
ZIMBABWE

**MINISTRY OF PRIMARY AND SECONDARY EDUCATION**

# METAL TECHNOLOGY AND DESIGN SYLLABUS

## FORMS 5 - 6

## 2015 - 2022

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# CONTENTS

**ACKNOWLEDGEMENTS** ..... **i**

**CONTENTS** ..... **ii**

**1.0 PREAMBLE** ..... **1**

**2.0 PRESENTATION OF THE SYLLABUS** ..... **1**

**3.0 AIMS** ..... **1**

**4.0 OBJECTIVES** ..... **2**

**5.0 METHODOLOGY AND TIME ALLOCATION** ..... **2**

**6.0 TOPICS** ..... **2**

**7.0 SCOPE AND SEQUENCE CHART** ..... **3**

**FORM 5** ..... **5**

**8.0 COMPETENCY MATRIX** ..... **5**

**FORM 6** ..... **13**

**8.0 COMPETENCY MATRIX** ..... **13**

**9.0 ASSESSMENT** ..... **19**

# 1.0 PREAMBLE

## 1.1 Introduction

The Metal Technology and Design syllabus is designed for forms 5-6 learners who have done Metal Technology and Design or Design and Technology from form 1-4 as prerequisite. The syllabus embraces inclusivity in the learning and teaching of Metal Technology and Design. Practical, theoretical and problem solving approaches will be used in the acquisition of competency based 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 competency based skills and ethical attributes (unhu/ubuntu/vumunhu) which emphasize the learner`s role in making and shaping the environment whilst adding value to it. This encourages the learner to employ problem solving skills to produce value added products that are useful in the community, nation and global markets. The syllabus sets out to promote desirable enterprise and lifelong learning skills relevant to contemporary society. The syllabus enables the learner to explore numerous Metal Technology and Design career opportunities. In addition, it encourages the learner to value the use of multi- materials, Science, Mathematics, ICTs and other related learning areas.

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

- Innovativeness
- Invention
- Creativity and problem solving
- Project management
- Value addition and beneficiation

## 1.3 Summary of Content

This syllabus is intended to cover theoretical, practical and problem solving activities in Metal Technology and Design.

It will focus on:

- Health and safety
- Material science
- Manufacturing
- Product design
- Systems and control
- Engineering science
- Design drawing and realization
- Enterprise skills
- Intellectual property rights

## 1.4 Assumptions

The syllabus assumes that learners have knowledge of:

- Health and safety
- Product design
- Material science
- Systems and control
- Engineering science
- Intellectual property rights
- Use and maintenance of tools and equipment
- Manufacturing
- Design drawing and realization
- Enterprise skills

## 1.5 Cross-cutting themes

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

- Gender equity
- Inclusivity
- Teamwork
- Health and Safety
- Technology and innovation
- Environmental issues

# 2.0 PRESENTATION OF THE SYLLABUS

The Metal Technology and Design syllabus is a single document covering Forms 5-6. It contains the Preamble, Aims, Objectives, Syllabus Topics, Methodology, Scope and Sequence, Competency Matrix and Assessment.

# 3.0 AIMS

The syllabus should enable learners to:

3.1 develop confidence, creativity, practical competencies and responsibility in designing and manufacturing products to solve local problems and engage in inventions for the community, nation and the ever changing technological world
3.2 appreciate importance of health and safety in the working environment
3.3 prepare for life in the world of work in an indigenized economy and increasingly globalized and competitive environment
3.4 develop an awareness of design in the areas of social, culture and environment
3.5 develop enterprising skills through problem solving
3.6 develop a maintenance culture
3.7 develop an appreciation of function, aesthetic, economic, moral and technological value judgment

# 4.0 OBJECTIVES

Learners should be able to:

4.1 apply scientific and technological knowledge and skills in solving problems in the environment
4.2 plan steps in making artefacts
4.3 use appropriate materials and tools to attain quality products
4.4 experiment with design ideas to solve community based problems
4.5 observe health and safety regulations
4.6 demonstrate awareness of societal and technological influences in design
4.7 identify situations for which design solutions are required in communities
4.8 make aesthetic, economic, moral (ethical) and technological value judgment
4.9 exhibit enterprise skills by recognizing opportunities and constraints through design
4.10 demonstrate a consistent maintenance culture

# 5.0 METHODOLOGY AND TIME ALLOCATION

## 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 waste management. The use of ICT, Computer Aided Design/ Manufacturing (CAD/CAM) is mandatory.

