



MACHAKOS UNIVERSITY

University Examinations 2019/2020 Academic year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL SCIENCES

FIRST YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (APPLIED TECHNOLOGY)

SPH 107: INTRODUCTION TO APPLIED TECHNOLOGY

DATE: 6/12/2019

TIME: 2.00-4.00 PM

INSTRUCTIONS TO CANDIDATES

- I. This paper consists of **FIVE** questions. Answer **Question One** (compulsory) and any **TWO** questions from the rest of the questions.
- II. Cheating will lead to automatic disqualification.

IMPORTANT CONSTANTS

Acceleration due to gravity, $g = 9.81 \text{ N/kg}$

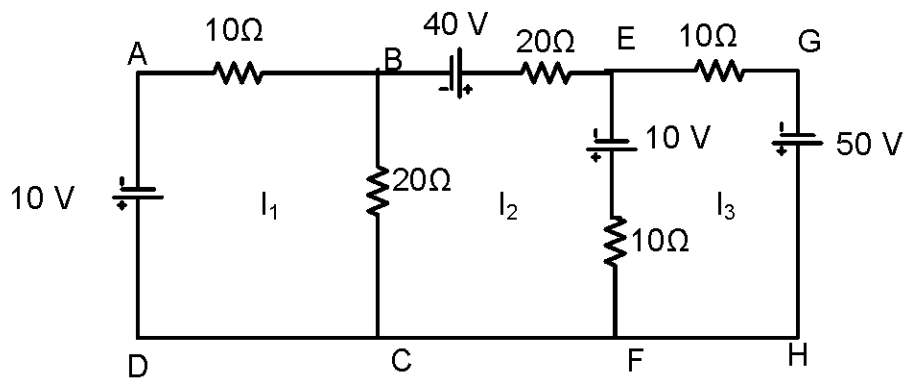
QUESTION ONE (30 MARKS)

- a)
 - i Draw a functional block diagram of a measurement system. (4 marks)
 - ii Define a sensor and give one example. (4 marks)
- b) State one distinct difference between an analogue instrument and a digital instrument. (2 marks)
- c) Describe photovoltaic effect with the aid of a diagram. (4 marks)
- d) Briefly distinguish between the following types of errors as used in instruments,
 - i. Gross error (2 marks)
 - ii. Systematic error (2 marks)
 - iii. Random error (2 marks)
- e) Describe the three main parts of a spherometer and describe its basic principle of operation. (4 marks)
- f)
 - (i) Identify the two main types of passive solar hot water thermal systems and state the difference in their operation. (4 marks)

- (ii) State two advantages of using solar energy as compared to nuclear energy? (2 marks)

QUESTION TWO (20 MARKS)

- a) What is a photovoltaic effect? (2 marks)
- b) (i) What is the principle of operation of a travelling microscope? (3 marks)
- (ii) State three advantages of a travelling microscope. (3 marks)
- c) Distinguish between a travelling microscope and a spherometer. (4 marks)
- d) Find I_1 , I_2 and I_3 in the network shown in figure below using loop current method. (8 marks)



QUESTION THREE (20 MARKS)

- a) Explain the following terms as applied static measurement systems.
- i. Hysteresis and (2 marks)
- ii. Resolution (2 marks)
- b) Distinguish with the aid of a diagram the following types of damping in instruments,
- i. Under damping (2 marks)
- ii. Over damping (2 marks)
- c) By way of diagrams and calculations, derive the expression of the radius of curvature measured in a spherometer. (6 marks)
- d) Explain how the least count is determined in the following instruments
- i. Vernier calipers. (3 marks)
- ii. Micrometer screw-gauge (3 marks)

QUESTION FOUR (20 MARKS)

- a)
 - i Distinguish between a primary transducer and a secondary transducer and give an example of each. (4 marks)
 - ii State four factors responsible in selection of a transducer. (4 marks)
- b) Describe how solar cells convert sunlight into electricity, preferably using a cross section sketch of a solar cell. (4 marks)
- c) Discuss two factors that affect the efficiency of a solar water heating system. (4 marks)
- d) A moving coil voltmeter has resistance of $100\ \Omega$. The scale is divided into 150 equal divisions. When potential difference of 1 V is applied to the terminals of the voltmeter a deflection of 100 divisions is obtained. Explain how the instrument could be used for measuring up to 300 V. (4 marks)

QUESTION FIVE (20 MARKS)

- a) Define the following terms as used in static characteristics of an indicating instrument,
 - i. Resolution (2 marks)
 - ii. Accuracy (2 marks)
 - iii. Precision (2 marks)
- b) A 0 – 2.5 A ammeter has a guaranteed accuracy of 1% of full scale reading. The current measured by this instrument is 10A. Determine the limiting error in percentage. (4 marks)
- c) Discuss the differences between non-renewable and renewable sources of energy. (4 marks)
- d) Discuss three main parts of a domestic solar hot water heating system. (6 marks)