Time: 3 hrs   Max. Marks: 100

*Note: i) Answer **FIVE** full questions, selecting at least **ONE** full question from each **unit**.*
ii) Missing data may suitably be assumed.

UNIT - I

1 a. Define the following terms with respect to the systematic Errors :

   i) Instrumental Errors   ii) Environmental Errors   iii) Observational Errors.   6

   b. A voltmeter having a sensitivity of 1 kΩ/V is connected across an unknown resistance in series with a millimeter reading 80 V on 150 V scale. When the millimeter reads 10 mA? calculate;

   i) Apparent value of the unknown resistance   6

   ii) Actual value of the unknown resistance

   iii) Error due to the loading effect of the voltmeter.

   c. Two different voltmeters are used to measure the voltage across 'R_b' in the circuit of Fig. 1(c) below.

Fig. 1(C)

8
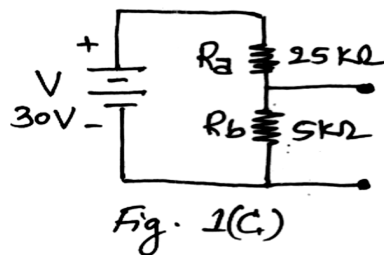
The meters are as follows:

Meter 1 : S = 1 kΩ/V, R_m = 0.2 k range 10 V,

Meter 2 : S = 20 kΩ/V, R_m = 1.5 k, range 10 V

Calculate; i) Voltage across 'R_b' without any meter across it

          ii) Voltage across 'R_b' when the meter 1 is used

          iii) Voltage across 'R_b' when the meter 2 is used

          iv) Error in the voltmeter.

2 a. Draw and explain the concept of AC voltmeter using Bridge Rectifier. Mention necessary details.   10

   b. Draw and describe the block diagram of Ramp type Digital voltmeter.   10

UNIT - II

3 a. Draw the circuit diagram and derive the equation for the unknown value of resistance using the Wheatstone's Bridge. Find the value of 'R_x' for the following parameters R_1 = 10 kΩ; R_2 = 15 kΩ; R_3 = 40 kΩ.   10

b. Describe the working of Inductance comparison Bridge, with the help of circuit diagram and necessary equations. 6

c. A capacitance comparison bridge is used to measure capacitive impedance at a frequency of 2 kHz. The bridge constants at balance are $C_3 = 100$ μF, $R_1 = 10$ kΩ, $R_2 = 50$ kΩ, $R_3 = 100$ kΩ. Find the equivalent series circuit of the unknown impedance. 4

4 a. A Maxwell's, Bridge is used to measure inductive impedance, the bridge constants balance are: $C_1 = 0.01$ μF, $R_1 = 470$ kΩ, $R_2 = 5.1$ kΩ, $R_3 = 100$ kΩ. Find the series equivalent of the unknown impedance. 4

b. Justify how the losses of inductor or 'Q' value being less than 10 is not suited for measurements of coils using Hay's Bridge. Draw the circuit diagram and derive the necessary equations. 10

c. Write a short notes on Wagner's Earth connection. 6

UNIT - III

5 a. What are the parameters to be considered while selecting a Transducer? 4

b. Describe the working principle of Resistive Position Transducer along with its constructional details. 8

c. Draw and briefly discuss semiconductor strain Gauge. Mention its advantages and disadvantages. 8

6. a. What is Thermistor? With a neat sketch, depict various configurations of Thermistors. Also list out the advantages of Thermistor. 10

b. Discuss the functioning of variable Reluctance Transducer with a neat diagram. Specify the equation of self Inductance of coil 'L' and the reluctance of Air Gap 'R_g" Also draw the circuit of variable Reluctance Bridge. 10

UNIT - IV

7 a. Mention the construction of Photo Conduction cells with a neat diagram. Draw the typical curve of Resistance versus illumination. 10

b. A certain crystal has a coupling coefficient of 0.32. How much electrical energy must be applied to produce an output of 1 oz.in. of mechanical energy. 4

c. Write a short note on 7-segment LCD character. 6

8 a. Draw and explain the block diagram of conventional standard signal Generator. 10

b. Briefly Discuss the Audio frequency sine and square wave Generator with a neat diagram. List out the front panel control knobs/switches present on signal generator. 10

UNIT - V

9 a. Draw the block diagram of sampling oscilloscope along with neat waveforms. 10

b. Briefly describe Passive Voltage (High-Z) CRO probe with 10:1 probe equivalent circuit. 10

10a. Write a short note on Heterodyne wave Analyzer. 10

b. Explain the following methods with respect to Harmonic Distortion Analyzer : 10
   i) Resonance Bridge Method ii) Wein Bridge method.

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