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Total No. of printed pages = 5

19/3rd Sem/UIE303

2021

ELECTRICAL AND ELECTRONIC MEASUREMENTS

Full Marks – 100

Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer any *five* questions.

1. (a) Deduce the expression for deflection ? in a PMMC galvanometer under dynamic conditions. How critical damping is achieved ? 8

   (b) A PMMC meter has a full scale deflection of 10mA and an internal resistance of 10Ω, how it can be used for voltage measurement in the range of 0-100 V ? 4

   (c) Describe in brief the construction of moving iron instruments using a suitable diagram.

[Turn over

The inductance of a moving iron instrument at full scale deflection of 90° is L=(10+30θ) mH when the input current is 1A. Calculate the deflection of the instrument when the input current is .4A. 8

2. (a) Deduce the expression for deflecting torque in an electrodynamometer type instruments under D.C. and A.C. conditions. 10

(b) The full scale deflection of an electrostatic voltmeter is 90° at 1000 V and is controlled by a spring with a torsion constant of 4×10^{-6} Nm/rad. What is the capacitance at full scale deflection when the initial capacitance at zero voltage is 20pF ? 5

(c) Explain in brief the construction and working of hot wire instruments. 5

3. (a) Describe the construction and working of electrodynamometer type wattmeter using a suitable diagram. What are the causes of error in wattmeter ? 10

(b) Describe the direct deflection method for measurement of insulation resistance using a suitable diagram. 5

(c) How a potentiometer is standardized for the measurement of unknown voltage ? 5

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4. (a) Show that in a single-phase induction type energy meter the total number of revolutions of the disc is directly proportional to the energy consumed by the load. 10

(b) A 230-V, single-phase domestic energy meter has a constant load of 5 A at unity power factor when it is operated for 10 hours, the meter disc makes 3200 revolutions during the period. What is the power factor of the meter when it makes 2000 revolutions when operating at 230V and 7A load for 6 hours ? 6

(c) What is Phantom loading in energy meter testing ? 4

5. (a) How ammeters and voltmeters are calibrated using potentiometer? Explain with a diagram. 8

(b) A strain gauge is a part of one arm of a wheatstone bridge as shown in the figure 1 and has a nominal resistance without any load as R_s=100Ω. Other bridge resistances are $R_1 = R_2 = R_3$=100Ω. The maximum permissible current through the strain gauge is 10 mA. During certain measurement when the bridge is excited by maximum permissible voltage and the strain gauge resistance is increased by 5% over the nominal value, what will be the output voltage V_0 in mV ? 6

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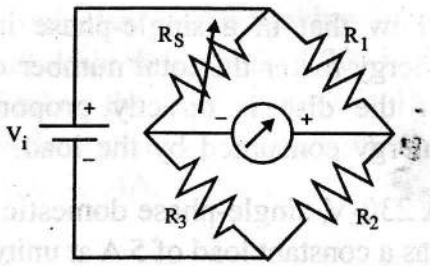

Fig. 1

(c) Explain the working of Wein's bridge for the measurement of unknown frequency using relevant expressions and circuit diagram. 6

6. (a) A Maxwell's capacitance is balanced by adjusting $C_1 = 2\mu F$ and $R_4 = 300\Omega$ as shown in figure 2. Determine L_1 and R_1. 6

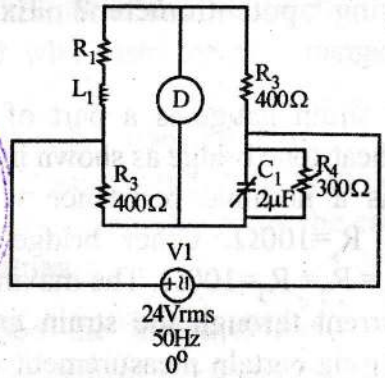

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Figure 2

(b) What are the different types of cable faults ? Describe Murray Loop test for localization of cable faults. 7

(c) Describe a suitable method for the measurement of mutual inductance with relevant mathematical expressions and circuit diagram. 7

7 (a) Write short notes on the following : 7×2=14

(i) Measurement of low resistance.

(ii) Megger.

(b) A De Sauty's Bridge is used for the measurement of unknown capacitance as shown in figure 3. Determine C_1 when bridge is balance at R_2= 200Ω. 6

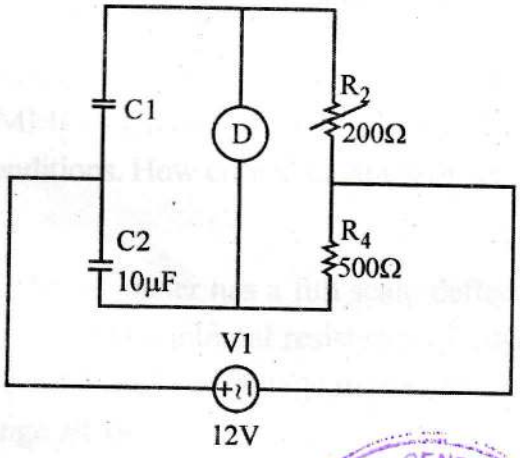

Figure 3

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