REPUBLIC OF KENYA

COMPETENCY BASED MODULAR CURRICULUM

FOR

AGRICULTURAL ENGINEERING

KNQF LEVEL 6

(CYCLE 3)

PROGRAMME ISCED CODE: 0716 554 A

TVET CDACC
P.O. BOX 15745-00100
NAIROBI

MATERIAL SCIENCE

UNIT CODE: 0716 541 20A

TVET CDACC UNIT CODE: ENG/CU/AGR/CC/04/6/MA

UNIT DURATION: 80 Hours

Relationship to Occupational Standards

This unit addresses the unit of competency: **Apply material science principles**

Unit Description

This unit specifies the competencies required by an Agricultural Engineering Technologist Level 6 to apply material science principles. It involves analyzing physical and mechanical properties of engineering materials, performing engineering materials heat treatment and testing of engineering materials.

Summary of Learning Outcomes

S/No.	Learning Outcomes	Duration (Hours)
1.	Analyze physical and mechanical properties of engineering materials	20
2.	Perform engineering materials heat treatment	30
3.	Test engineering materials	30
TOTAL		**80**

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Analyze physical and mechanical properties of engineering materials	1.1 Types of engineering materials 1.3.1 Steel 1.3.2 Aluminium 1.3.3 Copper 1.2 Physical properties of engineering materials 1.3.4 Density 1.3.5 Texture	• Practical • Project • Portfolio of evidence • Third party report • Written tests • Oral questioning

Learning Outcome	Content	Suggested Assessment Methods
	1.3.6 Melting point 1.3.7 Boiling point 1.3.8 Thermo conductivity 1.3.9 Electrical resistivity 1.3.10 Color 1.3 Mechanical properties of engineering materials 1.3.11 Ductility 1.3.12 Malleability 1.3.13 Elasticity 1.3.14 rigidity 1.3.15 Toughness 1.3.16 Hardness 1.3.17 Brittleness 1.3.18 Plasticity 1.3.19 Strength 1.4 Techniques of testing and analysing properties of engineering materials	
2. Perform engineering materials heat treatment	2.1 Equipment used in performing heat treatment of engineering materials. 2.2 Methods of heat treatment 2.2.1 Annealing 2.2.2 Tempering 2.2.3 Case hardening 2.2.4 Normalizing 2.2.5 Hardening	• Practical • Project • Portfolio of evidence • Third party report • Written tests

Learning Outcome	Content	Suggested Assessment Methods
	2.3 Service and maintenance of equipment used in performing heat treatment	• Oral questioning
3. Test engineering materials	3.1 Tools and equipment used in material testing 3.1.1 Hydraulic servo testing machine 3.2 Methods of testing materials 3.2.1 Dynamic testing 3.2.2 Static testing 3.2.3 Destructive testing 3.2.4 Non destructive material testing 3.3 Material testing characteristics 3.3.1 Tensile strength 3.3.2 Ductility 3.3.3 Malleability 3.3.4 Compression strength 3.3.5 Electrical conductivity 3.3.6 Particle analysis	• Practical • Project • Portfolio of evidence • Third party report • Written tests • Oral questioning

Suggested Methods of Delivery

- Demonstration
- Projects
- Group discussion
- Direct instructions

Recommended Resources for 25 Trainees

S/No.	Category/Item	Description/ Specifications	Quantity	Recommended Ratio (Item: Trainee)
A	**Learning Materials**			
•	Projector		1	1:25
•	Manuals		1	1:25
•	Scientific calculators		25	1:25
•	Computer with internet		1	1:25
B	**Learning Facilities & infrastructure**			
•	Classroom	40 M^2	1	1:25
C	**Consumable materials**			
•	Stationery	Assorted	1 rim of printing papers 1 packet of pens 1packet of maker pens	1:25
D	**Tools and Equipment**			
•	Toolboxes		2 pc	1:13
•	Testing material kits		2 pcs	1:13

•	compression testing equipment		21pc	1:25
•	Torsion testing equipment		1 pc	1:25
•	metal melting equipment		1pc	1:25
•	Inspection instruments		5pc	1:5