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# KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS  
2016/2017 ACADEMIC YEAR

FOURTH YEAR SECOND SEMESTER  
SPECIAL/SUPPLEMENTARY EXAMINATIONS

FOR THE DEGREE OF B.ED (SCIENCE)

**COURSE CODE:** SPH 443

**COURSE TITLE:** MEASUREMENT & INSTRUMENTATION

**DURATION:** 2 HOURS

**DATE:** 18/10/2018

**TIME:** 3-5PM

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## INSTRUCTIONS TO CANDIDATES

- Answer **QUESTION ONE** (Compulsory) and any other two (2) Questions.
- Indicate **answered questions** on the front cover.
- Start every question on a new page and make sure question's number is written on each page.

This paper consists of 3 printed pages. Please Turn Over



KIBU observes ZERO tolerance to examination cheating

### QUESTION ONE (30mks)

1. a) Define the following terms as used in measurement and instrumentation (5mks)
  - i) Calibration
  - ii) Test instrumentation
  - iii) Transducer
  - iv) Sensor
  - v) Actuator
- b) State and explain any two types of standards. (4mks)
- c) State the similarities between Electronic Counters and Digital Voltmeters (4mks)
- d) Identify any three sensors an engineer is likely to use in measuring temperature. (3mks)
- e) Differentiate between determinate and indeterminate errors (2mks)
- f) Highlight any two main causes of random errors. (2mks)
- g) Define the term calibration (2mks)
- h) Explain any two methods of instrument calibration. (4mks)
- i) State and explain any two static characteristics of measuring instruments. (4mks)

### QUESTION TWO (20mks)

2. a) A 150-V DC voltage source is coupled to a 50 k $\Omega$  load resistor through a 100 k $\Omega$  source resistance. Two voltmeters (A) and (B) are available for the measurement. Voltmeter-A has a sensitivity 1000  $\Omega/V$ , while voltmeter-B has a sensitivity 20000  $\Omega/V$ . Both meters have 0 – 50 V range.
  - i) Calculate reading of each voltmeter. (4mks)
  - ii) Calculate error in each reading expressed in a percentage of the true value (4mks)
- b) In chemical process industries, the most commonly used temperature sensors are thermocouples, resistive devices and infrared devices. Briefly describe these devices. (12mks)

### QUESTION THREE (20mks)

3. a) What is a digital voltmeter (DVM) ? State any four advantages of the DVM. (5mks)
- b) Use a block diagram to illustrate the principle of operation of a digital voltmeter. (7mks)
- c) Using diagrams explain how the Analog to Digital Converter (ADC) works (8mks)

### QUESTION FOUR (20mks)

4. a) Using a well labeled diagram, explain the working mechanism of a wheatstone bridge in measuring resistance. Indicate its equivalent circuit configuration and show how it can be used to measure the output voltage. (10mks)

b) Briefly explain the AC voltmeters and show that the average power is equivalent to the power that would be generated by a DC current called the effective current i.e

$$I_{eff}=0.707I_m$$

(10mks)

**QUESTION FIVE (20mks)**

5. a) Using a flow diagram, describe the various elements of a generalized measurement system. (8mks)
- b) Describe the various sources of measurement of noise. (12mks)

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