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(2063)

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B.Tech 4th Semester Examination

Electrical Measurements & Measuring Instruments

EE-4005

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 : Question Paper consists of five sections A, B, C, D & E. Section E is compulsory. Attempt five questions in all selecting one question from each of the sections A, B, C & D and all the subparts of the question in section E. Use of non-programmable calculator is allowed.

SECTION - A

1. (a) Draw detailed comparison between Null type and deflection type instruments on the basis of their operation and applications. **(10)**

   (b) Compare the operating principle of indicating, recording and integrating instruments. Give suitable examples of each case along with advantages and disadvantages. **(10)**

2. (a) Give detailed description of static characteristics of measuring instruments. **(10)**

   (b) Draw the block diagram of a generalized instrument. Give brief description of each block of the instrument. **(10)**

SECTION - B

3. (a) A moving coil instrument whose resistance is 20Ω gives full scale deflection with a current of 1 mA. This instrument is to be used with a

manganin shunt to extend its range to 100 mA. Calculate the error caused by a 10 degree centigrade rise in temperature when (i) Moving coil of copper is connected directly across the manganin shunt & (ii) A 75Ω manganin resistance is used in series with moving coil of instrument. Assume temperature coefficient of copper to be 0.004/ºC and that of manganin be 0.00015/ºC. **(10)**

(b) What are the main sources of errors in dynamometer type instruments? Explain in detail. **(10)**

4. (a) Give constructional details of permanent magnet moving coil instruments. Also describe the torque equation for these instruments. **(10)**

(b) What do you understand by multi-range ammeters? Design a multi-range d.c. milli-ammeter using a basic movement with an internal resistance R_m = 50Ω and a full scale, deflection current I_m = 1mA. The ranges required are 0-10 mA, 0-50 mA, 0-100 mA & 0-500 mA. **(10)**

SECTION - C

5. (a) Derive the torque equation of electrodynamometer wattmeter. Comment upon the shape of scale if spring control is used. How is it that a uniform scale is obtained when the scale span is about –45° to 45° of the position where there is zero mutual inductance between fixed and moving coil? **(10)**

(b) Explain in detail the principle of operation and working of moving iron type single phase power factor meters. **(10)**

6. (a) Explain the working of electro-dynamometer type frequency meters with the help of suitable diagram. How does calibration of meter scale carried out in terms of frequency? **(10)**

(b) Derive expression for deflecting torque in single phase induction type energy meters. Show that deflection torque is maximum when the phase angle between two fluxes is 90° and when the disc is purely non-inductive. **(10)**

SECTION - D

7. (a) What are the applications of Kelvin double bridge method? A four terminal resistor of approximately 50μΩ. resistance was measured by means of a Kelvin double bridge with standard resistor of 100.03μΩ, inner ratio arms with resistances 100.31Ω and 200Ω, respectively, outer ratio arms with resistances 100.24Ω and 200Ω, respectively. Resistance of the link connecting standard and unknown resistance is 700μΩ. Calculate the unknown resistance. **(10)**

(b) Derive the equations of balance for Anderson's bridge. Also draw phasor diagram of this bridge in balance conditions. What are the advantages and disadvantages of the bridge? **(10)**

8. (a) An Owen's bridge is used to measure the properties of a sample of sheet steel at 2kHz. At balance, the four arms of a bridge are given as follows:

Arm AB: has test specimen.

Arm BC: has a non-inductive resistance $R_3 = 100\Omega$.

Arm CD: has a capacitor $C_4 = 0.1\mu F$.

Arm DA: has a resistance R_2 = 834Ω in series with a capacitor C_2 = 0.124μF.

Derive the balance condition and calculate the effective impedance of the test specimen. **(10)**

(b) Explain Wheatstone bridge method of precise measurement of medium resistance. What are the factors to be taken into account while doing such measurement? **(10)**

SECTION - E

9. (a) What do you understand by fundamental units and derived units? Explain.

(b) What do you understand by sliding balance in case of a.c. bridges?

(c) What are the advantages of Maxwell inductance Capacitance Bridge?

(d) A 50 A, 230 V meter on full load makes 61 revolutions in 37 seconds. If the normal disc speed is 520 revolutions per KWh, find the percentage error.

(e) What are the difficulties generally encountered in measurement of high resistances?

(f) What are the factors which affect the value of earth resistance?

(g) How does controlling torque obtained in electrodynamometer type frequency meters?

(h) What is creeping in case of single phase induction type energy meters?

(i) What are the two alternative connections of wattmeter in a circuit? How do these connections affect the power measurement?

(j) What do you understand by swamping resistance used in measuring instruments? **(10×2=20)**