Code: AE60   **Subject: INSTRUMENTATION AND MEASUREMENTS**

AMIETE – ET

Time: 3 Hours   **DECEMBER 2014**   **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.**

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

a. A measure of the repeatability of a measurement of some quantity is

   (A) Accuracy   **(B)** Error
   (C) Reproducibility   **(D)** Precision

b. An integrator contains $100K \Omega$ and $1\mu F$ capacitor. If the voltage applied to the integrator input is 1V, then the output voltage of integrator after 1 second is _____

   (A) 10V   **(B)** 1V
   (C) 5 V   **(D)** 15 V

c. A digital voltmeter has a read-out range from 0-9,999 counts. The resolution of the instrument for full scale reading is 9.999V is _____

   (A) 11 mV   **(B)** 11 V
   (C) 1mV   **(D)** 1 V

d. Device similar to an RTD but has a negative temperature coefficient is _____

   (A) Strain Gauge   **(B)** Thermistor
   (C) Thermocouple   **(D)** Negative-type RTD

e. The value of the multiplier resistance on the 50V dc voltmeter that uses a $500\mu A$ meter movement with an internal resistance of $1K\Omega$ is _____

   (A) $2k\Omega$ **(B)** $20K\Omega$
   (C) 99Ω **(D)** $99K\Omega$

f. Capacitance can be measured by _____

    (A) Maxwell's bridge   **(B)** Schering bridge
    (C) Kelvin bridge   **(D)** Wien's bridge

g. An aquadag is used in a CRO to collect _____

    (A)   primary electrons
    (B)   secondary emission electrons
    (C)   both primary and secondary emission electrons
    (D)   none of these

h. X-Y recorders records _____

    (A)   one variable with respect to another variable
    (B)   one variable on X-axis with respect to time on Y-axis
    (C)   one variable on Y- axis with respect to time on X–axis
    (D)   none of these

i. The inductance of the coil using Q- meter can be calculated by the expression
  _____

    (A) $\dfrac{1}{2\pi f\ C}$ henry   **(B)** $\dfrac{1}{(2\pi f)^2 C}$ henry

    (C) $2\pi f\ C$ henry   **(D)** $(2\pi f)^2 C$ henry

j. A bolometer is used for the measurement of _____

    (A) transmission loss   **(B)** high voltages
    (C) micro-wave power   **(D)** VSWR

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

Q.2   a. What are 'systematic errors' in electric and electronic measuring instruments? Discuss these errors giving suitable examples.   **(8)**

       b. A voltmeter reading 70V on its 100V range and an ammeter reading 80 mA on its 150 mA range are used to determine the power dissipated in a resistor. Both these instruments are guaranteed to be accurate within $\pm 1.5\%$ at full scale deflection. Determine the limiting error of power.   **(8)**

Q.3   a. Find the equivalent series resistance and inductance of Rx and Lx at balance for a given bridge: **(6)**
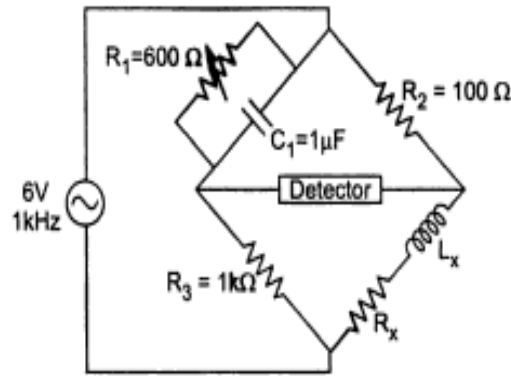
Fig.1

b. Derive the equations of balance for an Anderson's bridge. Draw the phasor diagram for the conditions under balance. Discuss the advantages and disadvantages of the bridge. **(10)**

Q.4 a. Explain the principle of operation of thermocouple. **(8)**

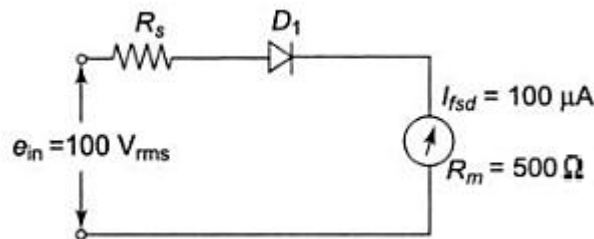b. Calculate the multiplier resistor required for a 100Vrms range on the voltmeter shown in given fig.2 **(8)**

Fig.2

Q.5 a. Explain the merits and limitations of DVM over analog voltmeter. **(8)**

b. Explain with the help of a neat diagram, the working of a digital frequency meter. **(8)**

Q.6 a. Explain the working of a square pulse generator. **(8)**

b. Explain the following with reference to a CRO:
   (i) Vertical amplifier
   (ii) Horizontal Deflection system **(8)**

Q.7 a. Explain with the help of a neat diagram, the working of a spectrum analyzer.**(8)**

b. Explain power measurement using Bolometer Bridge. Draw neat schematic diagram. **(8)**

Q.8   a. Explain the working of a potentiometric recorder.   **(8)**

b. Discuss in detail the objectives and requirements of recording data.   **(8)**

Q.9   a. Discuss the merits and limitations of RTDs.   **(8)**

b. Consider the following bridge circuit: **(8)**
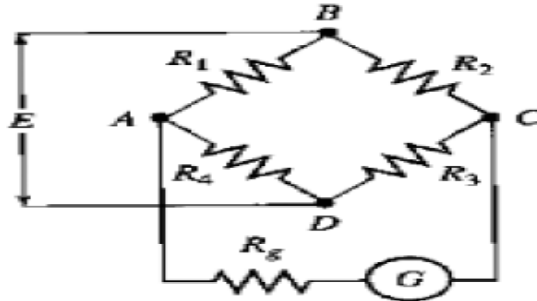

Fig.3

The galvanometer resistance is 75Ω. The strain gauge resistance $R_2 = R_3 = 120\Omega$ and $R_1 = 100\Omega$ at zero strain and the resistor R_4 is adjusted to balance the bridge at zero-strain conditions. The gauge factor is 2.5. Calculate the output voltage when the strain is 400×10^{-6}. Take the battery voltage as 9.0 V