## Suggested Methods

- Discussion
- Project based learning
- Brainstorming
- Experimentation/discovery problem solving
- Demonstration
- Educational visits
- Resource persons
- Team teaching
- Exhibitions

## Time Allocation

14 periods of 40 minutes periods per week should be allocated to adequately cover the syllabus.2x2 theory Drawing and Design and 2 blocks of 5 periods of practical should be allocated. Learners should be engaged in at least two educational tours per year, one exhibition per term, one seminar per term and an attachment of two weeks of the forth term school vacation.

# 6.0 TOPICS

6.1 Health and safety
6.2 Material science
6.3 Manufacturing
6.4 Product design
6.5 Systems and control
6.6 Engineering science
6.7 Design drawing and realization
6.8 Enterprise skills

# 7.0 SCOPE AND SEQUENCE CHART

| SUB TOPIC | FORM 5 | FORM 6 |
|---|---|---|
| **7.1 Health and Safety** | • Waste management<br>• Fire drills<br>• Disaster management<br>• Workshop management | • Occupational health and safety |
| **7.2 Material Science** | • Solid solution (alloying)<br>• Working properties and characteristics | • Application of plastics<br>• Workshop tests of engineering materials<br>• Material finishes |
| **7.3 Manufacturing** | • Systems of manufacturing<br>• Industrial manufacturing processes | • Manufacturing<br>• Quality control systems<br>• Automation |
| **7.4 Product Design** | • Cultural and technological influence on design<br>• Design process models<br>• Intellectual property | • Design process model<br>• Intellectual property |

| SUB TOPIC | FORM 5 | FORM 6 |
|---|---|---|
| **7.5 Systems and Control** | • Mechanisms<br>• Structures<br>• Electronics | • Structures<br>• Electronics |
| **7.6 Engineering Science** | • Engineering calculations | • Engineering calculations |
| **7.7 Design drawing and realization** | • Graphic engineering | • Graphic engineering |
| **7.8 Enterprise Skills** | • Business management<br>• Value addition and beneficiation | • Business management<br>• Value addition and beneficiation<br>• Setting up a business enterprise |

# FORM 5

# 8.0 COMPETENCY MATRIX

## 8.1 TOPIC 1 : HEALTH AND SAFETY

| SUB TOPIC | OBJECTIVES<br>Learners should be able to: | CONTENT<br>(ATTITUDES, SKILLS AND KNOWLEDGE) | SUGGESTED NOTES AND ACTIVITIES | SUGGESTED RESOURCES |
|---|---|---|---|---|
| **8.1.1 WASTE MANAGEMENT** | • identify proper methods of waste disposal<br>• observe relevant By-laws | • Waste disposal methods<br>• By-laws | • Identifying proper methods of waste disposal<br>• Observing relevant By-laws<br>• Visiting waste management sites<br>• Watching videos | • ICT tools<br>• Print media<br>• Resource persons<br>• Site visits<br>• Educational Tours |
| **8.1.2 FIRE DRILLS** | • demonstrate fire drill procedures<br>• identify equipment for use in fire drills<br>• identify emergency exits | • Fire drill procedures<br>• Equipment | • Demonstrating fire drill procedure<br>• Reacting to fire drills | • Procedure manual<br>• Assembly points<br>• Resource persons<br>• Fire-fighting equipment<br>• ICT tools |
| **8.1.3 DISASTER RISK MANAGEMENT** | • identify equipment<br>• demonstrate procedures<br>• support the affected | • International Organisation for Standardisation (ISO) Certification | • Selecting the right equipment/procedure | • Regulatory Acts<br>• ICT tools<br>• Procedure manual<br>• Resource persons-<br>• Standard Association of Zimbabwe (SAZ)<br>• National Social Security Authority (NSSA) |
| **8.1.4 INDUSTRIAL WASTE MANAGEMENT** | • manage industrial waste<br>• identify disposal methods | • Environmental protection<br>• Disposal methods | • Designing for second use | • Environmental Management Agency (EMA) leaflets<br>• Print media<br>• Disposal sites |

| | | | | |
|---|---|---|---|---|
| | | | | • ICT tools |
| **8.1.5 WORKSHOP MANAGEMENT** | • plan the layout design<br>• demonstrate organizational structure of a workshop<br>• demonstrate a maintenance culture | • Layout design<br>• Organization<br>• Maintenance | • Planning layout design<br>• Demonstrating organizational structure of a workshop<br>• Maintaining tools and equipment on a regular basis | • Workshop plans<br>• ICT tools<br>• Factories and Works(Machinery) Regulations of 1976<br>• Works(Electrical) Regulations of 1976<br>• Works(General) Regulations of 1976 |

