ZIMBABWE

MINISTRY OF PRIMARY AND SECONDARY EDUCATION

AGRICULTURE ENGINEERING SYLLABUS

FORMS 5 - 6

2015-2022

Curriculum Development Unit
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Contents

1.0 PREAMBLE

1.1 INTRODUCTION

Zimbabwe embarked on an agrarian Land Reform programme in which mechanization in agriculture is a key component. Consequently, it is imperative that learners, in their diversity, acquire essential agricultural engineering knowledge and skills to enhance food security. This syllabus is designed for Form 5 and 6 learners in Agriculture Engineering. Learners must cherish land as their national heritage which can sustainably be used to enhance food security through mechanization. It is hoped that the concepts, principles and practices learnt in Agriculture Engineering will equip learners with relevant skills to use appropriate technology to boost agricultural production. Learners will be assessed through continuous and summative assessments.

1.2 RATIONALE

Agriculture is a learning area studied from Grade 3 to Form 4, therefore it is important for learners to specialize in Agriculture Engineering at Forms 5 and 6 so as to acquire relevant skills and knowledge to enhance food production, create employment and for further learning opportunities. Specialisation would enable learners to be proactive, productive and add value to the community and national economy. This learning area will enhance learners' ability to operate, maintain, design, produce and manage agricultural machinery. Learners will, at the end of the two-year learning phase, value the dignity of labour, role of mechanization and food sovereignty.

The Agriculture Engineering syllabus will enable learners to develop the following skills:

- Psycho – motor
- Problem-solving
- Critical thinking
- Decision-making
- Conflict resolution
- Leadership and team-work
- Self-management
- Communication
- Technological innovation
- Enterprise development
- Research
- Equipment handling

1.3 SUMMARY OF CONTENT

The learning area will include the study on the creation of a favourable environment for crop and animal production, sources of farm power, farm structures and sustainable use of resources. It will also help learners to acquire competency skills in design, construction, operation and maintenance of farm machinery and structures.

1.4 ASSUMPTIONS

It is assumed that learners have practical skills and knowledge in:

- Agricultural farm machinery and tools.
- General maintenance of farm machinery and tools
- Properties of material
- Soil and water conservation
- Sustainable use of agricultural resources
- E – learning
- Basic scientific calculations

1.5 CROSS- CUTTING ISSUES

The Agriculture Engineering learning area will encompass the following cross cutting themes:

- Environmental issues
- enterprise skills
- Sustainable resource utilisation
- Disaster and risk reduction
- Inclusivity
- Teamwork
- Digital literacy

2.0 PRESENTATION OF SYLLABUS

The Agriculture Engineering syllabus is a single document covering Forms 5- 6. The syllabus has a suggested list of resources to be used during teaching and learning.

3.0 AIMS

The syllabus aims to help learners to:-

3.1 develop an appreciation of the socio-economic importance of Agriculture Engineering to the agriculture industry in the country.
3.2 develop positive attitudes towards Agriculture Engineering as a learning area
3.3 develop knowledge and understanding of advanced scientific principles in Agriculture Engineering
3.4 apply psycho-motor and cognitive skills in solving agriculture engineering problems
3.5 develop innovativeness in Agriculture Engineering through sustainable utilisation of local resources
3.6 prepare learners for life and work in an indigenised and competitive environment

4.0 SYLLABUS OBJECTIVES

By the end of the learning period learners should be able to:

4.1 demonstrate the socio – economic importance of Agriculture Engineering to the agriculture industry in the country.
4.2 demonstrate understanding of Agriculture Engineering terminology, concepts and principles
4.3 Apply indigenous knowledge systems (IKS), scientific and mathematical principles in Agriculture Engineering.
4.4 apply problem-solving skills in challenges encountered in agriculture engineering.

4.5 Carry-out experiments in Agriculture Engineering
4.6 design models and machinery in agriculture engineering
4.7 apply safety precautions in the use of farm machinery and equipment.
4.8 demonstrate operational skills in the use of farm structures, machinery and equipment

5.0 METHODOLOGY AND TIME ALLOCATION

Learner-centered and hands-on approaches should be used in the development of concepts and skills. These approaches should be inclusive and encourage curiosity as well as promote practical-orientated learning. Emphasis should be placed on equipping learners with psycho - motor and research skills. Linkage between theory and practice should be implemented in the teaching and learning of Agriculture Engineering.

