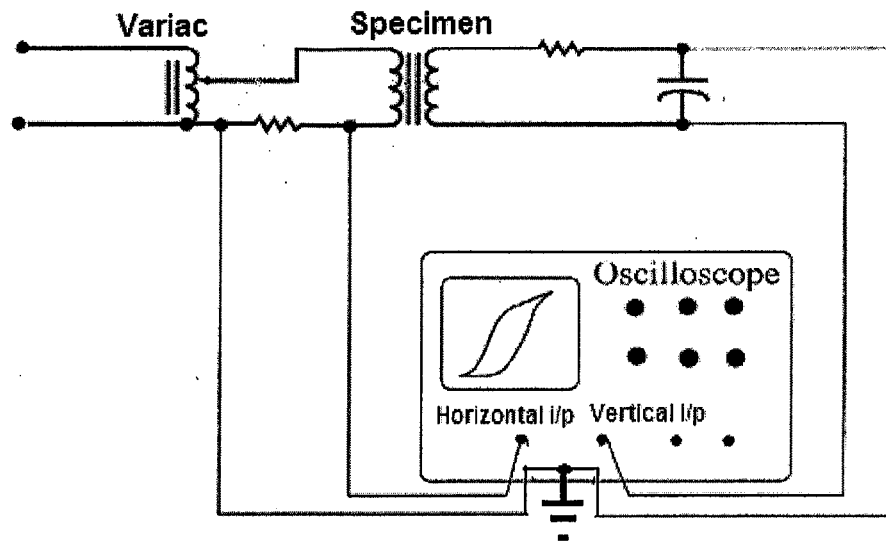# B.E. ELECTRICAL ENGINEERING 2NDYEAR 1STSEMESTER EXAMINATION, 2019

SUBJECT: - ELECTRICAL MEASUREMENTS & MEASURING INSTRUMENTS

Time: Three hours
Full Marks 100
(50 marks for each part)

Use a separate Answer-Script for each part

	PART-I	
	Answer any 2 (25X2=50)	
1.	a) How do you standardize a laboratory type DC Potentiometer? Explain with proper circuit diagram.	7
	b) A Crompton's potentiometer consists of a coarse resistance dial having 16 steps of 10Ω each and a series connected slide-wire of 10Ω which is divided into 100 divisions. If the working current of the potentiometer is 10 mA and each division of slide-wire can be read accurately upto 1/5 of its span, calculate the resolution of the potentiometer in volt.	6
	c) What is **phantom loading** in the context of calibration of wattmeter using DC potentiometer? Explain with proper diagram.	7+2+3
	What is the use of a metal link between current and potential coils of the wattmeter in this context?	
	Can the wattmeter calibrated using DC potentiometer be used to measure power consumption of an AC circuit? Justify your answer.	
2.	a) What is the use of guard wires in high resistance measurement? Explain with a measuring cuircuit diagram.	4
	b) Exlain Price's Guard wire method of measurement of cable insulation resistance with proper circuit connections.	8+3
	What precautions are to be taken at the moment of energization (supply ON) for the measurement circuit?	
	c) How can you measure the loss angle of a capacitor using Schering's Bridge? Derive an expression with the cuircuit diagram.	7
	d) In Price's Guard wire method, the insulation can be assumed as a dielectric of a capacitor. Is there any difference between the origin of resistances that you measure in Price's Guard wire method and that you obtain from Schering's Bridge?	3
3.	a) How can you devise a measurement setup to obtain the B-H loop of a specimen of magnetic material using Ballistic galvanometer?	10
	b) If you measure the B-H loop of the same specimen using a circuit shown below, will there be any difference between this B-H loop and the one that you get using the circuit developed in part (a) of this question? Explain your answer.	3

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c) In magnetic loss test of a specimen of total weight 5 kg the measured values of iron loss at a given peak flux density were 40 watt at 45 Hz and 70 watt at 55 Hz. Estimate hysteresis and eddy current losses in Watt/kg at 50 Hz for the same peak flux.   5

d) Derive the condition for maximum sensitivity of Wheatstone bridge based resistance measurement.   7