## 8.2 TOPIC 2:MATERIAL SCIENCE

| SUB TOPIC | OBJECTIVES<br>Learners should be able to: | CONTENT<br>(ATTITUDES, SKILLS AND KNOWLEDGE) | SUGGESTED NOTES AND ACTIVITIES | SUGGESTED RESOURCES |
|---|---|---|---|---|
| **8.2.1 SOLID SOLUTION (ALLOYING)** | • explain the importance of doping in electronics<br>• justify interstitial solid mechanism<br>• choose materials for solid solution amalgamation<br>• discuss substitution in solid solution mechanism | • Doping<br>• Interstitial mechanism<br>• Amalgamation<br>• Substitution mechanism | • Explaining the importance of doping in electronic materials<br>• Justifying interstitial in solid solution mechanism<br>• Selecting materials for solid solution amalgamation<br>• Discussing substitution in solid solution mechanism | • Periodic table<br>• ICT tools<br>• Print media<br>• Resource persons<br>• Educational tours |
| **8.2.2 WORKING PROPERTIES AND CHARACTERISTICS OF MATERIALS** | • illustrate the grain structure of different materials<br>• identify material defect<br>• explain the causes of failure, deformation and deflation of materials<br>• describe the behavior of materials under working conditions<br>• calculate safety factor for different materials | • Grain structure of materials<br>• Material defects<br>• Failure, deformation and deflation of materials<br>• Safety factor | • Drawing the grain structure of different materials<br>• Identifying defects in materials<br>• Explaining the causes of failure, deformation and deflation of materials<br>• Describing the behavior of materials under working conditions<br>• Calculating the stress and strain in materials<br>• Determining the safety factor for different materials | • ICT tools<br>• Educational tours<br>• Samples of materials<br>• Material testing equipment<br>• Structural sections |

## 8.3 TOPIC 3: MANUFACTURING

| SUB TOPIC | OBJECTIVES<br>Learners should be able to: | CONTENT<br>(ATTITUDES, SKILLS AND KNOWLEDGE) | SUGGESTED NOTES AND ACTIVITIES | SUGGESTED RESOURCES |
|---|---|---|---|---|
| **8.3.1 SYSTEMS OF MANUFACTURING** | • identify the types of manufacturing systems<br>• explore the purposes of each manufacturing system<br>• explain the advantages and disadvantages of each manufacturing system | • Custom Manufacturing<br>• Job shop production/intermittent manufacturing<br>• Continuous manufacturing<br>• Flexible manufacturing | • Identifying the types of manufacturing systems<br>• Exploring the purpose of each manufacturing system<br>• Explaining the advantages and disadvantages of each manufacturing system<br>• Watching videos | • ICT tools<br>• Educational tours<br>• Print media |
| **8.3.2 INDUSTRIAL MANUFACTURING PROCESSES** | • Apply the different processes in designing and manufacturing | • Forming (moulding/casting, compressing/stretching<br>• Separating (shearing chip removal)<br>• Combining (mechanical fastening and assembling)<br>• Conditioning (thermal/chemical/ electrical | • Applying different processes in designing and manufacturing<br>• Exhibiting products | • ICT tools<br>• Educational tours<br>• Resource persons |

## 8.4 TOPIC 4 : PRODUCT DESIGN

| SUB TOPIC | OBJECTIVES<br>Learners should be able to: | CONTENT<br>(ATTITUDES, SKILLS AND KNOWLEDGE) | SUGGESTED NOTES AND ACTIVITIES | SUGGESTED RESOURCES |
|---|---|---|---|---|
| **8.4.1 CULTURAL AND TECHNOLOGICAL INFLUENCES ON DESIGN** | • generate new ideas based on indigenous designs to solve community based problems<br>• create new ideas based on available technologies to solve real life problems in their communities | • Indigenous designs<br>• Impact of technology on design | • Generating new ideas based on indigenous designs to solve community based problems<br>• Creating new ideas based on available technologies to solve real life problems in the communities<br>• Undertaking empirical studies of indigenous designs | • ICT tools<br>• Educational tours<br>• Sample designs |
| **8.4.2 DESIGN PROCESS MODELS** | • explain the difference between prescriptive and descriptive models of design<br>• apply both prescriptive and descriptive models to come up with design solutions | • Prescriptive model<br>• Descriptive model | • Explaining the difference between prescriptive and descriptive model of design<br>• Applying both prescriptive and descriptive models to come up with design solutions<br>• Watching videos on CAD<br>• Exhibiting products | • ICT tools<br>• Resource persons<br>• Samples products |
| **8.4.3 INTELLECTUAL PROPERTY RIGHTS** | • carryout patenting procedures to protect their innovations and inventions | • Patenting process | • Describing the patenting process<br>• Carrying out patenting procedures to protect their innovations and inventions | • Resource persons<br>• ICT tools |

