Total No. of Questions—12]   [Total No. of Printed Pages—4+1

[3662]-145

S.E. (Electrical) (I Sem.) EXAMINATION, 2009

ELECTRICAL MEASUREMENT AND INSTRUMENTATION

(2008 COURSE)

Time : Three Hours   Maximum Marks : 100

N.B. :— (i) Answer any *three* questions from each Section.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

(v) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(vi) Assume suitable data, if necessary.

SECTION I
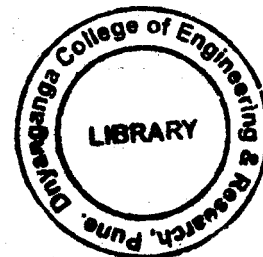
1. (a) Explain :   [6]

    (i) Speed of response

    (ii) Drift

    (iii) Reproducibility.

  (b) Explain construction and working of permanent magnet moving coil instrument, comment on shape of scale.   [6]

P.T.O.

(c) A moving coil voltmeter with a resistance of 20 Ω gives a full scale deflection of 120° when a potential difference of 100 mV is applied across it. The moving coil has dimensions of 30 mm × 25 mm and is wound with 100 turns. The control spring constant is 0.375×10^{-6} Nm/deg. Find the flux density in the air gap. Find also the diameter of Cu wire of coil winding if 30% of instrument resistance is due to coil winding. The specific resistance for copper 1.7×10^{-8} Ωm. [6]

Or

2. (a) Which *three* forces are required for satisfactory operation of an analog indicating instrument ? State the function of each force. [6]

(b) Explain construction and working of Repulsion type moving iron instrument, comment on shape of scale. [6]

(c) The coil of moving coil voltmeter is 40 mm × 30 mm wide has 100 turns wound on it. The control spring exerts a torque of 0.25×10^{-3} N-m, when the deflection is 50 divisions on the scale. If the flux density of magnetic field in the air gap is 1 Wb/m², estimate the resistance that must be put in series with coil to give 1 volt/div. Resistance of voltmeter is 10,000 Ω. [6]

3. (a) Explain the working construction of Kelvin's Double Bridge. Derive the expression to find the unknown resistance. [10]

(b) Give practical examples of low, medium and high resistances. Also describe the difficulties faced and remedies followed in measurement of low and high resistance. [6]

Or

4. (a) Derive the general equation for a.c. bridge at balance. [4]

(b) Explain the working construction of Anderson's Bridge. Derive the expression to find the unknown inductance, draw vector diagram. [6]

(c) A 1000 Hz bridge has the following constants :

Arm ab : 1000 Ω in parallel with C_1 = 0.5 μF.

bc : 1000 Ω in series with C_3 = 0.5 μF.

cd : L_4 = 30 mH in series with R_h = 200 Ω.

Find the constants of da to balance the bridge. Express your results as a pure resistance R in series with a pure inductance or capacitance. [6]

5. (a) Two wattmeter method is used for measurement of total power in a balanced circuit supplied from 400 V, 3-phase balanced supply. Calculate the total power, line current, power factor of the load if : [8]

(i) Both readings are 4 kW each.

(ii) Both readings are 4 kW but have opposite signs.

(iii) One reading is 4 kW and other reading is zero.

[3662]-145   3   **P.T.O.**

(*b*) Explain one wattmeter and two way switch method to measure active and reactive power measurement. Draw phasor diagram. [8]

Or

6. Explain block diagram and operation of the following digital meters (any *two*) : [16]

(*i*) Power factor meter

(*ii*) Tri-vector meter

(*iii*) Frequency meter

(*iv*) Power analyser.

SECTION II

7. (*a*) The meter constant of a 230 volt, 10 Amp., single-phase energy meter is 1800 rev/kWh. The meter is tested at half load, rated voltage and unity power factor. The disc of meter completes 80 revolutions in 138 seconds. Determine the meter error at this load. [6]

(*b*) What are the disadvantages of shunt and multiplier when it is used for measurement of a.c. high current and voltage ? [6]

(*c*) Explain the lag error and its adjustment in an induction type energymeter. [6]

Or

8. (*a*) Prove that the total number of revolutions made by an induction type energy meter is proportional to energy consumed. [8]

(*b*) Explain electronic energy meter with neat sketch. [6]

(c) Why should CT secondary not be kept open when primary is energised ? [4]

9. (a) What are Lissajous figures ? How can these be used to measure frequency and phase angle ? [8]

(b) What is the base for classification of pressure measurement ? How can the pressure be measured using piezoelectric transducer ? [8]

Or

10. (a) Explain Pirani gauge with neat sketch for measurement of vacuum pressure. [8]

(b) What is a transducer ? Give the detailed classification of transducer. [8]

11. (a) With neat sketch explain the construction and working of LVDT. State its advantages and disadvantages. [8]

(b) What are the different electrical methods used for measurement of level ? Explain any *one*. [8]

Or

12. (a) Explain ultrasonic method and electromagnetic method for flow measurement with neat sketch. [8]

(b) What is a strain gauge ? How is it classified ? Explain any *one* type of strain gauge in detail. [8]