Ref No: EX/IEBT/EE/T/124/2018

BACHELOR OF TECHNOLOGY (IEE) EXAMINATION, 2018

1st year, 2nd Semester

SUBJECT: - ELECTRICAL MEASUREMENTS

Time: Three hours

Full Marks: 100
(50 marks for each part)

PART – I

Answer any THREE questions. TWO marks are reserved for neatness.

1. a) Explain the precision measurement of medium resistances with Wheatstone bridge. Also discuss the sensitivity of the bridge. Show when sensitivity becomes maximum and minimum. 10

   b) A shunt type ohmmeter has a D'Arsonval movement of resistance 2Ω. 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 indicates 0.5Ω at the midpoint of the scale. 6

2. a) What modifications are made in the basic Wheatstone bridge to convert it into Kelvin's double bridge to make it suitable for low resistance measurement below the value of 0.1 Ω. Explain with the help of circuit diagram, how Kelvin bridge is used to measure low resistance. 10

   b) The arms of an AC bridge are as follows: AB is an inductive resistor; BC and ED are variable resistors. Branches CD and DA are non-inductive resistors of 400 ohms each and branch CE is a capacitor of 2 μF. The supply is connected across 'A' and 'C' and the detector across 'B' and 'E'. Balance is obtained when the resistors in arm BC and in the arm ED are 400 ohms each. Determine the resistance and inductance of arm AB. 6

3. a) Explain the term 'Standardization' of a potentiometer. Prove that in a multi range dc potentiometer circuit current through the slide wire for X0.1 position is $1/10^{th}$ of the current through the slide wire for X1 position, source current being the same for both cases. 10

   b) A four terminal resistance of approximately 50μΩ was measured by Kelvin's double bridge. The bridge has the following component resistances. 6
   Standard resistance = 100.03μΩ; Inner ratio-arms = 200.62μΩ and 400Ω; Outer ratio-arms = 200.48μΩ and 400Ω.
   The resistance of the link connecting the standard and unknown resistance = 700μΩ. Calculate the unknown resistance.

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4. a) Give a step by step approach of designing series type ohmmeter and derive expressions for current limiting resistor and zero adjust resistor. 10

   b) The ratio error of a given 1000/5 A Current Transformer is zero when feeding 5 VA, upf burden at rated current. Estimate the iron loss of the transformer at this operating condition if the secondary has 198 turns and a winding resistance of 0.02 Ω. Neglect leakage reactance. 6

5. Write short notes any TWO. 8×2

   a) Loss of charge methods;

   b) Ratio and Product Bridge;

   c) Calibration of low-range ammeter.

B.TECH INSTRUMENTATION AND ELECTRONICS ENGINEERING 1ST YEAR SECOND SEMESTER EXAMINATION, 2018

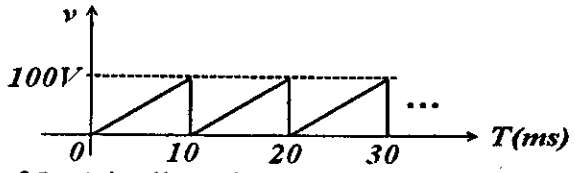
SUBJECT: - ELECTRICAL MEASUREMENTS

Time: **Three hours**

Full Marks 100
(50 marks for each part)

Use a separate Answer-Script for each part

No. of Questions	PART- II	Marks
	Answer any five.	5X10=50
1.	Derive an expression of deflection of an underdamped permanent magnet moving coil instrument in terms of its steady state deflection, relative damping and natural angular frequency.	10
2.	a) An electrodynamometer type wattmeter with resistances of the two coils as 1mΩ and 10kΩ, is used to measure the power supplied to a load of power factor 0.8. The load current and voltage are 20A and 60V. Show the two ways in which coils can be connected and find the corresponding errors in readings.	8+2
	b) Why is an electrodynamometer type instrument called a transfer instrument?	
3.	a) A PMMC type instrument has a resistance of 20 ohms and gives full scale deflection when carrying current of 5mA. Show how it can be used to measure a full scale: i) voltage up to 750V and ii) current up to 30A. Draw the relevant connection diagrams.	8+2
	b) What happens to the response of a permanent magnet moving coil instrument if the face of poles is made flat?	
4.	What do you mean by Logarithmic decrement in connection with Ballistic Galvanometer? Derive an expression of logarithmic decrement in terms of inertia constant, damping constant and control constant of the instrument.	3+7
5.	Write short note on any *One*: a) control of damping in indicating instruments. b) measurement of frequency using moving coil instrument.	10

6.	a) An electrodynamometer type wattmeter is subjected to a voltage of $v(t)$ and $i(t)$ across and through its pressure coil and current coil as given below: $v(t) = 80 + 100\sin(100\pi t - 50^\circ) + 60\sin(300\pi t + 30^\circ)\ V$ $i(t) = 2 + 4\sin(100\pi t + 40^0) + 3\sin(300\pi t + 60^0)\ A$ What will be the reading of the wattmeter?	5
	b) An wattmeter has a pressure coil of 10kΩ resistance and 4mH inductance. It is used to measure a power of 8kW consumed by a load at 0.7 power factor. How much is the error (in watt) of the reading of the meter?	5
7.	a) A PMMC-rectifier (full wave) arrangement is used to measure a voltage whose waveform is shown below. What will the meter read?  	3
	b) A current of 5mA is allowed to pass through a D'Arsonval galvanometer. The following design data of the galvanometer are given: Height of the coil = 3.0 cm; Width of the coil = 2.0 cm; No. of turns of the coil = 140; Resistance of meter coil = 6Ω; Open circuit relative damping = 0.1; Flux density in the airgap = 0.15 wb-m^{-2}; Moment of inertia of moving system = 30×10^{-8} Kg-m^2; Stiffness constant of suspension = 25×10^{-6} N-m-rad^{-1}; (i) Find the steady state deflection in degree and also the deflection on a scale placed 1m away from the mirror. (ii) Also find the external critical damping resistance (CDRX) of the galvanometer.	7