Ref. No. : EX/EE/5/T/211/2018

B. E. ELECTRICAL ENGINEERING (PART TIME) 2ND YEAR 1ST SEMESTER EXAMINATION, 2018

SUBJECT: - ELECTRICAL MEASUREMENT AND MEASURING INSTRUMENTS

Time:Three hours

Full Marks 100
(50 marks for each part)

Use a separate Answer-Script for each part

No. of Questions	PART I	Marks
	Answer question: 1 and any TWO from the rest.	
	Answer any four.	
1. (a)	Why the material of swamping resistance must be same as that of shunt resistance?	
(b)	Explain why the scale of dynamometer type wattmeter is linear but it is non linear in case of dynamometer type voltmeter or ammeter.	
(c)	Explain why the parameter logarithmic decrement is significant for ballistic galvanometer but not for D'Ársonval galvanometer.	
(d)	Distinguish between the Eddy current damping and Electromagnetic damping using shunt	
(e)	Explain why an induction disc type meter needs braking torque but not damping torque.	
(f)	How do you maximize the amplitude of vibration in a vibration galvanometer?	4 X 5=20
2. (a)	A PMMC instrument has a coil resistance of 25 ohms and gives full scale deflection, when carrying current of 25 mA. Show how it can be adapted to measure i) Voltage upto 300V and ii) Current upto 10A.	
(b)	Explain why the moving iron instrument has square law scale	
(c)	Explain how AC and DC electrical voltage and current can be measured by rectifier type PMMC instrument	6+4+5
3.(a)	The pressure coil of a dynamometer type wattmeter has a resistance of 6600 ohm. When the voltage applied to the pressure coil is 120V and a current 20A flows in the current coil, the deflection is 160 degree. What additional resistance must be connected in the pressure coil circuit to make the constant of the meter equal to 20W per degree at the same power factor? What is the change in meter	

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	constant ?	
(b)	Explain how the accuracy of reading in dynamometer type wattmeter can be improved by eliminating the effect of pressure coil inductance?	
(c)	Show the two preferred alternative connections for current and pressure coils when the load current is small and high. Also comment on errors in both cases.	5+5+5
4. (a)	.Explain with the help of phasor diagram, why the ratio and phase angle errors of C.T. depend on secondary circuit burden?	
(b)	Derive the expression of energy measured by induction disc type energy meter, in terms of load current and voltage ,showing constructional parts, connection diagram and necessary phasor diagram.	6+9
5.	**Write short notes on any three of the following:**	
i)	AC measurement using PMMC type instrument	
ii)	Extension of AC ammeter, voltmeter and wattmeter ranges using C.T. and P.T.	
iii)	Lag adjustment in induction disc type energy meter	
iv)	Normal shunt and Universal shunt.	
v)	Attraction and repulsion type moving iron instruments	5+5+5

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PART II

Answer Question no. 1 and any two from the rest.

1. Justify and correct (if required) the following statements (any four): 4X5

   a) Series and Shunt type ohmmeters can be identi from their scales.
   b) Megger has an arrangement to minimize the effect of stray magnetic field for proper measurement.
   c) Low resistances are made with four terminals.
   d) Dummy gauges are used to increase sensitivity of measurement in Wheatstone bridge based strain measurement arrangements.
   e) Ratio bridges should employ adjustable circuit elements in an arm adjacent to the arm containing unknown element.
   f) In Lloyd-Fisher Square method the pressure coil of the wattmeter is connected to the secondary of the magnetizing coil.
   g) Due to piezoelectric property, semiconductor strain gauges are better than metal resistance gauges.

2. a) Explain the steps of standardizing of a laboratory type DC potentiometer with proper circuit diagram. 4
   b) A Crompton potentiometer has 18-step coarse dial where each step represents 0.1 V and each step resistance is 20 ohm. The fine dial is total 11 ohm with 100 divisions. How can you make this into dual range potentiometer (namely X1, X0.1) by connecting a series combination of two resistances parallel to the total dial resistance? Derive necessary relations. 6
   c) How can you separate the hysteresis and eddy current losses from iron loss of a magnetic test specimen? 5

3. a) Define gauge factor and Poisson's ratio and establish a relation between them. 8
   b) A Kelvin double bridge has each of the ratio arms P = Q = p = q = 1000Ω. The emf of the battery is 100V and a resistance of 5Ω is included in the battery circuit. The galvanometer has a resistance of 500Ω and the resistance of the link connecting the unknown resistance to the standard resistance may be neglected. The bridge is balanced when the standard resistance S = 0.001Ω. Determine (a) the value of unknown resistance, (b) the current through the unknown resistance R at balance, (c) the deflection of the galvanometer when the unknown resistance R is changed by 0.1% from its value at balance. The galvanometer has a sensitivity of 200 mm/μA. 7

4. a) A shunt type ohmmeter has a D'Arsonval movement of resistance 2 Ω. Its full-deflection current is 10 mA and the battery voltage is 3 volts. Determine the value of current limiting resistor so that the meter deflects to the midpoint of its scale if 5 Ω external resistance is connected across the terminals of the ohmmeter. 8
   b) Is it possible to separate hysteresis and eddy current losses of a specimen of magnetic material using Lloyd Fisher square? Explain your answer. 7