



KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2011/2012

SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF
SCIENCE IN ELECTRICAL AND ELECTRONICS ENGINEERING
EEE 208: ELECTRICAL MEASUREMENTS

DATE: Monday 16th April, 2012

TIME: 11.00 a.m. – 1.00 p.m.

INSTRUCTIONS

- Answer question one (1) which is compulsory and any other TWO questions.
- Start each question on a fresh page.
- Clearly show your working and label your diagrams.

1. a) Three quantities x, y and z were measured. The results, rounded to two significant

figures were

$$x = 3.4, y = 9.8, z = 9.3$$

Find the lower and the upper bounds of

(i) $y - z$

(ii) $\frac{x}{y-z}$ [5 marks]

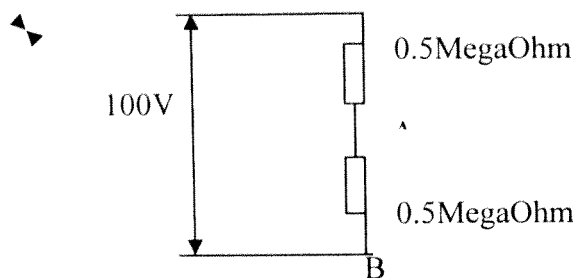
b) Distinguish between systematic errors and random errors and give an example in each case. [4 marks]

c) Distinguish between accuracy and precision. [2 marks]

d) Calculate the rms current for the following current $i(t) = 10 \cos(37.7)t$ A. [1 mark]

e) Draw the circuit for a Maxwell bridge and write the expression used to find the impedance and the unknown resistance. [5 marks]

- f) Draw the single diode halfwave rectification circuit and show the waveform for both the input and output voltage. Show how a capacitor can be connected to obtain a continuous output. [6 marks]
- g) What is the instrument used to measure electrical energy? [1 mark]
- h) The voltage at point A and B is to be measured. A constant 100V is impressed on the circuit as shown. Two meters are available for the measurement; a small volt ohm meter with an internal impedance of $100\,000\,\Omega$ and a range of 100 V and an EVM with an input impedance of $17\text{M}\Omega$.



Compare the error in measurements with each of these devices. [6 marks]

2. a) Draw the block diagram schematic of an oscilloscope. [7 marks]
- b) Draw a schematic diagram of a cathode ray tube (CRT) and explain how it works. [11 marks]
- c) An oscilloscope is used for a phase shift measurement. The measurements are
 $A = 2.5 \pm 0.05\text{ cm}$
 $B = 1.5 \pm 0.05\text{ cm}$
 Calculate the nominal value of the phase angle. [2 marks]
3. a) Draw the wheatstone bridge circuit for the measurement of resistance and hence derive the expression for finding the unknown resistance i.e $R_x = \frac{R_1 R_3}{R_2}$ [14 marks]

- b) For the basic wheatstone bridge, determine the uncertainty (error) in the measured resistance R_x as a result of an uncertainty of 1% in the known resistances. [6 marks]
4. Using a schematic diagram, describe the working principle of the following transducers.
- (a) Capacitive transducer [5 marks]
 - (b) Piezoelectric transducer [5 marks]
 - (c) Photoelectric effect transducers. [5 marks]
 - (d) Hall effect transducer [5 marks]
5. a) Using diagrams explain the working principle of:
- (i) moving iron (iron-vane) instrument.
 - (ii) Electrostatic voltmeter instrument. [16 marks]
- b) State and explain two shortcomings of analogue meters. [4 marks]

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