The following are suggested methods of teaching and learning of Agriculture Engineering:

- Research
- Educational tours
- E-learning
- Problem-solving
- Design
- Exhibitions
- Demonstrations
- Discussions

NB. The above suggested methods should be enhanced by the application of orthodidactic principles and multi-sensory approaches to teaching. These include tactility, concreteness, individualization, self-activity, totality and wholeness. Teachers are encouraged to address the learners' residual senses.

5.1.1 TIME ALLOCATION

12 periods of 40 minutes per week should be allocated to adequately cover the syllabus which should be 8 periods for practicals and 4 periods for theory. Learners should be engaged in at least 1 Educational Tour and 1 Exhibition per term.

6.0 TOPICS

1. Farm mechanization
2. Engines
3. Tillage implements
4. Planting and fertilizing equipment
5. Crop protection equipment
6. Harvesting and processing equipment
7. Farm structures
8. Irrigation structures and scheduling
9. Soil and water conservation structures
10. Cost analysis in Agriculture Engineering

7.0 SCOPE AND SEQUENCE

7.1 TOPIC 1: FARM MECHANISATION

TOPIC	FORM 5	FORM 6
Importance of Farm Mechanization	• Role of farm mechanization • Workshop practices • Selection of farm machinery	

TOPIC	FORM 5	FORM 6
Engineering Mechanics	• Force • Work • Energy • Power • Machines • Computer applications in agricultural engineering	
Sources of Farm Power	• Renewable sources • Non-renewable sources	

7.2 TOPIC 2: ENGINES

TOPIC	FORM 5	FORM 6
Internal combustion engines	• Operational principles • Power transmission	
Engine systems	• Fuel system • Cooling system • Lubrication system • Electrical system	

7.3TOPIC 3: TILLAGE IMPLEMENTS

TOPIC	FORM 5	FORM 6
Tillage implements	• **Tillage implements**	

7.4TOPIC 4: PLANTING AND FERTILIZING EQUIPMENT

TOPIC	FORM 5	FORM 6
Planting and Fertilizing equipment	Planting and fertilizing equipment	

7.5TOPIC 5: CROP PROTECTION EQUIPMENT

TOPIC	FORM 5	FORM 6
Spraying and dusting equipment	• Sprayers and dusters • Operational principles	

7.6TOPIC 6: HARVESTING AND PROCESSING EQUIPMENT

TOPIC	FORM 5	FORM 6
Harvesting and Processing equipment		• Operational principles

TOPIC	FORM 5	FORM 6

7.7 TOPIC 7: SURVEYING AND FARM STRUCTURES

TOPIC	FORM 5	FORM 6
Surveying and Farm Structures		• Surveying for agricultural projects • Environmental Impact Assessment • Theory of structures and stress analysis • Animal structures • Engineering of controlled environments • Storage structures

7.8 TOPIC 8: IRRIGATION, STRUCTURES AND SCHEDULING

TOPIC	FORM 5	FORM 6
Soil water		• Soil-plant-water relationships • Soil-water movement and retention

TOPIC	FORM 5	FORM 6
		• Soil-water determination
Irrigation		• Irrigation methods • Irrigation designs • Hydraulic irrigation structures • Irrigation scheduling • Irrigation efficiency

7.9. TOPIC 9: SOIL AND WATER CONSERVATION STRUCTURES

TOPIC	FORM 5	FORM 6
Soil erosion		• Soil-loss models • Control measures
Water conservation techniques		• water conservation techniques • Integrated water management (IWM) • water legislation

7.10. TOPIC 10: COST ANALYSIS IN AGRICULTURE ENGINEERING

TOPIC	FORM 5	FORM 6
Farm machinery operation cost calculations		• Valuation of machinery • annual operating costs • income tax and finance

TOPIC	FORM 5	FORM 6

8.0 COMPETENCY MATRIX

FORM 5 SYLLABUS

8.1 TOPIC 1: FARM MECHANISATION

KEY CONCEPT	LEARNING OBJECTIVES Learners should be able to:	CONTENT	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
Role of farm mechanization	• explain the concept farm mechanization • discuss the implementation and impact of farm mechanization in Zimbabwe	• Farm mechanization • Role of farm mechanisation	• Explaining the concept of farm mechanization • discussing the implementation and impact of farm mechanization in Zimbabwe	• Farm machinery • Recommended text books/talking • ICT Tools with JAWS software
Workshop practices	• apply safety practices in the workshop	• Workshop safety • Workshop operations:	• applying safety practices in the workshop eg first aid	• Farm machinery

