[Total No. of Questions - 9] [Total No. of Printed Pages - 4] (2064)

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B. Tech 4th Semester Examination

Electrical Measurement & Measuring Instrument (N.S.)

EE-224

Time : 3 Hours **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt five questions in all, selecting one question from each of the Sections A, B, C & D. Section E is compulsory.

SECTION - A

1. (a) Describe different types of errors encountered in measurements. Suggest how these errors can be minimized. (10)

   (b) The limiting errors in the measurement of power and current are ±1.5% and ±1.0% respectively. Find the limiting error in the measurement of resistance. Also find the percentage relative error in power if it is found that the ammeter reads 1.0% more than the true current and the resistance of the resistor was 0.5% greater than the specified resistance. (10)

2. (a) Explain with block diagram the generalized instrument, and discuss each block. (10)

   (b) What are the merits and demerits of the spring and gravity control system in indicating type instruments. (10)

SECTION - B

3. (a) What happens when alternating current (a.c.) supply is applied to the Permanent Magnet Moving Coil (PMMC) instrument ?. A PMMC instrument has the following data: Number of turns=100, width of coil=20mm, depth of coil=30mm, flux density in the gap=0.1 Wb/m^2. Calculate the deflecting torque when carrying a current of 10 mA. Also calculate the deflection if the control spring constant is 2×10^{-6} Nm/degree. (10)

   (b) Normally shunts are avoided in Moving Iron (MI) instruments for the current range extension. Still if we go for current range extension, how the current distribution in meter coil and shunt is made independent of frequency. (10)

4. (a) Derive the torque equation for Electrodynamics type of instrument. (10)

   (b) The inductance of a certain moving iron ammeter is expressed as $L = 10 + 3\theta - \frac{\theta^2}{4}\mu H$ where θ is the deflection in radians from the zero position. The control spring constant is 25×10^{-6} Nm/rad. Find the deflection of the pointer in radians when the meter carries a current of 5 A. (10)

SECTION - C

5. (a) What do you understand by creeping in energy meters? What are the methods to overcome this problem? (10)

   (b) A watt-hour meter is calibrated to measure energy on a 250 V supply. In one test a steady current of 15.0 A is passed through it for 5 hours at unity power factor. If the meter readings before and after the test are 8234.21 kWh and 8253.13 kWh respectively, calculate the percentage error. If the disc makes 290 revolutions during 5 min when a current of 20 A is passing through the meter at 250 V and 0.87 p.f. Calculate the meter constant (10)

6. (a) The power flowing in a 3 phase, 3 wire balanced load system is measured by two wattmeter method. The reading of wattmeter A is 7500 W and of *B* is 1500 W when the terminals are reversed. Find (i) The power factor of the system, (ii) If the voltage of the circuit is 400 V what is the value of capacitance which must be introduced in each phase to cause the whole of the power measured to appear on wattmeter A. The frequency is 50 Hz. (10)

(b) Prove that the total reactive power in 3-ϕ balanced circuit is $-\sqrt{3}$ times the reading of the single wattmeter connected as shown in Figure 1. (10)

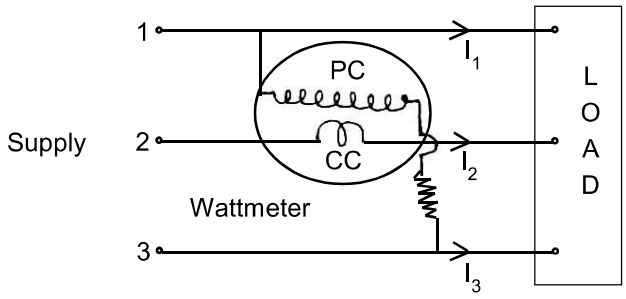

Figure 1

SECTION - D

7. (a) List different methods for low resistance measurements. How the effect of contact resistance is avoided? Derive the balanced condition for Kelvin's Double Bridge. Also write the condition by which lead resistance can be nullified during measurement. (10)

(b) A capacitor bushing forms arm 'ab' of a Schering bridge and a standard capacitor of 500 pF and negligible loss forms arm 'ad'. Arm 'bc' consists of a non-inductive resistance of 300Ω When the bridge is balanced. Arm 'cd' has a resistance of 72.6Ω in parallel with a capacitance of 0.148 pF. The supply frequency is 50 Hz. Calculate the capacitance and dielectric loss angle of the capacitor. Derive the equations for balance and draw the phasor diagram under balance conditions. (10)

8. (a) Explain with circuit diagram the loss of charge method for measurement of high resistances. (10)

(b) Derive the balanced equation for the Hay's Bridge for measurement of self inductance of a coil. Also draw the phasor diagram under balanced condition. (10)

SECTION - E

9. (a) Distinguish between Resolution and Threshold.

(b) Distinguish between Accuracy and Precision

(c) Distinguish between Sensitivity and Linearity

(d) Distinguish between Absolute error and Limiting error

(e) Why damping torque is important in indicating instruments?

(f) Why dynamometer type instruments are called transfer instrument?

(g) Why low resistances are of four terminals?

(h) Why Wheat stone bridge sensitivity is high when the arms ratio is unity?

(i) What do you understand by sliding balance in ac bridges?

(j) Why shielding and earthing is required in ac bridges?

(10×2=20)