## 8.5 TOPIC 5: SYSTEMS AND CONTROL

| SUB TOPIC | OBJECTIVES<br>Learners should be able to: | CONTENT<br>(ATTITUDES, SKILLS AND KNOWLEDGE) | SUGGESTED NOTES AND ACTIVITIES | SUGGESTED RESOURCES |
|---|---|---|---|---|
| **8.5.1 MECHANISMS** | • construct cam profiles<br>• demonstrate the application of cams<br>• determine the right bearing for a particular use based on calculations | • Cam profiles<br>• Bearings | • Identifying different types of cams<br>• Demonstrating the application of cams and followers<br>• Determining the right bearing for a particular use based<br>• on calculations<br>• Watching videos | • Sample mechanisms<br>• ICT tools<br>• Print media |
| **8.5.2 STRUCTURES** | • determine forces acting on different members of a structure<br>• design samples of structures | • Structural analysis | • Determining forces acting on different members of a structure<br>• Designing samples of structures<br>• Exhibiting products | • Print media<br>• Samples of structures |
| **8.5.3 ELECTRONICS** | • design electronic circuits<br>• apply the principles of logic gates in design solutions | • Electronics sensors<br>• Logic gates | • Designing electronic circuits<br>• Applying the principles of logic gates in design solutions<br>• Watching videos | • ICT tools<br>• Resource persons<br>• Print media<br>• Electronic components |

## 8.6 TOPIC 6: ENGINEERING SCIENCE

| SUB TOPIC | OBJECTIVES<br>Learners should be able to: | CONTENT<br>(ATTITUDES, SKILLS AND KNOWLEDGE) | SUGGESTED NOTES AND ACTIVITIES | SUGGESTED RESOURCES |
|---|---|---|---|---|
| **8.6.1 ENGINEERING CALCULATIONS** | • calculate machine speeds<br>• calculate tool feeds<br><br>• calculate gear ratios when cutting screw threads<br><br>• apply calculations involving forces<br><br>• calculate the coefficient of friction to establish frictional resistance on moving parts | • Machines<br>- speeds and feeds<br>- gear trains<br>- forces<br>- coefficient of friction<br>• Limits and fits<br>• Trigonometrical applications | • Calculating machine speeds to produce designed products<br>• Calculating tool feed during machine operations<br><br>• Calculating gear ratios when cutting screw threads using machines<br>• Solving practical problems involving forces<br>• Calculating tolerances on holes and shafts<br>• Calculating the coefficient of friction to establish frictional resistance on moving parts | • ICT tools<br>• Machines<br>• Machined products |

## 8.7 TOPIC 7: DESIGN DRAWING AND REALISATION

| SUB TOPIC | OBJECTIVES<br>Learners should be able to: | CONTENT<br>(ATTITUDES, SKILLS AND KNOWLEDGE) | SUGGESTED NOTES AND ACTIVITIES | SUGGESTED RESOURCES |
|---|---|---|---|---|
| **8.7.1 GRAPHIC ENGINEERING** | • illustrate working drawings<br>•<br>• generate computer aided drawings<br>• determine true lengths<br>• develop surfaces | • Production drawings<br>• Computer Aided drawings CAD/CAM)<br>- Conic sections<br>- True lengths<br>- Development by triangulation. | • Illustrating working drawings<br>• Generating computer<br>• aided drawings<br>• generating surface developments | • ICT tools<br>• Standard drawing convention (PD 7038:1980)<br>• Resource persons<br>• Geometrical models<br>• Surface templates |

