



KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2010/2011

SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF
SCIENCE (AGRICULTURE, CROP IMPROVEMENT AND CROP PROTECTION)

KST 103: PHYSICS FOR AGRICULTURALISTS

DATE: Tuesday 29th March 2011

TIME: 11.00a.m -1.00p.m

INSTRUCTIONS:

All candidates must attempt all the questions in section A, and any two questions in section B

Section A. Basic Physics; Answer all questions in this section. 40 Marks

1. a) Experimental measurements are the basis of establishing events and quantifying scientific parameters.
 - i) Identify and describe the two types of errors associated with measurements of scientific parameters in experiments. [4marks]
 - ii) Explain how the two types of errors can be reduced in practice. [4marks]
- b) Motion is caused by forces and the two are linked by Newton's Law of motion.
 - i) State Newton's second and third laws of motion. [4marks]
 - ii) Explain the meaning of Newton's second law of motion and list any properties introduced by the law. [4marks]
 - iii) Newton's third law is a special case of the second law. Explain. [4marks]
- c) Write short notes describing the following natural forces. Write down any equations associated with these forces.
 - i) Gravitational forces [4marks]

- ii) Electrical forces [4marks]
- d) Using kinetic theory of matter account for the three states of matter. [4marks]
- e) Electricity is the movement of charged particles.
 - i) List and discuss all modes of electrical conductance. [4marks]
 - ii) Using any equation(s) known to you derive expression for work and energy in the flow of electrical current. [4marks]

Section B. Applied Physics; Answer any two questions in this section. 30 Marks

- 2. a) Agriculture and energy
 - i) List at least two agricultural products and two agricultural wastes that are important sources of energy. [4marks]
 - ii) Identify the energy sources that can be classified as modular. Explain. [3marks]
 - iii) List the important physical properties that these energy sources have in common. [3marks]
 - iv) Discuss how any one of the energy sources listed above can be used for large scale energy production. [5marks]
- 3. Archie's equation, given below, relates electrical conductivity some of the properties of soils and porous media.

$$\rho = \alpha \phi^{-m} S^{-n} \rho_w$$

ρ is general resistivity, ρ_w is resistivity for the water in the pores of the media, ϕ is the porosity S is saturated and α constant.

- a) Discuss the meaning of this equation. [4marks]
- b) Sketch the laboratory experimental set up where this equation can be used in the laboratory for soil investigation. [4marks]

Archie's equation can also be applied to field investigations.

- c) Name the geophysical method in which this equation is relevant. [2marks]
- d) Explain how the field procedure is conducted. [5marks]
- 4. The earth like all elastic solid matter can transmit physical waves.

- i) Identify and distinguish the two main types of physical waves transmitted by the earth. [5marks]

A seismograph is the equipment that detects these waves.

- i) Sketch the main components of seismograph and explain how it works. [6marks]
- ii) Name the geophysical method that uses these earth waves for field investigation. [1mark]
- iv) Hence explain how this geophysical method can be used in the field investigation. [4marks]

5. The following two equations govern transfer of thermal energy.

a) $Q = \alpha AT^4$

b) $Q = -K \frac{dT}{dx}$

- i) What are the names of these equations? [2marks]
- ii) Label all variables that appear in these equations. [4marks]
- iii) What mode of energy transfer does each equation apply? [2marks]
- iv) Which of the two equations will apply in the design and fabrication of a green house? Explain [2marks]
- v) List other parameters that are important in the design of the green house. Explain. [5marks]