Total No. of Questions—**12**] [Total No. of Printed Pages—**7**

[4062]-144

S.E. (Electrical) (I Sem.) EXAMINATION, 2011

ELECTRICAL MEASUREMENTS AND INSTRUMENTATION

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

N.B. **:—** (*i*) Answer *three* questions from Section I and *three* questions from Section II.

(*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 in detail the classification of the measuring instruments. [8]

(*b*) With a neat sketch describe construction and working of PMMC instrument. Derive the torque equation for this instrument. Comment on shape of scale. [10]

P.T.O.

Or

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

(*b*) What are shunts and multipliers ? What are the disadvantages of shunt ? [6]

(*c*) The inductance of a moving iron ammeter is given by the expression $L = (12 + 5\theta - 2\theta^2)$ mH, where θ is the angular deflection in radians from zero position. Determine :

(*i*) the spring constant

(*ii*) the angular deflection in radians for a current of 10 A, if the deflection for a current of 5 A is 30°. [6]

3. (*a*) Draw circuit diagram of Kelvin's double bridge. Derive expression for unknown resistance with usual notations. [8]

(*b*) In a Maxwell's inductance comparison bridge arm *ab* consists of a coil with inductance L_1 and resistance r_1 in series with a non-inductive resistance R. Arm *bc* and *cd* are each a non-

inductive resistance of 100 W. Arm *ad* consists of standard variable inductor L of resistance 32.7 W. Balance is obtained when L_2 = 47.8 mH and R = 1.36 W. Find the resistance and inductance of the coil in the arm *ab*. [4]

(*c*) The four impedances of an bridge are :

Z_1 = 400 W Ð 50°, Z_2 = 200 W Ð 30°, Z_3 = 800 W Ð –50°, Z_4 = 400 W Ð –40°.

Find out whether the bridge is balanced under these conditions. [4]

Or

4. (*a*) Write a short note on megger and earth tester. [8]

(*b*) Draw circuit diagram of Anderson's bridge. Derive the equation for unknown inductance and draw the phasor diagram. [8]

5. (*a*) Explain two wattmeter method for measuring power in a (R + L) load. Draw the phasor diagram. [8]

(*b*) Write a short note on digital multi-meter. [8]

Or

6. (*a*) A wattmeter reads 5 kW when its current coil is connected in red phase and its voltage coil is connected between neutral and red phase of symmetrical 3-phase system supplying a balanced three-phase inductive load of 25 A at 440 V. What will be the reading of the wattmeter if the connections of current coil remain unchanged and voltage coil be connected between blue and yellow phases ? Hence determine the total reactive power in the circuit. Draw the diagram in both the cases. [8]

(*b*) Write a short note on LPF type wattmeter. [4]

(*c*) What are the errors in dynamometer type wattmeter ? How are these errors compensated ? [4]

SECTION II

7. (*a*) An energy meter has constant of 3200 imp/kWh rated for 220 V, 5 A. Calculate total number of impulses in one minute for full load at unity power factor. In a test run at half

load, the meter takes 59.5 sec to complete 30 impulses, calculate error of meter. [6]

(*b*) Derive torque equation of single-phase induction type energy meter with the help of phasor diagram. [8]

(*c*) Show a neat connection diagram of a three-phase energy meter used for measurement of energy incorporating CT and PT. [4]

Or

8. (*a*) A 230 V single-phase energy meter has constant load of 5 A passing through it for 8 hours at 0.9 P.F. If the meter LED makes 26500 impulses during this period, find the meter constant in imp/kWh. Calculate the power factor of the load if the number of impulses are 11230 when operating at 230 V and 6 A for 5 hours. [6]

(*b*) Which are the possible errors in an induction type single phase energy meter explain and give compensation for the errors ? [4×2]

(*c*) What is creeping error in an induction type energy meter ? How is it overcomed ? [4]

9. (*a*) Describe low pressure measurement by McLeod guage. [8]

(*b*) In an experiment, the voltage across a 10 kW resistor is applied to CRO. The screen shows a sinusoidal signal of total vertical occupancy 3 cm and total horizontal occupancy of 2 cm. The front panel controls of V/div and time/div are on 2 V/div and 2 ms/div respectively. Calculate the rms value of the voltage across the resistor and its frequency. Also find rms value of current. [6]

(*c*) Explain vacuum pressure. [2]

Or

10. (*a*) Explain pressure capacitance transducer with a neat diagram. Write advantages and disadvantages of capacitive transducer. [8]

(*b*) Explain front panel controls of CRO : [8]

(1) Time/div

(2) Volt/div

(3) dual ch.

(4) invert

(5) x-position

(6) y-position

(7) xy-mode

(8) CH1 CH2.

11. (*a*) Explain any *two* types of head type flowmeters. [8]

(*b*) Explain level measurement by mechanical method. [8]

Or

12. (*a*) Explain construction, working and application of load cell with a neat diagram. [8]

(*b*) Describe displacement measurement by LVDT in detail. [8]