Code: D-11   Subject: ELECTRONIC INSTRUMENTATION & MEASUREMENTS
Time: 3 Hours   Max. Marks: 100

NOTE: There are 11 Questions in all.

- **Question 1 is compulsory and carries 16 marks. Answer to Q. 1. must be written in the space provided for it in the answer book supplied and nowhere else.**
- **Answer any THREE Questions each from Part I and Part II. Each of these questions carries 14 marks.**
- **Any required data not explicitly given, may be suitably assumed and stated.**

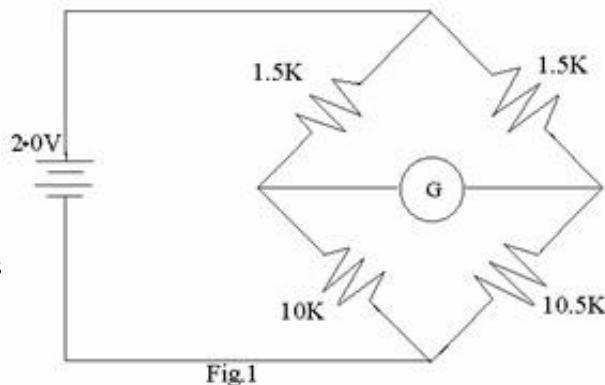**Q.1   Choose the correct or best alternative in the following: (2x8)**

   a.   A thermocouple is normally used to measure temperatures _____.

       (A) between $100^\circ C$ and $800^\circ C$.   **(B)** below $200^\circ C$.
       (C) above $500^\circ C$.   **(D)** above $2000^\circ C$.

   b.   A load cell is used in an arrangement in which _____ are available.

       (A) Steel bar on which strain gauges are attached.
       (B) Kelvin bridge along with a voltmeter.
       (C) Opamp along with bridge.
       (D) Copper bar on which flexible wires.

   c.   An opamp is advantageous because of _____ possible with it

       (A) high gain.   **(B)** low temperature coefficient.
       (C) high dissipation.   **(D)** high tensile strength and low
                                                            dissipation.

   d.   The signal conditioning system commonly used with a thermistor is _____ arrangement

       (A) an instrumentation amplifier.   **(B)** an opamp without feedback.
       (C) an opamp with feedback.   **(D)** a bridge.

   e.   The principle used in a stroboscope is that of a high intensity light which _____.

       (A) is focussed on a target.
       (B) is compared with another light of standard intensity.
       (C) flashes at precise intervals when directed on a rotating object.
       (D) rotates at a speed depending on a vibrating object.

f.   The principle of operation of a digital frequency meter is _____.

(A)   to count the digital signal which is the output of an A/D converter.
(B)   to count the trigger pulses from an oscillator.
(C)   to count the number pulses which are the output of an AND gate.
(D)   to count the number of pulses which are the output of an OR gate.

g.   Considering a radio receiver, its sensitivity indicates _____.

(A)   a response which is spurious.
(B)   the ability to reject an unwanted signal.
(C)   the measure of how much noise is produced.
(D)   the measure of the receiver's ability to pick up weak signals.

h.   The set up for the measurement of RF power by thermal method. Consists of
_____.

(A)   a transmitter, directional coupling, element and DC connector.
(B)   a variable attenuator, temperature sensor, crystal diode and meter.
(C)   a transmitter, variable attenuator and thermal bridge.
(D)   A thermal watt meter, element, D.C. connector and meter cable.

PART I
Answer any THREE Questions. Each question carries 14 marks.

Q.2   a.   What is 'linearity' as applied to instruments? On a graph sheet draw linear and nonlinear characteristics of an instrument.   **(7)**

   b.   Distinguish between gross errors and systematic errors in measurements.   **(7)**

Q.3   a.   Give the set up of a PMMC type of multimeter and explain how the name 'multimeter' is justified.   **(6)**

   b.   Give the basic diagram of a microprocessor based ramp-type digital voltmeter and explain its junction.   **(8)**

Q.4   a.   How does the Hay's bridge differ from the Maxwell's bridge? For the former derive the expressions at balance for the resistance and inductance of the unknown series RL combination.   **(8)**

   b.   Calculate the current through the galvanometer in the circuit diagram of Fig.1.   **(6)**

Fig.1

Q.5   a.   Dr[...] and explain its operation.   **(6)**

     b.   [...] ghts assigned to the LSB, also the change in the output voltage due to the change in the 3rd and 4th LSBs. Assume bit 0 = 0 V and bit 1 = 10 V.   **(8)**

Q.6   a.   Give one method each for the measurement of sensitivity and selectivity of a receiver.   **(8)**

     b.   Describe the bridged T-network type of harmonic analyser.   **(6)**

PART II
Answer any THREE Questions. Each question carries 14 marks.

Q.7   a.   Distinguish between

        (i)   Primary sensors and transducers
        (ii)   Piezoelectric and photoelectric transducers.   **(8)**

     b.   A resistance strain gauge with a gauge factor of 2.4 is connected to a steel member which is subjected to a strain of 1.8×10^{-4}. If the original resistance value of the gauge is $150\,\Omega$, calculate the change in the resistance.   **(6)**

Q.8   a.   Describe a time base generator used in the horizontal deflecting system of a CRO.   **(7)**

     b.   Explain the function of the delay line used in a CRO.   **(7)**

Q.9   a.   Give the block diagram of a sweep frequency generator and describe its working.   **(6)**

     b.   Give the block diagram of a conventional, standard signal generator. Also discuss its frequency stability and modulation aspects.   **(8)**

Q.10   a.   Distinguish between active and passive probes used in CRO's.   **(8)**

b.   With the help of a block diagram explain how frequency is measured using an electrodynamometer type frequency meter.
(6)

Q.11   Write short notes on any **TWO** of the following: **(7 + 7)**

(i)   Hall effect displacement transducers.
(ii)   Measurement of flux by induced emf.
(iii)   Bolometer method of power measurement..