Time:- 03 Hours   **Max. Marks:- 80 Marks**

(i) Question No. 1 is compulsory & attempt any three out of the remaining five questions.

(ii) Assume suitable data if required but justify it logically wherever applicable.

(iii)Figures to the right indicate full marks & every sub-question from Q.2 to Q.6 has equal weightage.

Q.1 <u>ATTEMPT ANY FOUR (04)</u> :-

(a) Define the following dynamic characteristics of instruments & mention for which types of measurements they have to be considered?
(i) Speed of Response
(ii) Lag
(iii) Fidelity
(iv) Dynamic Error

(b) Draw a neat circuit diagram of LCR – Q meter & explain its operating principle.

(c) Explain the function of delay line in cathode ray oscilloscope (CRO) with neat diagram.

(d) Describe operating principle of heterodyne wave analyzer with a neat block diagram.

(e) With a neat diagram, explain the principle of digital time measurement.

(f) Describe in brief, the classification / types of transducers.

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Q.2 (a) The true value of the voltage across a resistor in a circuit is 10 V when it is calculated by mathematical analysis. Measuring the same voltage by six different random individuals (but all with the same digital multimeter) gives the following results as shown :-

Observation No.	Measured Values
1	10.25 V
2	10.05 V
3	9.9 V
4	9.95 V
5	10.15 V
6	9.85 V

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(i) Calculate the percentage error for the fourth observation.

(ii) Calculate the accuracy for the second observation.

(iii) Determine the precision of the fifth observation.

(iv) Calculate the standard deviation (σ) for the above observations.

(v) Calculate the average deviation (d_{avg}) for the above observations.

(b) Draw a neat labeled circuit diagram of Wien Bridge & derive the mathematical expression for the unknown AC source frequency.

Q.3 (a) Explain the basic cathode ray oscilloscope (CRO) with neat labeled block diagram & describe all its individual sections briefly.

(b) Explain how Lissajous patterns / figures are used for measurement of an unknown frequency & phase shift using a cathode ray oscilloscope (CRO) with neat labeled diagrams.

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Q.4 (a) With neat labeled block diagram, describe the construction & operation of a ramp type digital voltmeter (DVM) with appropriate waveforms.

(b) With neat labeled block diagram, describe the spectrum analyzer construction & operation.

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Q.5 (a) Write a short note on the linear variable differential transformer (LVDT) with reference to its construction, operation / working & characteristics while mentioning its applications.

(b) Explain the ultrasonic level measurement transducer with a neat block diagram with respect to construction & operation.

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Q.6 (a) Describe the rotameter transducer for the measurement of flow with a neat diagram. What are its advantages & disadvantages ?

(b) How are thermistors (thermally sensitive resistors) different from the resistance temperature detectors (RTD) although both of them use same operating principle of converting temperature variations (ΔT) into resistance variations (ΔR) ? Describe construction, operation, characteristics & applications of thermistors with neat sketch wherever necessary.

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