**REPUBLIC OF KENYA**

# COMPETENCY BASED MODULAR CURRICULUM

## FOR AGRICULTURAL ENGINEERING
## KNQF LEVEL 5

**(CYCLE 3)**

**PROGRAMME ISCED CODE: 0716 454 A**

TVET CDACC
P.O. BOX 15745-00100 NAIROBI

# MECHANICAL SCIENCE PRINCIPLES

**UNIT CODE:** 0716 441 09A

**TVET CDACC UNIT CODE:** ENG/CU/AGR/CC/04/5/MA

**Duration of Unit:** 100 Hours

**Relationship to Occupational Standards**

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

**Unit Description**

This unit describes the competencies required by agricultural engineering Craftsperson to apply mechanical science principles. Competencies include: applying force, moment and motion in structural components and applying work, energy, power, gas, heat energy, density and pressure principles in engineering operations.

**Summary of Learning Outcomes**

| S/No | Learning Outcomes | Duration (Hours) |
|---|---|---|
| 1. | Apply force and moment in structural components | 25 |
| 2. | Apply motion principles in structural components | 25 |
| 3. | Apply work, energy and power principles in engineering operations | 25 |
| 4. | Apply density and pressure concepts in engineering operations | 25 |
| **TOTAL** | | **100** |

**Learning Outcomes, Content and Suggested Assessment Methods**

| Learning Outcome | Content | Suggested Assessment Methods |
|---|---|---|
| 1. Apply force and moment in structural components | 1.1 Types of forces<br>1.1.1 Applied Force.<br>1.1.2 Gravitational Force.<br>1.1.3 Normal Force.<br>1.1.4 Frictional Force. | • Practical<br>• Project<br>• Portfolio of evidence<br>• Third party report |

| Learning Outcome | Content | Suggested Assessment Methods |
|---|---|---|
| | 1.1.5 Air Resistance Force.<br>1.1.6 Tension Force.<br>1.1.7 Spring Force<br>1.1.8 Coplanar force<br>1.2 Distance, velocity and acceleration<br>1.3 Turning effects of a force (Moments) | • Written tests<br>• Oral questioning |
| 2. Apply motion principles in structural components | 2.1 Types of motion<br>2.1.1 Linear Motion.<br>2.1.2 Rotary Motion.<br>2.1.3 Oscillatory Motion<br>2.2 Laws of motion<br>2.2.1 Newton's laws of motion<br>2.2.2 Law of conservation of linear momentum<br>2.2.3 Law of conservation of energy<br>2.3 Displacement-time graphs | • Practical<br>• Project<br>• Portfolio of evidence<br>• Third party report<br>• Written tests<br>• Oral questioning |
| 3. Apply work, energy and power principles in engineering operations | 3.1 Work<br>3.1.1 Definition<br>3.1.2 Computation<br>3.1.3 Application<br>3.2 Energy<br>3.2.1 Definition<br>3.2.2 Computation<br>3.2.3 Application<br>3.3 Power<br>3.3.1 Definition<br>3.3.2 Computation | ○ Observation<br>○ Oral questioning<br>○ Written tests<br>○ Practical tests |

| Learning Outcome | Content | Suggested Assessment Methods |
|---|---|---|
| | 3.3.3 Application<br>3.4 Simple machine (levers) sample problems<br>3.4.1 Mechanical advantage<br>3.4.2 Velocity ratio<br>3.4.3 Efficiency | |
| 4. Apply density and pressure concepts in engineering operations | 4.1 Solid and fluid density<br>4.2 Applications of density<br>4.3 Pressure principles<br>4.4 Applications of pressure<br>4.4.1 Vacuum pump<br>4.4.2 Hydraulic pump<br>4.4.3 Hydrometers | o Practical<br>o Project<br>o Portfolio of evidence<br>o Third party report<br>o Written tests<br>o 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** | | | |
| 1. | Stationery | Assorted | 1 rim of printing papers<br>1 packet of pens | 1:25 |
| **D** | **Tools and Equipment** | | | |
| 1. | Welding and Fabrication Tools: | | 2 pc | 1:13 |
| 2. | Welding Machines | | 2 pcs | 1:13 |
| 3. | Cutting Torches and Plasma Cutters | | 21pc | 1:25 |
| 4. | Welding Helmets and Gloves | | 1 pc | 1:25 |
| 5. | Hardness Testers | | 1 | 1:25 |
| 6. | Tensile Testing Machines | | 1 | 1:25 |
| 7. | Impact Testers: | | 1 | 1:25 |