	• join materials using different welding methods • apply welding skills to design appropriate technology	-Welding -Soldering -Brazing	• Joining materials using different welding methods: which are arc welding, soldering and brazing • Designing farm machinery using welding •	• Recommended textbooks/ • ICT tools with JAWS software • Workshop foreman •
Selection of farm machinery	• classify Farm machinery according to use and power output • match tractor power output and implement power requirements • describe factors affecting selection of farm machinery	• Farm machinery: -Types -Classification • Factors affecting selection of farm machinery	• identifying categories and types of farm machinery • classifying tractors according to use and power output • matching tractor power output and implement power requirements • describing factors affecting selection of farm machinery • undertaking an educational tour to a local farm	• Tractor and implements • ICT Tools with JAWS software • Farm mechanic •

KEY CONCEPT	LEARNING OBJECTIVES Learners should be able to:	CONTENT	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
Force	• demonstrate equilibrium of forces • Solve problems related to forces	• Forces - equilibrium of forces - moments of forces	• Demonstrating equilibrium of forces • Solving problems related to	• Objects and materials to demonstrate

	• determine centre of gravity using freely suspended bodies • discuss the application of friction in farm machinery	• Friction	forces • Determining centre of gravity using freely suspended bodies • Discussing the application of friction in farm machinery	forces Print and electronic media • ICT Tools with JAWS software
Work, Energy and Power	• describe types of energy • • calculate work done • solve problems related to work, energy and power	• Types of energy • • Work done • Power output	• Describing types of energy such as potential, kinetic, electrical, heat • • Calculating work done (Work = Force X Distance) • Solving problems related to work, energy and power	• Tractor and implements Print and electronic media • ICT Tools with JAWS software
Machines	• identify drives used in farms • describe operational principles of drives • calculate machinery efficiency,	• Types of Drives: -Chains -Belts -Pulleys -Gears -Block and Tackles Operational Mechanisms Machinery efficiency	• Identifying drives used in farms • • • Describing operational principles of drives : levers, wheel and axle, velocity ratio, mechanical advantage, efficiency • Calculating machinery efficiency=Work output/work input,	• Machines Print and electronic media • ICT Tools with JAWS software

	mechanical advantage and velocity ratio design agricultural machinery • operate agricultural machinery • carry-out routine maintenance procedures on farm machinery	 • designs and models • machinery operation • routine maintenance of farm machinery	mechanical advantage = Load/Effort, Velocity Ratio= Distance moved by Effort/ Distance moved by load • Designing agricultural machinery • Operating farm machinery • Carrying-out routine maintenance procedures on farm machinery	
Computer applications in agricultural engineering	• describe the significance of computer programmes in agricultural engineering • carry out computer programming for selected agricultural equipment	• Computer programming	• describing the application of computer programmes in agricultural engineeringcarrying out computer programming for selected agricultural equipment	Print and electronic media • ICT Tools with JAWS software

KEY CONCEPT	LEARNING OBJECTIVES Learners should be able to:	CONTENT	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
Renewable Sources of farm power	• discuss applications of renewable energy in agriculture	• solar energy • hydro-energy • Wind	• discussing applications of renewable energy in agriculture. • designing systems to harness renewable energy	• Locally available renewable sources of farm power Print and electronic media • ICT Tools with JAWS software
Non-Renewable Sources of farm power	• describe mechanical sources of farm power • describe production limitations of thermal electric power	• Mechanical power • Thermal Electricity	describing mechanical sources of farm power • describing production limitations of thermal electric power • designing mechanical sources of farm power such as generators and motors	• Mechanical sources of farm power such as generators, tractors Print and electronic media • ICT Tools with JAWS software

8.2 TOPIC 2: ENGINES

KEY CONCEPT	LEARNING OBJECTIVES Learners should be able to:	CONTENT	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
Operational principles	• describe operational principles of a 2 and 4 stroke cycles	• Operational principles of: -2 stroke cycle engine -4 stroke cycle engine	• describing the operational principles of 2 and 4 stroke cycles	• Engine blocks and models • Print and electronic media • ICT tools
Power transmission	• describe power transmission from the engine to the final drive. • describe the functions of components of the power transmission system	• Sequence of gears and shafts. • Components and functions of the power transmission system.	• describing power transmission from the engine to the final drive. • describing the functions of components of the power transmission system: clutch, transmission gears, differential, rear axle and rear wheels.	• Print and electronic media • ICT tools. • Tractor