                                                                                        25

4.   **Write notes on *any two* (12.5 X2 =25)**

a)   Ratio Bridge and Product bridge topologies for Alternating Current Bridges

b)   Kelvin's Double bridge method for measurement of low resistance

c)   Linearization of thermistor characteristics

d)   Cold junction compensation of thermocouples

e)   Loss of Charge method for high resistance measurement

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Full Marks 100

Time: **Three hours**   (50 marks for each part)

Use a separate Answer-Script for each part

No. of Questions	PART- II	Marks
	Answer question as per the directives associated with each group.	
	GROUP-A [*Answer any one from the following questions*]	
1.	Derive an expression of steady state deflection of vibration galvanometer. Hence suggest methods to increase amplitude of vibration.	6+4
2.	Describe in brief with the help of appropriate diagram, the construction of PMMC type meter. What modification is needed to convert it into a rectifier type PMMC meter?	7+3
	GROUP-B [*Answer any one from the following questions*]	
3.	What are the different sources of errors that may be present in the reading of wattmeter? Discuss all the types and show the ways the errors affect the reading of the meter.	10
4.	What do you mean by 'braking torque? How is the braking torque introduced in an induction type energy meter? How can the magnitude of the torque be adjusted?	2+6+2
	GROUP-C [*Answer any four from the following questions*]	4x5=20
5.	a) A dynamometer type wattmeter is rated at 10A, 25V. The current coil has a resistance of 0.06 ohm and the resistance of potential coil is 6250 ohm. Find the error in reading due to two different connections used in normal courses. The meter measures power at rated condition and at a power factor of 0.174 lagging.	5
	b) A 110V, 5A wattmeter is used in conjunction with PT and CT of nominal ratios: 10000/10V and 200/10A, respectively. The wattmeter reading is 350W. If the ratio errors and phase angle errors of PT and CT are : +0.8%, -45' and -0.24%, +90', what is the true value of the power consumed in load? The power factor angle of the load is 50° lagging.	5
	c) A PMMC instrument has the coil resistance of 50ohm and gives full scale deflection while carrying a current of 50mA. Find the shunt resistance	

	and multiplier resistance required to add to the meter to measure currents in the range of 0 – 10A and 0 – 300V, respectively.	5
	d) A ballistic galvanometer has a resistance of 150ohm and an undamped period of 7.5s. A steady emf of 3.5mV across the meter produces a steady deflection of 210 mm. When a capacitor discharges through the meter the deflection produced is 750mm. Find the quantity of electricity passed through the galvanometer. The relative damping of the instrument is 0.8.	5
	e) A galvanometer has the following constants as : Inertia constant = 1.5×10^{-6} N-m-s^2-rad^{-1}; Damping constant = 6×10^{-6} N-m-s-rad^{-1}; Deflection constant = 3N-m-A^{-1}; The scale of the meter is placed 1m away from the mirror. Determine the value of the spring constant that would give critical damping. Find also the current sensitivity of the galvanometer.	5
	f) A single phase electrodynamometer type wattmeter connected normally to read power indicates 100W. It indicates a reading of 30W when a capacitor is connected in series with the pressure coil. Reactance of capacitor is same as the resistance of pressure coil. Determine the power factor of the load.	5
	GROUP-D [*Answer any two from the following questions*]	2x5=10
6.	a) What is 'Lag adjustment'? Explain the method used to make the adjustment possible.	5
	b) In what way is a universal shunt different from normal shunt? Elucidate.	5
	c) Generally a moving iron instrument can carry a current much higher than that for other types of instruments. – State clearly whether the statement is true or false and justify it in favour of your argument.	5
	d) The knowledge of phase errors of CT and PT are required only for measurement of high-valued power, not for measuring high-valued current and voltage. – State clearly whether the statement is true or false and justify in favour of your argument.	5