## 8.8 TOPIC 8: ENTERPRISE SKILLS

| SUB TOPIC | OBJECTIVES<br>Learners should be able to: | CONTENT<br>(ATTITUDES, SKILLS AND KNOWLEDGE) | SUGGESTED NOTES AND ACTIVITIES | SUGGESTED RESOURCES |
|---|---|---|---|---|
| **8.8.1 BUSINESS MANAGEMENT** | • define a business model<br>• analyse different examples of business models | • Business models<br>- Definition of business model<br>- Examples of business models | • Defining business model<br>• Analysing different business models<br>• Conducting educational tours<br>• Watching videos | • ICT tools<br>• Educational tours<br>• Resource persons<br>• Educational tours |
| **8.8.2 VALUE ADDITION AND BENEFICIATION** | • identify local resources from which value addition and beneficiation concepts can be promoted<br>• explain the advantages and challenges of value addition and beneficiation<br>• redesign products in order to improve quality | • Resources<br>• Impact<br>• Quality control | • Identifying local resources from which value addition and beneficiation concepts can be promoted<br>• Explaining the advantages and challenges of value addition and beneficiation<br>• Redesigning products in order to improve quality<br>• Exhibiting products | • Local resources<br>• ICT tools<br>• Sample products |

# FORM 6

# 8.0 COMPETENCY MATRIX

## 8.1 TOPIC 1 :HEALTH AND SAFETY

| SUB TOPIC | OBJECTIVES<br>Learners should be able to: | CONTENT<br>(ATTITUDES, SKILLS AND KNOWLEDGE) | SUGGESTED NOTES AND ACTIVITIES | SUGGESTED RESOURCES |
|---|---|---|---|---|
| **8.1.1 OCCUPATIONAL HEALTH AND SAFETY** | • determine the level of health and safety in various work environments | • Work environment<br>• Work procedures | • Determining the<br>• Level of health and safety in various work environments (research) | • Educational tours<br>• ICT tools<br>• Health and Safety Acts |

## 8.2 TOPIC 2: MATERIAL SCIENCE

| SUB TOPIC | OBJECTIVES<br>Learners should be able to: | CONTENT<br>(ATTITUDES, SKILLS AND KNOWLEDGE) | SUGGESTED NOTES AND ACTIVITIES | SUGGESTED RESOURCES |
|---|---|---|---|---|
| **8.2.1 APPLICATION OF PLASTICS** | • outline tools and equipment used in moulding<br>• illustrate moulding tools and equipment<br>• perform plastic moulding operations | • Plastic moulding<br>- injection<br>- blow<br>- extrusion | • Outlining tools and equipment for the moulding processes<br>• Illustrating moulding tools and equipment<br>• Performing plastic moulding operations<br>• Conducting industrial visits<br>• Watching videos | • ICT tools<br>• Tools and Equipment<br>• Educational Tours<br>• Resource persons |
| **8.2.2 WORKSHOP TESTS OF ENGINEERING MATERIALS** | • experiment on the working characteristics of materials<br>• apply knowledge of material characteristics in design and realization | • Experiments/tests of material characteristics | • Experimenting on the working characteristics of materials<br>• Applying knowledge of material characteristics in design and realization | • ICT tools<br>• Testing equipment<br>• Resource person<br>• Educational tours |
| **8.2.3 MATERIAL FINISHES** | • evaluate cost benefit analysis of material finishes | • Cost benefit analysis of material finishes | • Evaluating cost benefit analysis of material finishes | • ICT tools<br>• Resource persons |

## 8.3 TOPIC 3: MANUFACTURING

| SUB TOPIC | OBJECTIVES<br>Learners should be able to: | CONTENT<br>(ATTITUDES, SKILLS AND KNOWLEDGE) | SUGGESTED NOTES AND ACTIVITIES | SUGGESTED RESOURCES |
|---|---|---|---|---|
| **8.3.1 MANUFACTURING** | • machine prototypes on the milling and lathe machine<br>• perform programming operations on Computer Numeric Controlled(CNC) machines | • Machining operations:<br>• Manual lathe/and CNC<br>• Manual Milling machine/and CNC milling<br>• CNC programming | • Visiting manufacturing industries<br>• Machining prototypes on milling and lathe machines<br>• Performing programming operations on CNC machines | • ICT tools<br>• Industrial visits<br>• Resource persons<br>• Educational tours |
| **8.3.2 QUALITY CONTROL SYSTEMS** | • analyze methods of instituting quality control<br>• apply quality control measures(SAZ) | • Methods of instituting quality control<br>- benchmarking<br>- supplier partnering<br>- continuous improvement<br>- continuous training | • Analyzing methods of instituting quality control<br>• Applying quality control measures<br>• Visiting manufacturing industries<br>• Watching videos | • ICT tools<br>• Industrial visits<br>• Resource persons<br>• Educational tours<br>• Standards Association Of Zimbabwe(SAZ) |
| **8.3.3 AUTOMATION** | • apply automation techniques in manufacturing | • Industrial automation<br>• Automation activating techniques<br>- electronic<br>- hydraulic<br>- mechanical | • Applying automation technique in manufacturing<br>• Visiting industries<br>• Explaining the advantages and disadvantages of automation | • ICT tools<br>• Educational tours |

| | | | | |
|---|---|---|---|---|
| | • analyze the activating techniques in automation<br>• outline the advantages and disadvantages of automation | - pneumatics<br>- combination | • Analyzing the activating techniques in automation<br>• Watching videos<br>• Conducting educational tours | |