KEY CONCEPT	LEARNING OBJECTIVES Learners should be able to:	CONTENT	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
Fuel system	• describe fuel properties • describe the functions of components of petrol and diesel fuel systems	• Properties of fuels. • Components and functions of petrol and diesel fuel systems.	• describing fuel properties: volatility, calorific value and ignition quality of fuel. • describing functions of components of petrol and diesel fuel systems: tank, fuel filters, fuel pump, injection pump	• Print and electronic media • ICT tools. • Tractor • Fuel samples
Cooling system	• explain the reasons for cooling the engine. • describe the principles of air and water cooling systems.	• Purpose of cooling • Principles of air and water cooling systems.	• explaining reasons for cooling: maintaining optimum temperature, maintain lubricating properties of the oil. • describing the principles of air and water cooling systems.	• Print and electronic media • Tractor/ models • Motor cycle • radiators fans

Lubrication system	• explain the importance of lubrication • describe properties of lubricants • describe lubrication systems	• Lubrication: -importance - classification of lubricants -properties of lubricants • Splash and forced feed	• discussing the importance of lubrication • classifying lubricants • demonstrating lubrication of machinery • describing properties of lubricants • testing viscosity of lubricants • describing lubrication systems	• Print and electronic media • Lubricants. • Tractor
Electrical system	• identify parts of the electrical system of petrol and diesel engines • explain the functions of parts of the electrical system of engines	• electrical system of petrol and diesel engines: - parts - functions	• identifying parts of the electrical system of petrol and diesel engines: battery, ignition coil, condenser, ignition switch. • explaining the functions of parts of the electrical system of engines	• tractor/ models • Print and electronic media • . • ICT tools.

TOPIC 3: TILLAGE IMPLEMENTS

KEY CONCEPT	LEARNING OBJECTIVES Learners should be able to:	CONTENT	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
Tillage implements	• classify tillage implements • describe tillage implements • carry-out routine maintenance practices on tillage implements	• Types: -Primary -Secondary • Routine Maintenance	• classifying tillage implements • Identifying primary and secondary tillage implements • describing parts of primary and secondary tillage implements • carrying-out routine maintenance practices on tillage implements	• Print and electronic media • ICT –with JAWS software

8.4 TOPIC 4: PLANTING AND FERTILIZING EQUIPMENT

KEY CONCEPT	LEARNING OBJECTIVES Learners should be able to:	CONTENT	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
Planting and fertilizing equipment	• identify types of planters and fertilizing equipment • describe operational principles of planters and fertilizer applicators • calibrate planters and fertilizer applicators • carry out routine maintenance practices on planters and fertilizer applicators	• Types • Operational principles • Calibration • Maintenance	• identifying types of planters and fertilizing equipment • describing operational principles of planters and fertilizer applicators • calibrating planter and fertilizer applicators • carrying out routine maintenance practices on planters and fertilizer applicators	• Planters and fertilizer applicators • Farm technician Print and electronic media • ICT with JAWSsoftware • Scientific calculator

8.5 TOPIC 5: CROP PROTECTION EQUIPMENT

KEY CONCEPT	LEARNING OBJECTIVES Learners should be able to:	CONTENT	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
sprayers and dusters	• Identify types of sprayers and dusters • discuss the properties of materials used in sprayers • describe how parts are related to their functions • demonstrate the calibration and operation of sprayers • carry out routine maintenance practices of sprayers • explain the safety precautions to consider when using crop protection equipment	• Types of sprayers -Knapsack -Boom -Mist blower -Ultra low volume -sprayers(UlV) -Aerial -Dusting machines • Parts and functions • Calibration and operation • Maintenance of sprayers • Safety precautions	• Identifying types of sprayers and dusters • Discussing the properties of materials used in sprayers • Describing how parts are related to their functions • Demonstrating the calibration and operation of a knapsack sprayer • Carrying out routine maintenance practices of sprayers • Explaining the safety precautions to consider when using crop protection equipment	• Dfferent types of sprayers • Recommended text books • ICT Tools • Recommended text books • ICT Tools • • Protective clothing

