

Electrical Measurements & Instrumentation

P. Pages : 3

NRT/KS/19/3309

Time : Three Hours

0180

Max. Marks : 80

-
- Notes :
1. All questions carry marks as indicated.
 2. Solve Question 1 OR Questions No. 2.
 3. Solve Question 3 OR Questions No. 4.
 4. Solve Question 5 OR Questions No. 6.
 5. Solve Question 7 OR Questions No. 8.
 6. Solve Question 9 OR Questions No. 10.
 7. Solve Question 11 OR Questions No. 12.
 8. Due credit will be given to neatness and adequate dimensions.
 9. Assume suitable data whenever necessary.
 10. Illustrate your answers whenever necessary with the help of neat sketches.

1. a) Define loading effect of instrument. Explain loading effect due to shunt connected instruments. **7**

b) In the wheatstones bridge the value of resistance of various arms are $P = 1000\Omega$, $Q = 100\Omega$, $R = 2005\Omega$ and $S = 200\Omega$. The battery has an emf of 5V and negligible internal resistance the galvanometer has a current sensitivity of 100 mm/ μA and internal resistance of 100. Calculate the deflection of galvanometer and sensitivity of bridge in terms of deflection per unit change in resistance. **7**

OR

2. a) Derive an expression for bridge sensitivity for a wheatstone bridge in terms of bridge voltage, bridge parameters and the voltage sensitivity. **7**

b) A 4 terminal resistor of approximately $50\mu\Omega$ resistance was measured by means of a Kelvin bridge having the following component resistance : Standard resistor = 100.03Ω , Inner ratio arms = 100.31Ω and 200Ω , Outer ratio arms = 100.24Ω and 200Ω , resistance of link connecting the standard and the unknown resistance = $700\mu\Omega$. Calculate the unknown resistance to the nearest $0.01\mu\Omega$. **7**

3. a) Derive the torque equation for permanent magnet moving coil instrument and explain construction and working of attraction type moving iron instrument. **7**

b) Write short notes on **any one**. **6**

i) Power factor meter.

ii) Frequency meter.

OR

4. a) What are the different methods of measurement of frequency in the power frequency range ? Explain the working of a mechanical resonance type frequency meter. **7**
- b) The inductance of attraction type instrument is given by $L = (10 + 5\theta - 2\theta^2)\mu\text{H}$, where θ is the deflection in radians from zero position. The spring constant is $12 \times 10^{-6} \text{ N m / rad}$. Find out deflection for a current of 5A. **6**
5. a) Two wattmeters connected to measure the input to a balanced 3 phase circuit indicate 2000W and 500 W respectively find the power factor of the circuit. **7**
- i) When both readings are positive.
- ii) When the latter reading is obtained after reversing the connections to the current coil of the first instrument.
- b) Define the following : **6**
- i) Transformation ratio
- ii) Nominal ratio
- iii) Turns ratio

OR

6. a) State and explain Blondie's theorem. **6**
- b) A 100/5A, 50 Hz current transformer has a bar primary and nated secondary burden of 12.5 VA. The secondary winding has 196 turns and a leakage inductance of 0.96 mH. With a purely resistive burden at rated full load, the magnetization mmf is 16 A and the loss excitation requires 12A. Find the ratio and phase angle errors. **7**
7. a) Explain static and dynamic characteristics of instruments. **7**
- b) Define error. What are the different types of error in instrument system. Explain them in detail and suggest remedies for it. **6**

OR

8. a) Explain with the help of block diagram digital data acquisition system. **6**
- b) A circuit was tuned for resonance by eight different trainee engineers and the value of resonant frequency in kHz was recorded as 532, 548, 543, 535, 546, 531, 543 and 536. Calculate : **7**
- i) Arithmetic mean
- ii) The average deviation
- iii) The standard deviation
- iv) Deviation from mean
- v) Variance
9. a) Explain the construction and working of L.V.D.T. **7**
- b) What is load cell ? What are the different types of Load Cell ? **6**

OR

10. a) What is gauge factor ? Prove that the gauge factor = $1 + 2\nu + \frac{\Delta\rho / \rho}{\Delta L / L}$ **7**

where ν = Poission's ratio
 ρ = resistivity
 L = Length

b) What is piezo-electric effect ? How it can be used for measurement of acceleration ? **6**

11. a) Write short notes on **any two.** **7**

i) RTD

ii) Flow measurement using ultrasonic flow meter.

iii) Bourden tube

b) Explain various laws of thermoelectric circuits. **7**

OR

12. a) Explain in details any one method used for measurement of low pressure. **7**

b) Explain total radiation pyrometer. **7**