## 8.4 TOPIC 4: PRODUCT DESIGN

| SUB TOPIC | OBJECTIVES<br>Learners should be able to: | CONTENT<br>(ATTITUDES, SKILLS AND KNOWLEDGE) | SUGGESTED NOTES AND ACTIVITIES | SUGGESTED RESOURCES |
|---|---|---|---|---|
| **8.4.1 INTELLECTUAL PROPERTY RIGHTS** | • carryout patenting procedures to protect their innovations and inventions | • Patenting process<br>- Case studies on patenting procedures | • Carrying out patenting procedures to protect innovations and inventions<br>• carrying out case studies on patenting procedures | • Resource persons<br>• ICT tools<br>• Patent Acts |
| **8.4.2 DESIGN PROCESS MODEL** | • apply CAD skills to solve practical problems in their communities | • Computer Aided Design (CAD) | • Applying CAD skills to solve practical problems<br>• Watching videos on CAD | • ICT tools<br>• Resource persons |

## 8.5 TOPIC 5: SYSTEMS AND CONTROL

| SUB TOPIC | OBJECTIVES<br>Learners should be able to: | CONTENT<br>(ATTITUDES, SKILLS AND KNOWLEDGE) | SUGGESTED NOTES AND ACTIVITIES | SUGGESTED RESOURCES |
|---|---|---|---|---|
| **8.5.1 STRUCTURES** | • analyse factors to consider in designing a structure<br>• design structures | • Structural designs | • Analyzing factors to consider when designing structures<br>• Designing structures<br>• Watching videos<br>• Conducting educational tours | • ICT tools<br>• Structures<br>• Educational tours |
| **8.5.2 ELECTRONICS** | • demonstrate the application of different integrated circuits | • Integrated circuits | • Demonstrating the application of different integrated circuits | • ICT tools<br>• Circuit diagrams |

## 8.6 TOPIC 6 : ENGINEERING SCIENCE

| SUB TOPIC | OBJECTIVES<br>Learners should be able to: | CONTENT<br>(ATTITUDES, SKILLS AND KNOWLEDGE) | SUGGESTED NOTES AND ACTIVITIES | SUGGESTED RESOURCES |
|---|---|---|---|---|
| **8.6.1 ENGINEERING CALCULATIONS** | • perform indexing calculations<br>• carryout calculations to solve practical problems involving cams and linkages<br>• determine stress and strain | • Indexing<br>• Cams and linkages<br>• Stress and strain | • Performing calculations that include direct, angular, differential and simple indexing<br>• Carrying out calculations to solve practical problems involving cams and linkages<br>• Applying calculations on stress and strain to produce products designed | • ICT tools<br>• Machines<br>• Machined products |

## 8.7 TOPIC 7: DESIGN DRAWING AND REALISATION

| SUB TOPIC | OBJECTIVES<br>Learners should be able to: | CONTENT<br>(ATTITUDES, SKILLS AND KNOWLEDGE) | SUGGESTED NOTES AND ACTIVITIES | SUGGESTED RESOURCES |
|---|---|---|---|---|
| **8.7.1 GRAPHIC ENGINEERING** | • design geometrical models | • Computer aided designs and models | • Designing and modelling | • ICT tools<br>• Geometrical models<br>• Resource persons |

## 8.8 TOPIC 8: ENTERPRISE SKILLS

| SUB TOPIC | OBJECTIVES<br>Learners should be able to: | CONTENT<br>(ATTITUDES, SKILLS AND KNOWLEDGE) | SUGGESTED NOTES AND ACTIVITIES | SUGGESTED RESOURCES |
|---|---|---|---|---|
| **8.8.1 VALUE ADDITION AND BENEFICIATION** | • explore opportunities for value addition and beneficiation in their local communities<br>• explore methods and technologies in their local communities<br>• redesign products in order to improve quality | • Opportunities<br>• Methods and technologies | • Exploring opportunities for value addition and beneficiation in their local communities<br>• Exploring methods and technologies in their local communities<br>• Redesigning products in order to improve quality | • ICT tools<br>• Local resources |
| **8.8.2 Setting up a Business Enterprise** | • outline the procedure of setting up a business enterprise.<br>• generate a business proposal | • Business registration process<br>• Generation of a business proposal | • Writing of a business proposal<br>• Generating a business proposal<br>• Watching videos | • ICT tools<br>• Resource persons |

# 9.0 ASSESSMENT

Forms 5-6 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 assessment methods to allow access and receipt of accurate performance, measurement of abilities by candidates with special needs.