FORM 6 SYLLABUS

7.6 TOPIC 6: HARVESTING AND PROCESSING EQUIPMENT

Sub topic: Harvesting and processing equipment

KEY CONCEPT	LEARNING OBJECTIVES Learners should be able to:	CONTENT	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
Operational Principles	• describe the operating mechanisms of combine harvesters	• Combine harvester operation.	• Describing the operating mechanisms of a combine harvester: cutting, picking, threshing, winnowing • Undertaking an educational tour to a local farm	• Combine harvester • Recommended text books • ICT tools with JAWS Software • Diggers • Driers. • Recommended textbooks
	• describe the operating mechanism of diggers	• Operating mechanism of diggers	• Describing the operating mechanisms of diggers .	
	• explain the operating mechanism of shellers and driers	• Operating mechanism of shellers and driers	• Explaining the operating mechanisms of shellers and driers • Operating a groundnut sheller	

8.7 TOPIC 7: SURVEYING AND FARM STRUCTURES:

Sub topic:

KEY CONCEPT	LEARNING OBJECTIVES Learners should be able to:	CONTENT	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
Surveying for agricultural projects.	• discuss the significance of surveying in Agricultural projects • carry out a survey to determine the suitability of land for agricultural projects	• Agricultural survey: - Types - importance	• Discussing the significance of surveying in agricultural projects • Carrying out a survey using surveying instruments and equipment: GPS, computers, pacing, stadia, tape measure	• Survey instruments and equipment • Surveyor ICT tools
Environmental Impact Assessment (EIA)	• describe Environmental Impact Assessment(EIA) and its applications	• Environmental Impact Assessment (EIA): -biodiversity -hydrology -soil properties	• Describing Environmental Impact Assessment (EIA) and its application in agricultural projects	• Resource person-EMA • software • Recommended text books • ICT tools

	in agricultural projects • Carry out EIA on agricultural projects	-water quality	• Carrying out EIA on agricultural projects	
Theory of structures and stress analysis	• describe internal forces • select appropriate material for the construction of farm structures • describe methods of improving properties of materials used in farm structures • test the mechanical properties of	• Stress-strain forces • Materials for construction • Improving properties of materials • Mechanical properties of materials	• Describing internal forces • Selecting appropriate material for construction of farm structures • Describing methods of improving properties of materials used in farm structures: - trusses - joining - reinforcement - alloying - painting - reverting • Testing the mechanical properties of materials	• • Text books • Talking calculators • Scientific calculators • Large print text books • Educational tours

	materials used in the construction of farm structures		used in the construction of farm structures: -material behaviour under axial static tension, static compression, static bending, static shear, static torsion, strain gauges, impact loads, fatigues of metals.	
Animal structures	• relate the design of the structure to its functions • design an animal structures	• Structural designs	• Relating the design of the structure to its function • designing animal structures	• Text books • ICT JAWS – software • Talking calculating • Scientific calculators • Large print text books • Educational tours

Engineering of Controlled environments	• identify controlled environments for crop production • site a greenhouse • design a greenhouse • describe the operational principles of a greenhouse • carry out correctional management practices in a green house	• Types of controlled environments: -glass houses -leth house - green house • Greenhouse: - design - operational principles - management	• Identifying types of controlled environments • Sitting greenhouse • Designing a greenhouse • Describing operational principles of a greenhouse • Carrying out correctional management practices in a greenhouse	• Models of structures • Resource person • Educational tours • Textbooks • Large print text books • Greenhouse
Storage structures	• identify factors affecting the site of different storage structures • identify different	• Water storage facilities • Crops/grain storage facilities • Animal storage facilities	• Identifying factors affecting the site of different storage facilities • Identifying different types of farm storage	• Educational tours • Text books • Large print text books • Models • Experienced personnel

	types of farm storage structures • describe qualities of ideal storage structures • design farm storage structures • Carry out routine maintenance practices		structures • Describing qualities of ideal storage structures • Designing farm storage structures • Constructing selected farm storage structures • Carrying out inspections and repairs on structures	

