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306404

May, 2019

B.Tech. EIC IV SEMESTER,

ELECTRICAL MEASUREMENT AND INSTRUMENTATION (EI403)

Time : 3 Hours] [Max. Marks : 75

Instructions :

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

PART–A

1. (a) Explain the consequences of loading effect in general Electrical instruments. (1.5)

(b) Define dissipation factor. (1.5)

(c) Explain why PMMC instruments are the most widely used instruments. Discuss their advantages and disadvantages. (1.5)

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(d) Describe the function of shunt and series magnet in single phase induction type energy meter. (1.5)

(e) Explain why Electrodynamometer type of instruments can be used both on A.C. and D.C.? (1.5)

(f) What are the difficulties encountered in measurement of high resistances? (1.5)

(g) Why the phase of shunt flux is made exactly in quadrature with that of applied voltage so as to produce a deflecting torque exactly proportional to power? (1.5)

(h) Describe the advantages of Instrument Transformers (1.5)

(i) Differentiate between Recording and Integrating Instruments. Give Suitable example in each case. (1.5)

(j) Classify the resistances from the point of view of measurements. (1.5)

PART–B

2. (a) A PMMC ammeter has an internal resistance of 25 Ω and carries a full deflection current of 1 mA.

(i) How much of the shunt resistance is required to measure a current of 100 mA? Also find the error in the measurement of the current due to temperature rise of 10°C.

(ii) If a swamp resistance is made of mangnin having a value of 75Ω is added in series with the meter, find the new value of the shunt resistance and the error in the measurement of current due to temperature rise of 10°C.

Given : - Temperature coefficient of Cu = 0.004/°C and Mangnin = 0.00015/°C. (10)

(b) Discuss the main sources of errors in Moving Iron instruments. Explain their advantages and disadvantages. (05)

3. (a) A voltage $v(t) = 100 \sin \omega t + 40 \cos (3 \omega t - 30°) + 50 \sin (5\omega + 45°)$ V is applied to pressure coil of wattmeter and through the current coil is passed a current of $i(t) = 8 \sin \omega t + 6 \cos (5 \omega t - 120°)$ A. Find the wattmeter reading. What %age of this power is due to the fundamental harmonics? (05)

(b) Prove that electrodynamometer type of wattmeters

True Power = $[\cos \phi / \cos \beta \cos (\phi - \beta)] \times$ actual watt meter reading

where $\cos \phi$ = power factor of the circuit and $\beta = \tan^{-1}(\omega L/R)$

L and R are the inductance and resistance of the pressure coil. Explain why errors are large when power factor is low. (10)

4. (a) The inductance of a moving iron ammeter is given by $L = (0.01 + C\theta)^2$ mH; where θ is the deflection from zero position in degree. The angular deflections of the instrument corresponding to 1.5 A and 2 A are respectively 90° and 120°. Find the value of C. (08)

(b) Explain why Maxwell's Inductance – Capacitance Bridge is useful for measurement of inductance of coils having storage factor between 1 and 10.

5. (a) Define instrument transformer. Explain ratio error and phase angle error in CT. (07)

(b) Derive the expression for driving Torque in a single phase Energy Meter. (08)

6. (a) Explain the function of following component in induction type energy meter :

(i) Driving system

(ii) Moving system

(iii) Breaking system

(iv) Counting mechanism. (08)

(b) What is Hall effect? Describe construction, working principle and applications of hall effect transducer. (07)

7. (a) An electrically deflected CRT has a final anode voltage of 2 kV and parallel deflecting plates 1.5 cm long and 5 mm apart. If the screen is 50 cm from the center of the deflecting plates, find

(i) beam Speed.

(ii) the deflection sensitivity of the tube.

(iii) the deflection factor of the tube. (07)

(b) Sketch a range-changing circuit for a Digital Volt Meter, and explain how it operates? (08)