Learners will be required to design and realize two community based projects as continuous assessment in November of form 5 and July of form 6. They will also be required to write2 theory, drawing and design exercises; and carryout 2 practicals (bench fitting and fabrication) and 2 practicals (machinework) that should be submitted as continuous assessment at the end of each year. The subject teacher will set and mark the exercises, as well as record the marks using ZIMSEC guides.

ZIMSEC will also provide a template for the assessment of soft skills. Subject teachers will be required to provide a file for each learner where each of the practical exercises and marked scripts will be kept. In addition, subject teachers will also be required to create a file where exercise question papers and marking guides for each exercise administered as well as recorded marks will be kept. ZIMSEC personnel will monitor the program.

School heads will submit continuous assessment marks for design projects at the end of the year in form 5 and form 6 as provided for by ZIMSEC.

(a) ASSESSMENT OBJECTIVES

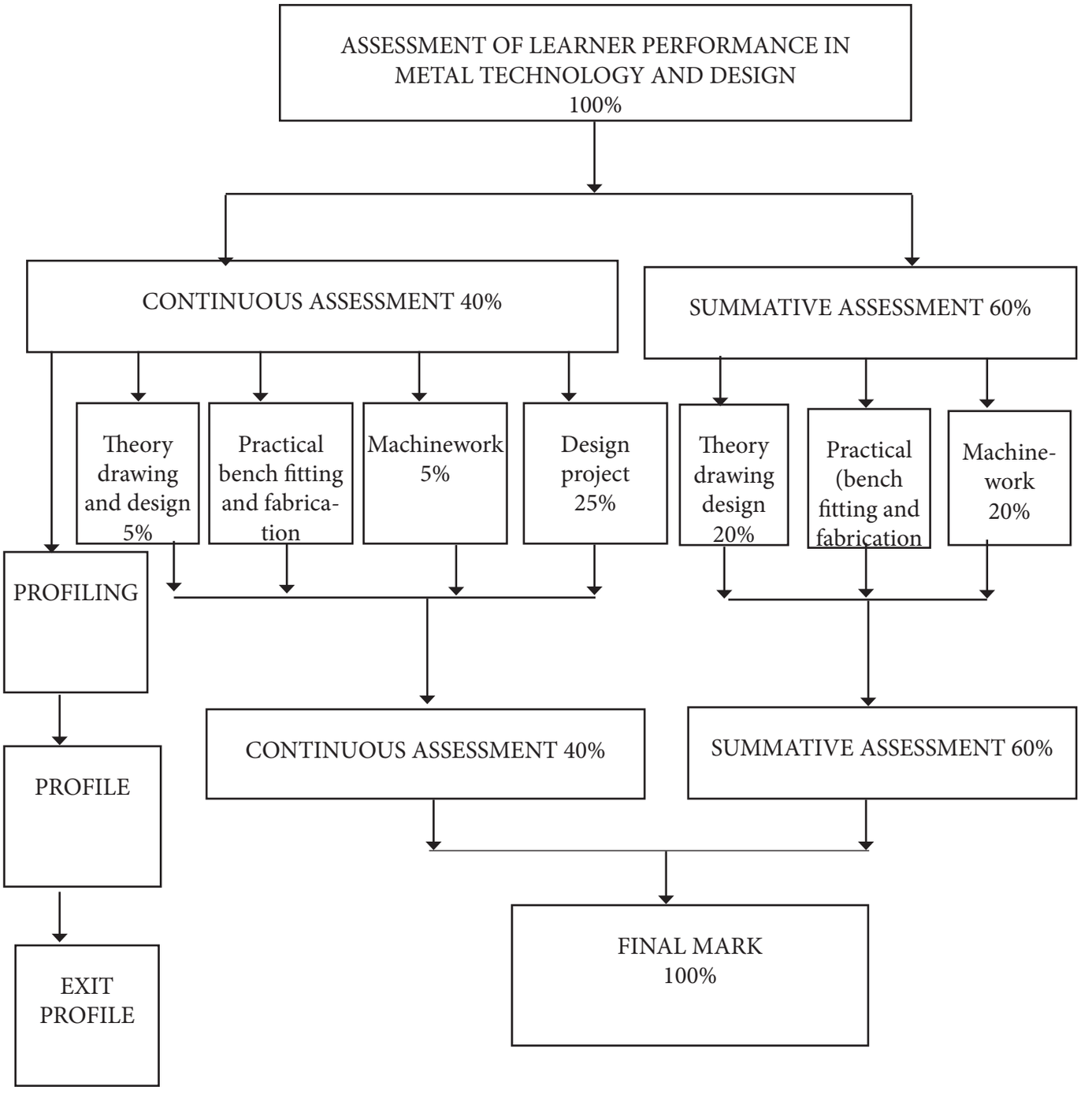
1. Apply scientific and technological knowledge and skills in solving problems in the environment
2. Plan steps in making artefacts
3. Use appropriate materials and tools to attain quality products
4. Observe health and safety regulations
5. Identify situations for which design solutions are required in communities
6. Exhibit enterprise skills by recognizing opportunities and constraints through design