7.8 TOPIC 8: IRRIGATION, STRUCTURES AND SCHEDULING

KEY CONCEPT	LEARNING OBJECTIVES Learners should be able to:	CONTENT	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
Soil plant water relations	• outline types of soil moisture	• Types of soil moisture • Moisture level: -wilting point -field capacity -saturation -available moisture gravitational moisture	• describing soil- water movement percolation, seepage, and infiltration, capillary.	• Recommended text books • ICT tools • Soil samples • water
Soil-water movement and retention **Soil-water determination**	• describe soil- water movement • determine available soil moisture content. • apply soil water relationsin irrigation	- • Drainage • Soil moisture determination: - gravimetric method - volumetric method, - moisture meter - neutron probes, -tensiometer	• carrying out experiment on soil-water movement • determining available moisture content in the soil • applying soil water relations in irrigation	• Recommended text books. • ICT tools. • calculator

KEY CONCEPT	LEARNING OBJECTIVES Learners should be able to:	CONTENT	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
Irrigation Methods **Irrigation designs**	• describe irrigation methods • design any one irrigation system	• Irrigation methods: - Overhead - Surface - drip • Irrigation designs	• Describing irrigation methods • Designing any one irrigation system - Overhead - Surface - drip	• Drip • Sprinkler • Flood, Basin • Recommended text books. • ICT tools.
Hydraulic Irrigation structures **Irrigation Scheduling**	• discuss types of pumps used in irrigation • select a suitable pump for irrigation systems • describe the operational mechanism of water conveyance and control structures. • Calculate crop water	• Irrigation pumps -types -size • Water conveyance and control structures. • crop water requirements	• Discussing types of pumps used in irrigation • Selecting a suitable pump for an irrigation system • Describing the operational mechanism of water conveyance and control structures: weirs, parshall flumes, drop chutes, canals. • Calculating crop water	• Recommended text books • ICT tools. • Evaporating pan • Plant samples • Canals • Recommended text books • ICT tools • Recommended

Irrigation efficiency	requirements • calculate efficiency for all types of irrigation systems. • carry out routine maintenance on irrigation systems	$ET_{crop} = ET_0.K_c$ • Irrigation efficiency • Routine maintenance on irrigation systems	requirements and irrigation cycles • Calculating efficiency for all types of irrigation systems. • Carrying out routine maintenance on irrigation systems	text books. • ICT tools. Irrigation engineer

7.9 TOPIC 9: SOIL AND WATER CONSERVATION STRUCTURES.

KEY CONCEPT	LEARNING OBJECTIVES Learners should be able to:	CONTENT	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
Soil-loss models	• determine soil-loss	• Soil-loss models - Soil Loss Estimation Model For Southern Africa (SLEMSA) -Universal Soil Estimation (USLE)	Determining soil-loss using prediction models	• Educational tour • Recommended text books • ICT tools
Control measures	- describe biological, mechanical and cultural control measures of erosion	• Control measures - Biological - Mechanical - cultural	- Describing biological, mechanical and cultural control measures of erosion -	- Recommended text books - ICT tools - Survey kit

	- construct soil conservation structures		- Surveying and constructing soil conservation structures	

KEY CONCEPT	LEARNING OBJECTIVES Learners should be able to:	CONTENT	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
Water conservation techniques	• describe water conservation techniques • Construct water conservation structures	• conservation techniques: - dams - roof harvesting - water wells - conservation tillage practices - contours	- Describing water conservation techniques • Constructing water conservation structures	- Educational tours - Text books - Survey kit - ICT tools
Integrated water management (IWM) **Water legislation**	• discuss the role of integrated water management in water conservation • interpret water legislation in Zimbabwe	• Integrated water management • Water legislation: - Water Act	• Discussing the role of integrated water management in water conservation • Interpreting water legislation	- Water Act - Resource person(ZINWA) - Water Act

