C 31824 (Pages : 3) Name.....

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FOURTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION JUNE 2007

EE 04 403—ELECTRICAL MEASUREMENTS AND MEASURING INSTRUMENTS

(2004 admissions)

Time : Three Hours Maximum : 100 Marks

Assume suitable data required, if any.
Answer **all** *the questions.*

I. (a) What are the various techniques by which damping torque is produced in an indicating instrument ? Briefly explain those techniques.

(b) Give the advantages and disadvantages of Instrument Transformers as compared to shunts and Multipliers used for the extension of instrument Range.

(c) Derive the expression for the capacitance to be connected across the resistor in the pressure coil circuit of a dynamometer type Wattmeter so as to neutralize the effect of inductance of Pressure coil circuit.

(d) Explain the sources of errors in Single-Phase induction type Energy Meters.

(e) In a test for a fault to earth by Murray loop test, the faulty cable has a length of 5.2 km. The faulty cable is looped with a sound cable of the same length and cross-section. The resistances of ratio arms are 100 Ω and 41.2 Ω at balance. Calculate the distance of the fault from the test end. If the decade resistance boxes forming the ratio arms have limits of error of ± 0.5 % (standard deviation) of the dial reading, what is the limit of error in the above calculated result ?

(f) In a Carey-Foster's bridge a resistance of 1.0125 Ω is compared with a standard resistance of 1.0000 Ω, the slide wire has a resistance of 0.250 Ω in 100 divisions. The ratio arms nominally each 10 Ω, are actually 10.05 and 9.95 Ω respectively. How far (in scale divisions) are the balance positions from those which would obtain of ratio arms were true to their Nominal value ? The slide wire is 100 cm. long.

(g) Explain the term "Standardization" of a potentiometer. Describe the procedure of standardization of a d.c. potentiometer.

(h) An iron ring of 350 $mm.^2$ cross-sectional area with a mean length of 1 m. is wound with a magnetising winding of 100 turns. A secondary coil with 200 turns of wire is connected to a ballistic galvanometer having a constant of 1 μC per scale division, the total resistance of the secondary circuit being 2000 Ω. On reversing a current of 10 A in the magnetising winding, the galvanometer shows a deflection of 100 scale divisions. Calculate the flux density in the specimen, and the value of permeability at this flux density.

(8 × 5 = 40 marks)

II. (a) Explain the construction and Working of Permanent Magnet Moving Coil Meter with the help of neat sketch. Derive its torque equation.

(15 marks)

Or

Turn over

(b) (i) A moving coil ammeter has a fixed shunt of 0.02 Ω with a coil resistance of R = 1000 Ω and a potential difference of 500 mV across it and full scale deflection is obtained

(a) To what shunted current does this correspond ?

(b) Calculate the value of R to give full scale deflection when shunted current I is (i) 10 A ; (ii) 75 A ; and (c) with what value of R is 40% deflection obtained with I = 100 A ?

(10 marks)

(ii) A permanent magnet Moving Coil Ammeter is connected across appropriate points of a bridge having Resistance of each arm of 35 Ω and connected across a supply of voltage, $V = 5 \sin \theta + 0.2 \sin 3\theta$. Determine the reading of the Ammeter if its resistance is 30 Ω.

(5 marks)

III. (a) Explain the construction and working of Electro-resonance type frequency meters. Also draw the phasor diagrams.

(15 marks)

Or

(b) (i) Explain how the Overload compensation is made in a single-phase induction type energy meter.

(5 marks)

(ii) A dynamometer type wattmeter is used for measurement of power in a single-phase circuit. The load voltage is 100 V and the load current is 9 A at a lagging power factor of 0.1. The wattmeter voltage circuit has a resistance of 3000 Ω and an inductance of 30 mH. Estimate the percentage error in the wattmeter reading when the pressure coil is connected : (a) on the supply side ; and (b) on the load side. The current coil has a resistance of 0.1 Ω and negligible inductance. The frequency is 50 Hz. Comment upon the result.

(10 marks)

IV. (a) (i) Describe the Murray loop test for localization of ground and short circuit faults in cables.

(5 marks)

(ii) Derive the equations for balance in the case of Maxwell's inductance capacitance bridge. Draw the phasor diagram for balance conditions.

(10 marks)

Or

(b) A modified form of Wheatstone bridge is shown in Fig. 1. Calculate the value of unknown resistance, R_x, if $R_a = 1200\ \Omega$, $R_a = 1600\ R_b$, $R_1 = 800\ R_b$, $R_1 = 1.25\ R_2$ and $R_3 = 0.5\ R_b$ are the resistance values under balanced conditions :

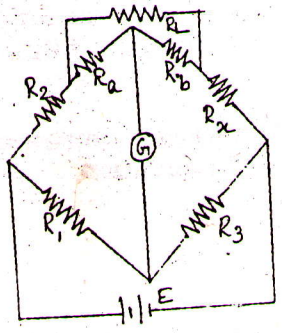

Fig. 1

(15 marks)

V. (a) Describe the construction and working of a co-ordinate type a.c. potentiometer. How is it standardized ? Explain how an unknown voltage can be measured with it.

(15 marks)

Or

(b) Describe the Lloyd Fisher square for measurement of iron losses in a specimen of laminations. Describe how corrections for resistance of wattmeter pressure coil resistance and resistance of secondary winding are applied.

(15 marks)

[4 × 15 = 60 marks]