PVP 20

Code: 20EE3401

II B.Tech - II Semester – Regular Examinations – JULY 2022

MEASUREMENTS AND INSTRUMENTATION
(ELECTRICAL & ELECTRONICS ENGINEERING)

Duration: 3 hours Max. Marks: 70

Note: 1. This paper contains questions from 5 units of Syllabus. Each unit carries 14 marks and have an internal choice of Questions.
2. All parts of Question must be answered in one place.

UNIT – I

1. a) A basic PMMC meter has full scale deflection of I_m with its internal resistance of R_m. What additional shunt resistance (R_{sh}) is required to measure a current of I (=m*I_m) with the basic PMMC meter.
Calculate the shunt resistance required to extend the range of basic PMMC meter from 10 mA to 1A. Internal resistance of basic PMMC meter is 10 mΩ. 7 M

b) A Moving Coil instrument with resistance 10Ω gives a full-scale deflection with a current of 10 mA. This instrument is to be used with a manganin shunt to extend its range to 500 mA. Calculate the error caused by a 10^0C rise in temperature when:
i) Copper moving coil is connected directly across the manganin shunt.
ii) A 100Ω manganin resistance is used in series with instrument moving coil.
iii) Justify the result obtained in (i) and (ii).
Take temperature coefficient of copper as $0.004/^0$C and manganin as $0.00015/^0$C. 7 M

OR

2. a) A standard C.T. with known ratio R_s, phase angle θ_s and a test C.T. with unknown ratio R_x, phase angle θ_x are used for testing.
   i) Draw the circuit diagram of Silsbee's testing method.
   ii) Draw the phasor diagram which describe Silsbee's testing procedure.
   iii) Apply the phasor diagram and deduce the equations for R_x and θ_x as a function of R_s and θ_s and wattmeter readings. 7 M

   b) The operating coil of a 300V moving iron voltmeter has a resistance of 500Ω an inductance of 1.2 H and the series resistance is 2500Ω. The instrument reads correctly at d.c. supply of 300V.
   i) What will it read when 300V at 50 Hz is applied?
   ii) With what value of capacitance must the series resistance be shunted to make the meter read correctly at 50 Hz? 7 M

UNIT – II

3. a) A wattmeter has a current coil of 0.02Ω resistance and pressure coil of 5000Ω resistance. If the load takes 10A at a voltage of 220V and 0.8 p.f calculate the percentage error if the wattmeter is so connected that:
   i) the current coil is on the load side.
   ii) the pressure coil is on the load side. 7 M

   b) "Three-phase reactive power can be measured using single wattmeter", Justify the above statement with neat sketch and phasor diagram. 7 M

OR

4. a) A 250V, 5A 1-phase energy meter is tested at its marked ratings. The resistance of pressure circuit is 7500 ohms and that of current circuit is 0.15 ohms. 7 M

Calculate the power consumed when testing the meter with phantom loading with current circuit excited by a 6V battery.

b) Compare the relative merits and demerits of Electro Dynamo Meter (EDM) and Moving Iron power factor meters with neat sketches. 7 M

UNIT-III

5. a) The four arms of a Wheatstone bridge are as follows: AB=100 Ω, BC=1000 Ω, CD=2000 Ω and DA=200 Ω. The galvanometer has a resistance of 10 Ω, a sensitivity of 100 mm/μA and is connected across arm AC. A source of 5V DC is connected across the terminals BD. Calculate the current through the galvanometer and its deflection if the resistance of arm DA is changed from 200 Ω to 205 Ω. 7 M

b) Develop the balance equations for measuring unknown inductance of low-quality factor coils with neat sketch and phasor diagram. 7 M

OR

6. a) A high resistance of 150 MΩ has a leakage resistance of 450 MΩ between each of its main terminals and guard terminal. Find the percentage error in measurement if the above resistance is measured by an ordinary Wheatstone bridge without providing guard circuit. 7 M

b) Develop the balance equations measuring unknown capacitance and dissipation factor using Schering bridge with neat sketch. Explain the need for high voltage Schering bridge and draw its circuit diagram. 7 M

UNIT – IV

7. a) Explain the working principle and operation of Linear Variable Differential Transformer (LVDT) with neat diagram. Draw the displacement characteristics of LVDT. 7 M

   b) Illustrate the construction, theory and working of Thermocouples. 7 M

OR

8. a) Explain the basic principle of thermocouples. With neat sketch explain the operation of thermocouples used for measuring temperature. 7 M

   b) Demonstrate briefly classification of transducers. Compare the relative merits and demerits of active and passive transducers. 7 M

UNIT – V

9. a) Demonstrate the advantages of Power analyzer with neat sketch. 7 M

   b) Compare wave analyzer and spectrum analyzer with necessary diagrams. 7 M

OR

10. a) Compare the relative merits and demerits of Successive approximation type and ramp type DVMs with neat sketch. 7 M

    b) Demonstrate the merits of digital frequency meter with neat sketch. 7 M