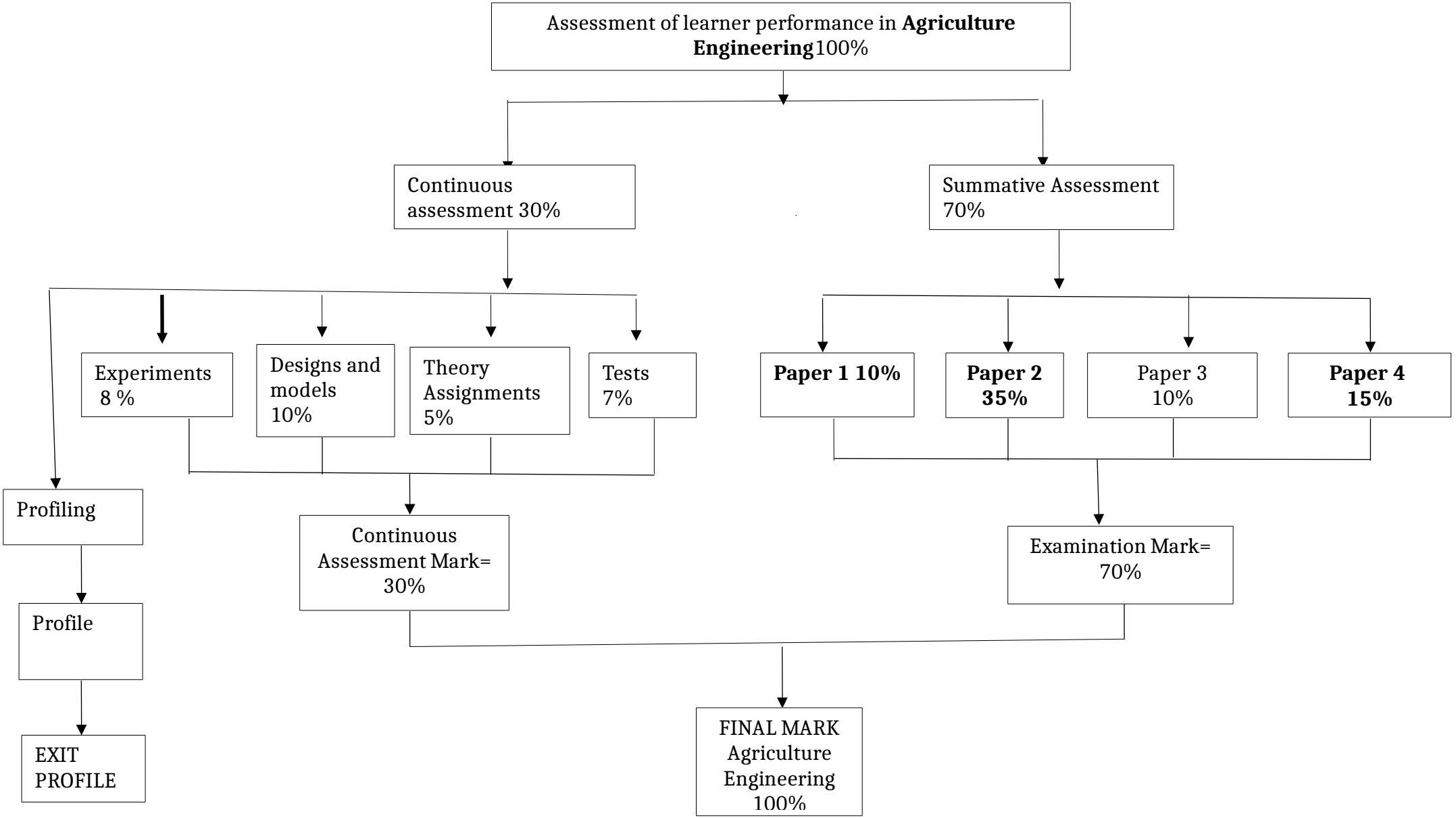
7.10 TOPIC 10: COST ANALYSIS IN AGRICULTURE ENGINEERING.

KEY CONCEPT	LEARNING OBJECTIVES Learners should be able to:	CONTENT	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
Valuation of machinery	• determine the value of machinery over time	• Valuation of machinery: - depreciation -analysis time period -remaining value period -purchase and selling price	• Calculating: - depreciation -analysis time period -remaining value period -purchase and selling price	• Recommended textbooks • ICT tools • Machinery records
Annual operating costs	• identify fixed and variable costs • apply fixed and variable costs in determining profitability and sustainability of machinery use	• Operating costs: - fixed costs - variable costs	• Identifying operating costs • Applying fixed and variable costs in determining profitability and sustainability of machinery use	• Recommended textbooks • ICT tools - Financial records

Income Tax and finance	• apply net-cash flows concept • apply results of analysis in decision making process • formulate budgets	• Machinery financial budgets: -cost of capital -net present value -marginal tax rates	• Applying net-cash flows concept in computing net-present value • Applying results of machinery cost analysis in the decision making process • Computing budgets: -cash-flow -break-even analysis -gross-margin -partial budgets	- Budgets - ICT Tools with JAWS Software

