B. Tech-4th (EE)

Measurement & Instrumentation

Full Marks : 50

Time : $2\frac{1}{2}$ hours

Answer **all** questions

The figures in the right-hand margin indicate marks

Symbols carry usual meaning

1. Answer *all* questions : 2×5

(*a*) Mentioned the essential features of indicating instruments.

(*b*) Illustrate the use of correction factor in Wattmeter.

(*c*) Demonstrate the sources of error present in Bridge circuit.

(*d*) What factor must be considered for the operation of AC potentiometer ?

(*e*) The gauge factor of a resistance wire strain gauge using a soft iron wire of small diameter is 4.2 Neglect the Piezo-resistive effect, calculate the Poisson's ratio.

2. (*a*) Discuss how a Moving Iron Type instrument enlists as a linear instrument. 4

(*b*) A milliammeter of 2.5 ohms resistance reads up to 100 milliamperes. Calculate the resistance which is necessary to enable it to be used as :

(*i*) A voltmeter reading up to 10V

(*ii*) An ammeter reading up to 10A.

Draw the connection diagram in each case. 4

Or

(a) What is the need of controlling torque in indicating instrument ? Mentioned the various types of controlling torque. 6

(b) Why permanent magnet moving coil is not suitable for AC supply ? 2

3. (a) Explain the behavior of electrodynamometer type wattmeter for AC input. 4

(b) What changes are incorporated in the wattmeter for measuring power in a circuit having low Power factor ? 4

Or

(a) Describe the construction and working of a ballistic galvanometer. 6

(b) Explain the difference in constructional details of a ballistic galvanometer and a D' Arsonval galvanometer. 2

4. (*a*) Draw a neat diagram of Kelvin double bridge and explain how to measure low resistance. 5

(*b*) Write the necessary balance condition for a Schering bridge. 3

Or

(*a*) An AC bridge has the following constants arm AB-Capacitor of 0.5μ F in parallel with 1KΩ resistance, Arm AD-resistance of 2 KΩ. Arm DC-Capacitor of 0.5μ F. Arm CD-Unknown C_x and R_x in series, frequency- 1KHz. Determine the unknown capacitance, resistance and dissipation factor. 4

(*b*) Discuss the term low, medium and high resistance. Suggest various methods for measuring them giving justification. 4

(*a*) A basic slide wire potentiometer has a working battery voltage of 3.0V with negligible resistance of the slide wire is 400 ohm and its length is 200 cm. a 200 cm scale is placed along the slide wire. The slide wire has 1mm scale divisions and it is possible to read upto 1/5 of the division. The instrument is standardized with 1.018V standard cell with sliding contact at 101.8cm work on scale. Calculate.

(*I*) Working cutrent

(*II*) Resistance of series rheostat.

(*III*) Measurement range

(*IV*) Resolution of instrument. 4

(*b*) Briefly explain how you will calibrate a given wattmeter in the laboratory using a DC potentiometer. 4

Or

(*a*) Draw the equivalent and phasor diagram of current transformer. 4

(*b*) The primary winding of a 1000/5A, 50 Hz current transformer has a single turn. Its secondary burden consists of a non-inductive impedance of 1.4 ohm. If the iron loss in the core is 1.4 W at full load and magnetizing *mmf* is 80 AT. Then calculate :

(*I*) Flux in the core

(*II*) Ratio error in full load.

Neglect leakage reactance. 4

6. (*a*) Describe briefly a digital multimeter with the help of block diagram. 4

(*b*) Explain working principle of capacitive transducer along with its application. 4

Or

(*a*) Illustrate the theory of strain gauge with proper derivation. 4

(b) A strain gauge is bounded to a beam which is 12 cm long and has a cross-sectional area of 3.8 cm^2. The unstrained resistance and gauge factor of the strain gauge are 220 ohm and 2.2 respectively. On the application of the load of the resistance of the gauge change by 0.015 ohm. If the modulus of elasticity for the steel is 207 GN/m^2, calculate :

(*I*) The change in length of steel beam

(*II*) The amount of force applied to the beam. 4