Ref No: EX/EE/T/221/2017(OLD)

BACHELOR OF ELECTRICAL ENGINEERING EXAMINATION, 2017 (OLD)

2nd Year, 2nd Semester

SUBJECT: - ELECTRICAL MEASUREMENT AND MEASURING INSTRUMENTS

Full Marks 100

Time: Three hours (50 marks for each part)

Use a separate Answer-Script for each part

PART I

Answer any **five** Questions.

1. Explain the precision measurement of medium resistances with Wheatstone bridge. Also discuss the sensitivity of the bridge. Show when sensitivity becomes maximum and minimum. 8+2

2. What is the importance of Drysdale phase shifter in a polar type AC potentiometer? Describe the standardization and testing procedures employed in Drysdale type AC potentiometer. 3+7

3. Describe with the help of neat diagram, the loss of charge method to determine the insulation resistance of a short length of cable and derive an expression for determination of insulation resistance. 5+5

4. Why is volt-ratio box arrangement employed for measurement of voltage? With necessary circuit diagram explain the method of calibration of wattmeter with the help of dc potentiometer. 4+6

5. Show how strain in a specimen can be measured with the help of one active gauge and one dummy gauge. Explain how temperature compensation is achieved by this method. 5+5

6. What are ballistic tests used for testing of magnetic materials? How is flux density determined in the ring type specimen of magnetic material? How is correction made for the flux in the space between specimen and the search coil wound round it? 3+3+4

7. The four arms of an AC bridge at balance are: arm AB an unknown inductance L_1 having an inherent resistance R_1; arm BC a non-inductive resistance of 100Ω; arm CD a capacitance of 0.5μF in parallel with a resistance 100Ω; arm DA a resistance of 1000Ω. The source is connected to A and C and the detector is connected between B and D. Derive the equations for balance and find the values of R_1 and L_1. 10

[Turn over

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No. of Questions	PART- II	Marks
	*Answer any **five**.*	
1.	Define logarithmic damping. Obtain its expression in terms of damping ratio of a Ballistic galvanometer.	10
2.	a) An electrodynamometer type wattmeter with resistance of the two coils as 0.04 ohm and 4000 ohm, is used to measure the power supplied to a resistive load. The load current and voltage are 10A and 70V. Show the two ways in which voltage coil can be connected and find the error in readings.	6
	b) What should be the connection of wattmeter coils at relatively high voltage low current load? Draw the connection diagram and justify your solution.	4
3.	Write short note on any ***one***: a) Electromagnetic damping in moving coil instrument b) extension of range of instruments	1x10
4.	a) A 1000/5A current transformer has bar primary and 196 secondary winding turns. The secondary winding burden is an ammeter of resistance 0.4 ohm and reactance of 0.9 ohm; the secondary winding has a resistance of 0.2 ohm and reactance of 0.5 ohm. The core requires an equivalent mmf of 20AT for magnetization and 10AT for core loss. Calculate : i) Primary current and ratio error when the ammeter reading is 5A.	10

	ii) Phase error of the CT.	
5.	The coil of a 300V moving iron voltmeter has a resistance of 600 ohms and inductance of 0.9 H. The instrument reads correctly at 50 Hz A.C. supply and takes 10 mA at full scale deflection. a) What is the % error in the reading when it is connected to 150V D.C. supply? b) Calculate the resistance that must be added in series with the instrument to extend its range to 600V. c) What will the instrument read when a voltage of 500V, 150Hz is applied?	10
6.	Derive an expression of amplitude response of Duddell's moving coil vibration galvanometer. How do you increase the amplitude of vibration?	10
7.	Compare between: (any ***two***) a) moving coil and moving iron instrument b) damping in PMMC meters and D'Arsonval galvanometer c) response of electrodynamometer type instrument under single frequency and multiple frequency excitation	2x5=10
8.	Justify in favour of or against the following statements. a) Burden of a current transformer must not be exceeded beyond a certain limit. b) Moving iron instrument has a time varying inductance.	5+5