ROLL NO. _____

**Code: AE60 Subject: INSTRUMENTATION AND MEASUR E**

# AMIETE – ET

**Time: 3 Hours** **DECEMBER 2012** **Max. Marks: 100**

***PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.***

**NOTE: There are 9 Questions in all.**

- **Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.**
- **The answer sheet for the Q.1 will be collected by the invigilator after 45 minutes of the commencement of the examination.**
- **Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.**
- **Any required data not explicitly given, may be suitably assumed and stated.**

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**Q.1 Choose the correct or the best alternative in the following: (2×10)**

a. The reading of a thermometer is recorded as 23.90ºC. The reading has

**(A)** 3 significant figures **(B)** 5 significant figures
**(C)** 4 significant figures **(D)** None of these

b. A Wheatstone bridge cannot be used for precision measurements because errors are introduced on account of

**(A)** Resistance of connecting leads **(B)** Thermoelectric emfs
**(C)** contact leads **(D)** all of these

c. Precision measurement of capacitance is done using_____

**(A)** Maxwell's bridge **(B)** Hay's bridge
**(C)** Wheatstone's bridge **(D)** Schering's bridge

d. Which of the following transducer is passive type_____

**(A)** LVDT **(B)** thermocouple
**(C)** Solar cell **(D)** piezoelectric pickup

e. A 600 V voltmeter is specified to be accurate within ±2% at full scale. The limiting error when the instrument is used to measure a voltage of 250V is _____.

**(A)** 10% **(B)** 7.5%
**(C)** 1.25% **(D)** 4.8%

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f. The resolution of four and half digit voltmeter is _____

**(A)** 0.0001 **(B)** 0.00001
**(C)** 0.001 **(D)** 0.1

g. A thin aluminium film is usually deposited on the non viewing side of phosphor because _____

**(A)** it acts as heat sink and prevents Phosphor burn
**(B)** the light scatter from the phosphor is reduced
**(C)** it does not allow the screen to be negatively charged
**(D)** all of these

h. The true RMS meter averages the_____

**(A)** instantaneous current **(B)** squares of instantaneous current
**(C)** square root of instantaneous current **(D)** none of these

i. An instrument designed to measure relative amplitudes of single frequency components in complex wave form is _____

**(A)** wave analyser **(B)** spectrum analyser
**(C)** harmonic distortion analyser **(D)** audio analyser

j. Which of the following type sensor is made up of semiconductor material?

**(A)** Thermistor **(B)** RTD
**(C)** Thermocouple **(D)** none of these

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**Answer any FIVE Questions out of EIGHT Questions.**
**Each question carries 16 marks.**

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**Q.2** a. Distinguish between intelligent Instrumentation systems and dumb instrumentation systems with an example. **(4)**

b. A temperature sensitive transducer can be modeled as first order system with time constant of 8s. It is suddenly subjected to step input of 25 ºC-150 ºC. What temperature will be indicated in 10s after the process has started? **(4)**

c. Brief the following terms:

(i) Hysteresis (ii) Fidelity
(iii) Threshold (iv) Random errors **(8)**

**Q.3** a. Wheatstone bridge has ratio arms of 1000 Ohm and 100 Ohm, standard arm of 200 Ohm and unknown resistance arm of 2003 Ohm. The galvanometer is

connected from the junction of the ratio arms to opposite corners. The bat has an emf of 5 V and negligible internal resistance. The galvanometer ha current sensitivity of 10 mm/μA and an internal resistance of 100 Ohm. Calculate the deflection of galvanometer and the sensitivity of the bridge in terms of deflection per unit change in resistance **(6)**

b. The arms of 5 node bridge are as follows:
Arm AB: unknown impedance ($R_1$, $L_1$) in series with a non inductive variable resistor $r_1$.
Arm BC: a non inductive resistor $R_3$= 100 Ohm
Arm CD: a non inductive resistor $R_4$= 200 Ohm
Arm DA: a non inductive resistor $R_2$= 250 Ohm
Arm DE: a non inductive variable resistor r.
Arm EC: a loss less capacitor c = 1 μF and
Arm BE: a detector and ac supply is connected between A and C points. Calculate the resistance and inductance ($R_1$, $L_1$) when under balanced conditions of $r_1$ = 45.1 Ohm and r = 239.7 Ohm **(5)**

c. What are the different sources of errors in AC bridges? Explain the precaution taken and the techniques used for minimization of errors. **(5)**

**Q.4** a. Differentiate between moving iron and moving coil instruments. **(3)**

b. Explain any one of the method used for measuring very large currents. **(5)**

c. Two different voltmeters are used to measure the voltage across $R_b$ in the circuit shown in Fig.1. The meters are as follows
Meter1: S=1K Ohm/V, $R_m$=0.2K Ohm, range 10 V
Meter2: S=20K Ohm/V, $R_m$=1.5K Ohm, range 10 V.
Calculate:
(i) Voltage across $R_b$ without any meter across it
(ii) Voltage across $R_b$ with meter1 connected across it
(iii) Voltage across $R_b$ with meter2 connected across it
(iv) Error in voltmeters in % **(8)**

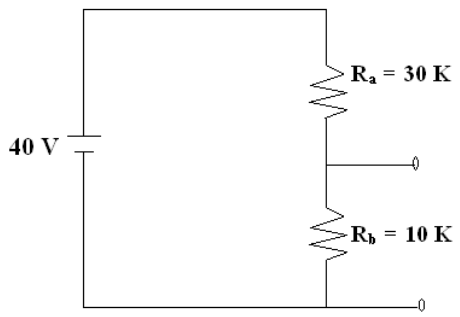


**Fig. 1**

**Q.5** a. In an integrating type digital voltmeter, the integrator consists of 100Kohm and 1 $\mu$F capacitor. If the voltage applied to integrator is 2V, what will be the output of integrator after 1s? **(4)**

b. Write short note on universal counter. (

c. Explain the working principle of a meter, which is used to measure the radiation intensity from a transmitting antenna at a given location. **(6)**

**Q.6** a. Explain the working principle of storage oscilloscope with it's applications. **(8)**

b. Explain the function generator with necessary sketches. **(8)**

**Q.7** a. A small AF voltage of 10 V is superimposed on the RF test power and balance is achieved. If the RF test power is now turned off, 30 V AF is required to balance the bridge. If the bridge arms has a resistance of 100 Ohm. Calculate the RF test power. **(5)**

b. How to measure standing wave ratio? **(3)**

c. Suggest a wave analyzer used to display a waveform in a frequency domain and explain its operation with neat sketch. **(8)**

**Q.8** a. Explain the null type recorder instrument with neat sketch and distinguish between single point and multi point recorders. **(8)**

b. What is XY recorder? How do you distinguish it from Digital Data recording? **(8)**

**Q.9** a. A resistance strain gauge with gauge factor of 1 connected to a steel member, which is subjected to a strain of $2 \times 10^{-6}$. If the original resistance value of gauge is 130 Ohm. Calculate the change in resistance. **(4)**

b. Explain the transducer that works on the principle of seebeck effect and also bring out the advantages and limitation for the same. **(8)**

c. Explain the computer based DAS. **(4)**