

**BACHELOR OF ENGINEERING (ELECTRICAL ENGINEERING) 2ND
YR 1ST SEMESTER EXAMINATION, 2019**

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 about the sensitivity of the bridge. Show when sensitivity becomes maximum and minimum. 8+2
2. A capacitor across which is connected an electrostatic voltmeter of infinite resistance and 10 μF capacitance is charged to a potential of 100 volts. After disconnecting from charging source the potential falls from 100 V to 50 V in 20.8 seconds. When an additional 50 μF air capacitor is connected in parallel with the test capacitor the voltage falls from 100 V to 50 V in 55.5 seconds, what is the leakage resistance of test capacitor? 10
3. A series type ohmmeter has a movement of 60Ω internal resistance. If full scale deflection current is 1.2 mA, internal battery voltage is 3 volt, and the desired scale marking for half scale deflection is 1500Ω , determine (i) R_{se} and R_{sh} (ii) maximum value of R_{sh} to compensate for a 10% drop in battery voltage (iii) scale error at the half scale mark when R_{sh} is not set as in (ii). 10
4. Explain the advantage of using 'phantom load' in calibration of wattmeter. Draw the connection diagram of calibrating a wattmeter with the help of d.c. potentiometer. 4+6
5. How can reference junction compensation of thermocouples be carried out using two temperature controlled ovens? What is neutral temperature of a thermocouple? What are the merits and demerits of thermistor? What is meant by the specification "Pt-100 RTD"? 5+5
6. How does the ambient temperature variation affect the measurement accuracy in strain gauges? Under what condition is a dummy gauge used? Derive bridge sensitivity in such a condition for Wheatstone bridge method based strain measuring system using one active and one dummy gauge. 3+2+5
7. Describe a method for determining the iron loss in a square specimen of a magnetic material. 4+6
The total iron loss in a sample is 300 watts at 50 Hz, with a loss component due to eddy current 5 times of that due to hysteresis. At what frequency will the iron loss double itself, if the peak flux density is kept the same?

| Turn over

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(1st / 2nd-Semester/Repeat/Supplementary/Annual/Bi-Annual)

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Time: Two hours/Three hours/ Four hours/ Six hours

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(50 marks for each part)

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PART II		Marks
	<i>Answer Question: 8 and any TWO from the rest:</i>	
8.	<p>Answer any four :</p> <p>a) Why the damping in a D'Arsonval galvanometer can be controlled by changing the value of CDRX?</p> <p>b) Why the parameter logarithmic decrement is important for Ballistic galvanometer?</p> <p>c) Explain why the scale of dynamometer type wattmeter is uniform but it is non uniform for dynamometer type ammeter and voltmeter?</p> <p>d) Why the performance of rectifier type PMMC meter will depend upon the form factor of input signal?</p> <p>e) Why the secondary circuit of CT should be opened, when its primary is energized?</p>	4X5=20
9.	<p>a) A PMMC instrument has the coil resistance of 50 ohm and gives full scale deflection, when carrying current of 50 mA. Find the shunt resistances to convert the meter to 10/20A multirange DC ammeter. Find the multiplier resistances to convert to 300/600 V multirange DC voltmeter.</p> <p>b) Explain how moving iron instrument can produce unidirectional deflecting torque.</p> <p>c) Explain the method of providing temperature compensations for PMMC instruments.</p>	6+4+5

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10.	<p>a) A galvanometer has the following constants as : Inertia constant=1.5; Damping constant=6; Deflection constant=8000 Nm/A; Coil resistance =10 ohm;</p> <p>Determine the value of the spring constant that would give critical damping. Current sensitivity and voltage sensitivity.</p> <p>b) Derive the expression of Eddy current damping torque produced by a metallic disc attached to the spindle of indicating instrument.</p>	10+5
11.	<p>a) Explain with the help of phasor diagram, why the observed reading by dynamometer type wattmeter differs to true watt reading?</p> <p>b) A dynamometer type wattmeter is rated at 10 A and 25 V. The current coil has a resistance of 0.06 ohm and the potential coil resistance is 6250 ohm . Find the error in reading due to two different connections. The load current is 10A at p.f. 0.174 lagging.</p> <p>c) What is compensating winding and how it can eliminate the effect of pressure coil inductance?</p>	5+6+4
12.	<p>a) Explain with the help of phasor diagram why the ration and phase angle errors of C.T. will depend on magnetizing current, secondary burden and secondary circuit power factor.</p> <p>b) Explain how turns compensation can reduce the ratio error for a C.T.</p> <p>c) A burden of (0.2+j0.2) ohm is connected to the secondary of a 1000/5A C.T. If the C.T. has bar primary and 198 turns in its secondary winding with 16 A and 8AT as its loss component and magnetizing component ampere-turns, determine the ratio and phase angle error of the C.T.</p>	6+4+5