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

PAPER ID : 2048 Roll No.

B. Tech.

(SEM. III) EXAMINATION, 2008-09
ELECTRICAL MEASUREMENTS & MEASURING INSTRUMENTS

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

Note : *Answer **all** five questions.*

1 Answer any four parts : 5×4=20

(a) Define the term "standards' in measurement system. How are they classified ?

(b) Find the value of $(R_1 + R_2)$. Considering the errors in their values as standard deviation when

$$R_1 = 100 \pm 2\%\ \Omega,\quad R_2 = 200 \pm 2.5\%\ \Omega.$$

(c) The meter constant of a single-phase 240 V energy meter is 400 revolutions per kWh. What is speed of the meter disc for a current of 10 amperes at 0.8 p.f. lagging ?

(d) The ratio of the reading of two wattmeters connected to measure power in a balanced 3-phase load is 5:3 and the load is capacitive. Calculate the power factor of the load.

(e) Discuss the effect of
(i) Waveform of input voltage and
(ii) Resistance of diodes on the performance of rectifier type instruments.

(f) An electrodynamic wattmeter is rated at 10 A and 100 V with a full scale reading of 1000 W. The inductance of the voltage circuit is 5 mH and its resistance is 2000 Ω. If the voltage drop across the current coil if the wattmeter is negligible. What is the error in the wattmeter at the rated VA rating with zero power factor ? The supply frequency is 50 Hz.

2 Answer any **two** parts : **10×2=20**

(a) A current transformer of nominal ratio 1000/5 A, is operating with total secondary impedance of $0.4 + j0.3\ \Omega$. At the rated current the components of primary current associated with the core-magnetizing and core-loss effects are 6 A and 1.5 A respectively. The primary winding has 4 turns. Calculate the ratio error and phase angle at rated primary current if the secondary winding has
(i) 800 turns and (ii) 795 turns.

(b) Explain the construction and working of a 3-phase rotating field power factor meter. Prove that the deflection of moving system is equal to the phase angle of the system.

(c) What are the different methods of measurement of frequency in power frequency range ? Explain the construction and working of electro-resonance type frequency meters. Draw the phasor diagrams under different power factor conditions.

3 Answer any **two** parts : **10×2=20**

(a) What are the different factors which affect the precision measurement of medium resistances with wheatstone bridge ? Explain how their effects are minimized / eliminated. Also describe Carey-Foster slide wire bridge method for precise measurement of medium resistances.

(b) The four arms of a bridge network are made up as follows : Arm ab - a resistor of $50\,\Omega$ in parallel with an inductor of 0.1H; Arm bc - a resistor of $\mathbf{100\Omega}$; Arm cd - an unknown resistor R in parallel with an unknown capacitor C and Arm da - a resistor of $\mathbf{1000\,\Omega}$. A 50 Hz voltage supply is applied across ac. Find R and C when a vibration galvanometer connected across bd is undeflected.

(c) Derive the equation of balance for modified De Sauty bridge. Draw the phasor diagram for balance conditions. Discuss how dissipation factor of a capacitor can be measured by it.

4 Answer any **two** parts : **10×2=20**

(a) The resistance and inductance of a test coil L_1, R_1 were determined at a frequency of $4000/2\,\pi$ Hz with a Maxwell's bridge. The results were as follows :

(i) With air core the balance was obtained with :

$$R_2 = 550\,\Omega,\quad R_3 = 18\,\Omega,\quad R_4 = 1250\,\Omega,$$

$$C_4 = 0.5\,\mu F.$$

(ii) With iron core the balance was obtained with

$R_1 = 550\ \Omega$, $R_3 = 18\ \Omega$, $R_4 = 1125\ \Omega$,

$C_4 = 3.85\ \mu F$.

Determine the iron loss in the core at test frequency. The voltage applied to the bridge is 50 V.

(b) Describe how magnetizing and loss components of no load current of a transformer be determined by using a.c. potentiometer.

(c) Explain with the help of suitable diagrams, how a.c. potentiometers can be used for

(i) Calibration of wattmeter

(ii) Measurement of reactance of a coil.

5 Answer any three parts : $6\frac{2}{3} \times 3 = 20$

(a) Explain the term 'total harmonic distortion'. Describe the functioning of a total harmonic distortion meter.

(b) Describe the terms :

(1) Synchronization

(2) Z-axis modulation

(3) Astigmatism control used in a CRO.

(c) Describe how frequency and phase angle measurements can be made with the use of a CRO.

(d) Explain with the help of block diagram, the various parts of an electronic multimeter.

(e) Explain the functioning of a ramp type digital voltmeter with suitable block diagram.
