B.E. Electrical (Electronics & Power) Engineering (Model Curriculum) Semester - IV

SE204 / OEC-EP-404 - Measurements and Instrumentation

P. Pages : 3 **GUG/S/23/13859**

Time : Three Hours * 2 5 9 6 * Max. Marks : 80

Notes :
1. Read the question paper carefully (Branch, Semester, Scheme) before attempting the questions.
2. Every question carry identical marks.
3. Answer five questions as per given internal choice.
4. Due credit will be given to neatness and adequate dimensions.
5. Use of programmable calculator is prohibited.
6. Assume suitable data wherever necessary.
7. Draw neat and proper diagram/sketches to illustrate your answer.
8. Don 't use red pen for writing the answers.
9. Don 't write any other comments except answers of questions.

1. a) Explain with neat sketch the construction of PMMC type instruments and states its merits and demerits. **8**

b) The coil of a moving coil voltmeter is 40 mm long and 30 mm wide and has 100 turns on it. The control spring exert a torque of $0.24\times10^{-3}\,\mathrm{N-m}$ when the deflection is 100 divisions on full scale. If the flux density of the magnetic field in the air gap is 1.0 $\mathrm{Wb/m^2}$, estimate the resistance that must be put in series with the coil to give one volt per division. The resistance of voltmeter coil may be neglected. **8**

OR

2. a) Classify the different types of measuring instruments and explanation types with an examples. **8**

b) A moving coil ammeter has a fixed shunt of 0.02Ω with a coil resistances of $\mathrm{R}+1000\,\Omega$ and a potential difference of 500 mV across it, full scale deflection is obtained: **8**
i) To what shunted current does this correspond?
ii) Calculate the value of R to give full scale deflection when shunted current I is-
   a) 10 A
   b) 75 A and
   c) With what value of Rs. Is 40% deflection obtained with I = 100A.

3. a) Describe the properties of materials used for Piezoelectric transducers. Derive expressions for voltage and charge sensitivities. **8**

b) The following 10 observations were recorded when measuring a voltage 41.7, 42.0, 41.8, 42.0, 42.1, 42.0, 41.9, 42.5,41.8 find: **8**
1) The mean,
2) The standard deviation,
3) Range
4) The probable error of one reading,
5) The probable error of mean and

OR

4. a) Explain the different static and dynamic characteristics of instrument. **8**

b) In a parallel circuit and current in one branch I_1 is $100 \pm 2A$ and in the other I_2 is $200 \pm 5A$ **4**
Determine the total current considering errors as
i) Limiting error

ii) Probable error

c) Discuss systematic error with the help of some examples. **4**

5. a) Derive the equation for active power measurement in three phase circuit using two wattmeter method. **8**

b) Two wattmeter connected to measure the power in a 440 V, 3 phase balanced system gave readings of 5000 W and 1000 W, the latter reading being obtained after reversing the current coil connection of wattmeter. Determine what value of capacitance which will cause the whole power to be read by the first wattmeter. Assume delta connection. The frequency is 50Hz. **8**

OR

6. a) Explain the term creeping in energy meter? How it can be prevented? **8**

b) A 230V, single phase energy meter has a constant load of 4 A passing through it for 6 hours at unit power factor. If the meter disc makes 2208 revolutions during this period what is the meter constant in revolutions per kWh? Calculate the power factor of the load if the number of revolutions made by the meter are 1480 when operating at 230V and 5A for 4 hours. **8**

7. a) Write a short note on **any two** terms:- **8**

1) Megger,

2) Earth tester

3) Loss of charge method

b) State different methods used for measurement of medium resistances and explain any one method of medium resistances measurement. **8**

OR

8. a) Explain in detail with neat sketch of Kelvin Double bridge method for measurement of low resistances and also derive its expression. **10**

b) A 4 terminal resistor of approximately $50\mu\Omega$ resistance was measured by means of a Kelvin Double bridge having the following component resistances: **6**
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 $0.01\mu\Omega$.

9. a) What is thermistor? Explain its construction, resistance temperature characteristics and application. **8**

b) A copper-constantan thermocouple was found to have linear calibration between 0ºC to 400ºC with emf at maximum temperature equals to 20.68mv (Reference junction temperature is 0ºC)- **8**

1) Determine the correction which must be made to the indicated emf if the cold junction temperature is 25ºC

2) If the indicated emf is 8.92 mv in the thermocouple circuit, determine the temperature of the hot junction.

OR

10. a) What are the differences between a instrument transformer and power transformer. **8**

b) Explain single phase power measurement in high voltage system using instrument transformer with suitable circuit diagram. **8**

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