CONTINUOUS AND SUMMATIVE 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** | **Paper 1** | **Paper 2** | **Paper 3** | **Paper 4** |
|---|---|---|---|---|
| | **Theory Drawing and Design** | **Practical (Bench fitting and fabrication)** | **Machinework** | **Design Project** |
| Summative | 20 | 20 | 20 | |
| Continuous | 5 | 5 | 5 | 25 |


ASSESSMENT OF LEARNER PERFORMANCE IN METAL TECHNOLOGY AND DESIGN 100%
CONTINUOUS ASSESSMENT 40%
SUMMATIVE ASSESSMENT 60%
Theory drawing and design 5%
Practical bench fitting and fabrica-tion
Machinework 5%
Design project 25%
Theory drawing design 20%
Practical (bench fitting and fabrication
Machine-work 20%
PROFILING
PROFILE
EXIT PROFILE
CONTINUOUS ASSESSMENT 40%
SUMMATIVE ASSESSMENT 60%
FINAL MARK 100%

(a) SCHEME OF ASSESSMENT

There are four (4) papers: Paper 1 Theory Drawing and Design, 3 hrs, Paper 2 Practical (bench fitting and fabrication) 3 hrs; Paper 3 Machinework 3hrs and Paper 4 Design Project

Paper 1: Theory Drawing and Design (3hrs 20%) 3 (three) sections will be offered:

Section A – four (4) compulsory theory questions based on workshop technology

Section B – a problem solving question based on a situation being experienced in a community or at the school and

Section C – drawing based on an appliance or a tool or a part of a machine in exploded view that requires to be assembled.

Paper 2 :Practical (bench fitting and fabrication) 3hrs, 20%

The examination is set in any of the common metals and alloys and will consist of bench fitting and fabrication using hand tools and other processes given in the syllabus. Details of the materials, tools and equipment required will be provided before the examination. The use of machines will be allowed on parts specified.

Paper 3: Machinework 3 hrs, 20%

This will mainly be machinework although processes in other sections of the syllabus may be included. Examination instructions will be sent to examination centres well in advance to allow candidates to make beforehand any special tools or jigs (e.g. templates, bending formers) required.

Paper 4: Continuous assessment (Design Project) 25%



The Design project will be done during the course of the school year beginning in June and completing in November of form 5, and beginning in January and completing in October of form 6. The design project guidelines will be sent to examination centres as advance information.

(c) SPECIFICATION GRID

| **Assessment Objectives** | **Paper 1 Theory, drawing and design** | **Paper 2 Practical (bench fitting and fabrication)** | **Paper 3 Machine work** | **Paper 4 Continuous Assessment (design project)** |
|---|---|---|---|---|
| 1. | **X** | **X** | **x** | **x** |
| 2. | **X** | **X** | **x** | **x** |
| 3. | **x** | **X** | **x** | **x** |
| 4. | **x** | **X** | **x** | **x** |
| 5. | **x** | **X** | **x** | **x** |
| 6. | **x** | **X** | **x** | **X** |
| Weighting | **20%** | **20%** | **20%** | **40%** |

| **Objectives** | **Paper 1** | **Paper 2** | **Paper 3** | **Paper 4** |
|---|---|---|---|---|
| **Knowledge with understanding** | **50** | **20** | **20** | **20** |
| **Practical skills and their application** | **20** | **50** | **50** | **30** |
| **Decision making and judgment** | **30** | **30** | **30** | **50** |