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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:** 28<sup>TH</sup> SEPTEMBER 2017 **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 term 'unit of measurement' (2mks)
- 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)
- j) Identify any three types of systematic errors (3mks)

### 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  $I_{eff} = 0.707 I_m$  (10mks)

**QUESTION FIVE(20mks)**

5. a) Using a flow diagram, describe the various elements of a generalized measurement system. (6mks)
- b) Draw a well labeled schematic diagram of a cathode ray tube and highlight the functions of its four basic parts (8mks)
- c) Explain the various limitations of the Oscilloscope as a Measuring Instrument(6mks)

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