.2 Design Process	• apply the design process to solve practical problems • compile design folios • produce designed artefacts	• Design process stages: - Situation - Design brief - Market research - Possible solutions	• Making of models and prototypes • Testing models or mock ups	• Videos • Resource persons • ICT tools

8.3 TOPIC 3: DRAWING AND DESIGN CONTD..

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
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

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.4.1 Bookkeeping and Accounting	• 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

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.5.1 Health and Safety	• 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..

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
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

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
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..

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
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

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
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

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.8.1 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: - 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 : - right cones - truncated cones • draw radial developments of right cones and truncated cones	• 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

8.10 TOPIC 1; FOUNDRY TECHNOLOGY

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.10.1 Basic Foundry Processes and Applications	• cast simple artefacts • apply fettling as a finish process to castings	• 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

8.11 TOPIC 11: FORGE TECHNOLOGY

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

8.13 TOPIC 13: ELECTRICITY AND ELECTRONICS

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.13.1 Application of Electronics	• demonstrate an appreciation of the role of electronics in everyday life • design and make electronic devices for use by the community • market their devices • repair basic electronic gadgets	• Design and make electronic devices • Marketing the devices • Repairing	• Determining the role of electronics in everyday life • Designing and making electronic devices to meet societal needs • Repairing electronic gadgets	• Tools and equipment • Sample artefacts • Educational Tours • Exhibitions

8.13 TOPIC 13: ELECTRICITY AND ELECTRONICS CONTD..

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
			• Formulating marketing strategies for the devices • Watching videos • Educational tours	

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.14.1 Application of Structures, Mechanisms, Hydraulics and Pneumatics in Design Solutions	• define the qualities of a well-designed structure • list the main groups of structures and examples of their applications • describe how hydraulic system works • give examples of hydraulics application	• Structures and their application • Pneumatic and hydraulics • Simple actuating cylinder • Simple hydraulic system • Calculations	• Discussing the qualities of a well- designed structure • Identifying the main groups of structures and examples of application • Explaining how a simple hydraulic system works • Visiting relevant sites • Watching videos	• ICT tools • Site visits • Videos

8.15 TOPIC 15: BEATEN METAL TECHNOLOGY

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.15.1 Material, Equipment and Processes	• Describe the properties of metals used in beaten metal technology • Illustrate tools and equipment used in beaten metal technology • perform beaten metal technology process	• Materials: - Aluminum - Copper - Brass - Mild steel • Equipment: - Hammers and mallets - Sand bags - Wooden blocks • Processes - Hollowing/blocking - Sinking - Raising	• Describing the properties of materials used in beaten metal technology • Illustrating tools and equipment used in beaten metal technology • Discussing beaten metal technology processes • Producing artefacts using beaten metal technology	• Sample artefacts • Print media • Tools and equipment

8.16 TOPIC 16: METAL JOINING PROCESSES

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.16.1 Permanent and Temporary Methods of joining Metals	• Identify permanent and temporary methods of joining methods • Perform correct riveting techniques	• Types of methods: - Permanent method - Riveting - Temporary method	• Riveting • Screwing • Using bolts and nuts • Watching videos	• Tools and equipment • Print media • Samples of products • Site visits • Videos

8.17 TOPIC 17: MAINTENANCE

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.17.1 Workshop Management	• 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

TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.18 Material Finishes	• 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 MANUFAC-

TOPIC	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.19.1 3D Forms	• 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

ASSESSMENT OBJECTIVES	PAPER 1 Theory/Drawing	PAPER 2 Practical	PAPER 3 – Continuous Assessment
8.10.1	*	*	*
8.10.2			*
8.10.3	*		*
8.10.4		*	*
8.10.5	*		*
8.10.6		*	*
8.10.7		*	*
8.10.8		*	*
8.10.9	*		
8.10.10	*	*	*
8.10.11	*		*
8.10.12	*	*	*
8.10.13	*		*
8.10.14	*		*
8.10.15	*		*
Weighting	30%	30%	40%

Objectives/Components	**Paper 1**	**Paper 2**	**Paper 3 Continuous Assessment**
Knowledge with understanding	50	20	20
Practical skills and their application	20	50	30
Decision making and judgement	30	30	50
Total	100%	100%	100%

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%

Assessment mode	Theory, Drawing and Design	Practical	Design
Summative	20	30	10
Continuous	10	20	10

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