8.0 ASSESSMENT MODEL

Agriculture engineering learning area will be assessed through continuous and summative assessment



ASSESSMENT

ASSESSMENT COMPONENT	WEIGHTING
Continuous assessment	30%
Summative assessment	70%

CONTINUOUS ASSESSMENT

Assessment will be done through

Theory Assignments	5%
Tests	7%
Designs and Models	10%
Experimental Tests	8%

ASSESSMENT MODE	FORM 5 WEIGHTING	FORM 6 WEIGHTING
Theory assignment	2,5%	2,5%
Tests	3,5%	3,5%
Designs and Models	5%	5%
Experimental tests	4%	4%

ASSESSMENT MODE	FREQUENCY PER LEVEL	
	FORM 5	**FORM 6**
Theory assignments	2 per year	2 per year
Tests	2 per year	2 per year
Designs and Models	2 for the 2 levels	
Experimental tests	2 per year	2 per year

SUMMATIVE ASSESSMENT 70%

Learners are required to take papers 1 to 4.

PAPER DESCRIPTION	DURATION	MARKS	WEIGHTING
Paper 1	1 hour	40	10%
Paper 2	2 hours 30mins	100	35%
Paper 3	2 hours	40	10%
Paper 4	4 terms	100	15%

PAPER 1
Consists of multiple choice questions from the whole syllabus. Candidates will be required to answer all 40 questions. Total marks 40

PAPER 2
This is a structured free response paper which has 2 sections namely A and B. Both sections are set from any part of the syllabus.

SECTION A
Candidates are required to answer all questions in this section. Six questions will be set, each question carries 10 marks
Section total 60 marks

SECTION B
Essay type questions will be set from any part of the syllabus. Four questions will be set and candidates will be required to answer any 2 questions. Each question carries 20 marks.
Section total (40)
Paper total (100)

PAPER 3
A practical examination will be set from any part of the syllabus. The paper will be based on experiments, investigations, observations and calculations. Full instructions will be given where unfamiliar material or techniques will be required. Two compulsory questions will be set. Each question carries 20 marks.
Total 40 marks

PAPER 4

Candidates are required to carry out an experimental or a survey project. Candidates will design and carry out the project work on any part of the syllabus. The research project must emphasise both theoretical and practical aspects of Agriculture Engineering

A project report of 2 500 to 3000 words should be prepared and submitted by candidates.
Total Marks 100

Skills Specification Grid

ASSESSMENT SKILL	**PAPER 1**	**PAPER 2**	**PAPER 3**	**PAPER 4**
Knowledge with understanding	50	40	15	10
Application of knowledge	30	40	35	40
Experimental skills	20	20	50	50
Total	**100**	**100**	**100**	**100**

ASSESSMENT OBJECTIVES

Learners will be assessed on their ability to demonstrate knowledge and understanding, application of knowledge and experimental skills

Knowledge and understanding

- discuss, describe, identify and demonstrate specific agricultural engineering facts, principles, relationships, concepts, practical techniques and terminology.
- summarise and explain any given agricultural engineering information.

Application of knowledge

- illustrate interpret, solve and criticize specific phenomena of agricultural engineering.
- schedule, test and experiment, using agricultural engineering facts and principles.
- compare, contrast and criticise any procedures, processes and techniques employed in agricultural engineering.

Experimental skills

- design and develop experimental activities in agricultural engineering.
- report, illustrate and interpret observations correctly.
- assess and justify methods of production employed in agricultural engineering.
- compose, construct and organise given agricultural engineering facts into diagrams, tables and graphs.
- analyse, interpret and evaluate results from any given agricultural engineering activity.

9.0 SUGGESTED RESOURCES FOR AGRICULTURE ENGINEERING

- **petrol and diesel engines (tractor and generator)**
- **workshop and workshop equipment**
  -arc welding machine complete with accessories
  -Gas welding
  -Grinders
  -spanners
  -drills
  -compressor
  -cutting equipment
  -protective equipment
  -consumables
- **survey kit**
- **farm machinery**
- **neutron probes,**
- **tensiometer**
- **recommended textbooks/talking**
- **Computers with JAWS Software**