Printed Pages : 4 TEE-302

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2048 Roll No.

B. Tech.

(SEM. III) EXAMINATION, 2007-08

ELECTRICAL MEASUREMENTS & MEASURING INSTRUMENTS

Time : 3 Hours] *[Total Marks : 100*

*Note : Attempt **all** questions. All questions carry **equal** marks.*

1. Attempt any **two** parts of the following : 2×10=20

(a) Prove that the true power :

$$= \left[\frac{\cos\phi}{\cos\phi \cos(\phi - \beta)} \times \text{Actual wattmeter reading} \right]$$

where, $\cos\phi$ = power factor of the circuit

$$\beta = \tan^{-1}\left(\frac{wL}{R}\right),$$

L and R are the inductance and resistance of the pressure coil of the wattmeter.

Explain why errors are large, when power factor is law.

(b) A three phase, 400 V delta connected system has the loads (1) branch AB, 20 kW at unity power factor; (2) branch BC, 30 kVA at 0.8 power factor lag (3) branch CA, 20 kVA at 0.6 power factor lead. Find the line currents and readings on wattmeter whose current coils are in lines A and B.

(c) Derive the expression for deflecting torque in single phase induction type meters. Show that the deflection is maximum when the phase angle between two fluxes is 90° and when the disc is purely non-inductive.

2. Attempt any two parts of the following : 2×10=20

(a) A current transformer with a bar primary has 300 turns in its secondary winding. The resistance and reactance of the secondary circuit are 1.5 Ω and 1.0 Ω respectively including the transformer winding. With 5A flowing in the secondary winding, the magnetizing mmf is 100 A and the iron loss is 1.2 W. Determine the ratio and phase angle errors.

(b) Describe the effect of the following on the characteristics of a potential transformer :
(1) Burden (VA) of secondary winding circuit
(2) Power factor of secondary winding circuit
(3) Frequency.

(c) What are the different methods of measurement of frequency in the power frequency range. Explain the working of a mechanical resonance type frequency meter.

3. Attempt any two of the following : 2×10=20

(a) Explain the loss of charge method for measurements of insulation resistance of cables. A cable is tested by loss of charge method using a ballistic galvanometer with following results : Discharged immediately after electrification, deflection 200 divisions. Discharged after 30 sec. and after electrification :

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(i) Deflection 126 divisions

(ii) When the parallel with a resistance of $10\ M\Omega$, deflection 100 divisions. Calculate the insulation resistance of the cable.

(b) An Owen's bride is used to measure the properties of a sample of sheet steel at 2 kHz. At balance, arm ab is test specimen, arm bc is $R_3 = 100\ \Omega$, arm cd is $C_4 = 0.1\ \mu F$ and arm da is $R_2 = 834\ \Omega$ in series with $C_2 = 0.124\ \mu F$. Derive balance conditions and calculate the effective impedance of the specimen under test conditions.

(c) What are the modifications and additional features incorporated in a low voltage Schering bridge for it to be used on high voltages ? Explain. Describe how relative permittivity of a specimen of insulating material can be determined using a Schering bridge.

4. Attempt any **two** parts of the following : 10×2

(a) Draw the circuit diagram of a Crompton's potentiometer and explain its working. Describe the steps used when measuring an unknown resistance.

A co-ordinate type potentiometer is used for determination of impedance of a coil and the results obtained are :

Voltage across a $1.0\ \Omega$ resistor in series with the coil : + 0.238 V on in-phase dial and –0.085 V on quadrature dial. Voltage across a 10:1 potential divider used with the coil : + 0.3375V on in-phase dial and + 0.232 V on quadrature dial. Calculate the resistance and reactance of the coil.

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(b) Describe with the help of suitable diagrams, how a d.c. potentiometer can be used for :
(i) Calibration of voltmeter
(ii) Calibration of ammeters
(iii) Calibration of wattmeter
(iv) Determination of resistance.

(c) Describe the method of experimental determination of flux density in a specimen of magnetic material using a ballistic galvanometer. Explain how the correction for flux in the air space between the specimen and the coil is applied. In a test on a specimen of total weight 13 kg the measured values of iron loss at a given value of peak flux density were 17.2 W at 40 Hz and 28.9 W at 60 Hz. Estimate the values of hysteresis and eddy current losses at 50 Hz.

5. Attempt any **two** parts of the following : **10×2=20**

(a) Describe in detail the construction and working of an analog type storage Oscilloscope. Explain the principle of secondary emission.

A CRT has an anode voltage of 2000 V and parallel deflecting plates 2 cm long and 5 mm apart. The screen is 30 cm from the centre of the plates. Find the input voltage required to deflect the beam through 3 cm. The input voltage is applied to the deflecting plates through amplifiers having an overall gain of 100.

(b) Draw and explain the circuit of a digital frequency meter. What are the different methods used for high frequency determination ?

(c) Describe the functioning of a diode matrix for conversion of BCD system to decimal readout. Give the over view of different digital display devices.