

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 ATTEMPT ANY FOUR (04) :-**

- (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 ( $\sigma$ ) 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. 20

**Q.4** (a) With neat labeled block diagram, describe the construction & operation of a ramp type digital voltmeter (DVM) with appropriate waveforms. 20

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

**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. 20

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

**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 ( $\Delta T$ ) into resistance variations ( $\Delta R$ ) ? Describe construction, operation, characteristics & applications of thermistors with neat sketch wherever necessary. 20

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