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

THERMODYNAMICS PRINCIPLES

UNIT CODE: 0716 541 21A

TVET CDACC UNIT CODE: ENG/CU/AGR/CC/05/6/MA

UNIT DURATION: 120 Hours

Relationship to Occupational Standards

This unit addresses the Unit of Competency: **Apply thermodynamics principles.**

Unit Description

This unit specifies the competencies required by an Agricultural Engineering Technologist Level 6 to apply thermodynamics principles. It involves applying fundamentals of thermodynamics, applying steady and non-steady flow processes, applying ideal gas laws and steam generation principles, demonstrating understanding of fuel and combustion and applying heat transfer and exchange principles.

Summary of Learning Outcomes

S/No.	Learning Outcomes	Duration (Hours)
1.	Apply fundamentals of thermodynamics	20
2.	Apply steady and non-steady flow processes	20
3.	Apply ideal gas laws	20
4.	Apply steam generation principles	20
5.	Demonstrate understanding of fuel and combustion	20
6.	Apply heat transfer and exchange principles	20
TOTAL		**120**

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Apply fundamentals of thermodynamics	1.1 Thermodynamics processes e.g. 1.1.1 Adiabatic 1.1.2 Isothermal 1.1.3 Isochoric 1.1.4 Isobaric 1.2 Thermodynamic cycles	o Practical o Project o Portfolio of evidence o Third party report

	1.2.1 Otto cycle 1.2.2 Carnot cycle 1.2.3 Rankine cycle 1.2.4 Bryton cycle 1.3 Laws of thermodynamics 1.3.1 First law 1.3.2 Second law 1.3.3 Third law	○ Written tests ○ Oral questioning
2. Apply steady and non-steady flow processes	2.1 Types of flow processes e.g.; 2.1.1 Steady 2.1.2 Non steady flow 2.2 Steady flow devices e.g. 2.2.1 Pipes 2.2.2 Nozzles 2.2.3 Pumps 2.2.4 Diffusers 2.3 Steady flow energy equation and its application. 2.4 Non steady flow energy equation and its application	• Practical • Project • Portfolio of evidence • Third party report • Written tests • Oral questioning
3. Apply ideal gas laws	3.1 Ideal gas laws e.g. 3.1.1 Boyle's law 3.1.2 Charles's law 3.1.3 Avogadro's law 3.1.4 Gay Lussac's law 3.2 Applications of ideal gas laws in engineering 3.3 Ideal gas cycle	• Practical • Project • Portfolio of evidence • Third party report • Written tests • Oral questioning

4. Apply steam generation principles	4.1 Melting and boiling point relationships. 4.2 Energy balance models 4.2.1 Positive energy balance 4.2.2 Negative energy balance 4.3 Perfect energy balance 4.4 Relationships between temperature and pressure	• Practical • Project • Portfolio of evidence • Third party report • Written tests • Oral questioning
5. Apply knowledge of fuel and combustion	5.1 Fuel classification e.g. 5.1.1 Fossil fuels 5.1.2 Liquid fuels 5.1.3 Gasoline 5.1.4 Natural fuels 5.2 Properties of different types of fuel e.g. 5.2.1 Density 5.2.2 Viscosity 5.2.3 Calorific value 5.2.4 Pour point 5.2.5 Cetane number 5.2.6 Octane number 5.2.7 Acid value 5.3 Combustion equations and their application	• Practical • Project • Portfolio of evidence • Third party report • Written tests • Oral questioning
6. Apply heat transfer and exchange principles	6.1 Heat transfer processes 6.1.1 Conduction 6.1.2 Radiation 6.1.3 Convection 6.1.4 Advection	• Practical • Project • Portfolio of evidence

	6.2 Modes of classification of heat exchangers 6.2.1 Shell and tube heat exchanger 6.2.2 Plate heat exchanger 6.2.3 Direct contact type 6.2.4 Indirect contact type 6.2.5 Single pass 6.2.6 Multi-pass 6.2.7 Tubular 6.3 Factors to consider when selecting heat exchangers 6.4 Application of heat transfer equations	• 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
	diesel fuel		25 ltrs	1:1
D	**Tools and Equipment**			
	Inspection instruments		5 pcs	1:5
	toolboxes		2 pc	1:13
	fuel testing kit		1 pc	1:25
	centrifugal pumps		2 pc	1:13
	displacement pumps		2 pc	1:13
	diffuser		1 pc	1:25