Faculty of Engineering and Technology

Third Semester B.E (Electrical Engg.)

(C.B.S.) Examination

ELECTRICAL MEASUREMENT AND

INSTRUMENTATION

Time : Three Hours]   [Maximum Marks : 80

INSTRUCTIONS TO CANDIDATES

(1) All questions carry marks as indicated.

(2) Due credit will be given to neatness and adequate dimensions.

(3) Assume suitable data wherever necessary.

(4) Illustrate your answers wherever necessary with the help of neat sketches.

1. (a) Explain with the help of neat sketch the construction and operation of Megger.   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 = 100.03 Ω ;

Inner ratio arms = 100.31 Ω and 200 Ω ;

Outer ratio arms = 100.24 Ω and 200 Ω ;

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

OR

2. (a) Explain Schering's bridge with phasor diagram. Derive an expression to find unknown capacitance. What are the advantages and limitations ?   7

  (b) A bridge consists of the following :

Arm ab : a choke coil having a resistance R_1 and inductance L_1

Arm bc : a non-inductive resistance R_3

Arm cd : A mica condenser C_4 in series with a non-inductive resistance R_4

Arm da : a non-inductive resistance R_2

when this bridge is fed from a source of 500 Hz, balance is obtained under following conditions :

R_2 = 2410 Ω ; R_3 = 750 Ω ; C_4 = 0.35 μF ; R_4 = 64.5 Ω.

A series resistance of capacitor = 0.4 Ω.

Calculate the resistance and inductance of the choke coil.

The supply is connected between a and c and the detector is between b and d.   7

3. (a) Explain the different types of error in moving iron instruments. Write merits and demerits of moving iron instruments.   7

  (b) Why P.M.M.C. type instruments can be used for d.c. only ? Enlist the advantages and disadvantages of P.M.M.C. instruments.   6

OR

4. (a) Explain the working of single phase Electrodynamometer power factor meter. Draw phasor diagram.   7

  (b) What are the different methods of measurement of frequency in the power frequency range ? Explain the working of a mechanical resonance type frequency meter.   6

5. (a) Explain how the following adjustments are made in a single phase induction type energy meter :

    (i) Lag adjustment

(ii) Adjustment for friction compensation

(iii) Creep

(iv) Overload compensation

(v) Temperature compensation. 7

(b) The power flowing in a 3 phase, 3 wire balanced load system is measured by two Wattmeter method. The reading of Wattmeter A is 6000 W and of Wattmeter B is 1200 W.

(i) What is the power factor of the system ?

(ii) If the voltage of the circuit is 350 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. 6

OR

6. (a) Draw the equivalent circuit and phasor diagram of a current transformer. Derive the expressions for ratio and phase angle errors. 7

(b) A 100/5 A, 50 Hz current transformer has a bar primary and rated 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 12 A. Find the ratio and phase angle errors. 6

7. (a) Explain the term static and dynamic characteristics of Instruments with examples. 7

(b) Define and explain the following :

(1) Zero drift

(2) Systematic error

(3) Random error

(4) Relative error. 6

OR

8. (a) Write short note on Data Acquisition System. 6

(b) During the test, the following values of resistors were obtained. Value of resistors in Ω :

897, 898, 899, 900, 901, 902, 903, 904 and 905.

The frequency of occurrence is 6, 2, 5, 9, 33, 18, 8, 4 and 2 respectively. Calculate :

(1) Arithmetic Mean

(2) Average Deviation

(3) Standard Deviation

(4) Probable error of Mean

(5) Variance. 7

9. (a) What is Load Cell ? What are the different types of load cell ? 7

(b) Explain how L.V.D.T can be used for measurement of :

(i) Displacement

(ii) Pressure. 6

OR

10. (a) Describe the working of a strain gauge type of torque transducer. 7

(b) Explain the operation and construction of piezoelectric accelerometer. 6

11. (a) Explain cold junction compensation of thermocouple. 7

(b) What is an RTD ? What are its desirable qualities ? 7

OR

12. Write short notes on (any **three**) :

(a) McLeod gauge 5

(b) Pitot tube 4

(c) Orifice plate 5

(d) Capacitive type pressure gauge. 4