EX/IEBE//PE/T/224/2018

B.E Instrumentation & Electronics Engineering 2nd Year 2nd Semester Examination – 2018

Subject: Electrical Measurements

Time: Three hours

Full Marks: 100

Module	Each module must be answered as per given instruction	Marks
[1]	**Answer *any ten* from this module**	**[10×2]**
(a)	Comment on most efficient instrument is whether most accurate or most precise.	
(b)	Differentiate between static & dynamic parameter of measuring instrument with example.	
(c)	Classify electrical measuring instrument on the basis of principle of operation.	
(d)	Classifying damping torque & comment on most efficient damping torque.	
(e)	State essential properties of efficient control spring.	
(f)	What are the advantages of concentric core construction over U shaped PMMC instrument?	
(g)	State application difference between silicon & germanium diode are used in rectifier instrument.	
(h)	Define deflecting torque equation of induction type instrument & comment on maximum torque condition.	
(i)	Briefly state how moving iron plays important role for creating deflecting torque in MI instrument.	
(j)	Classify moving coil instrument & comment on constructional difference between those types.	
(k)	How vibration galvanometer tuning is carried out?	
(l)	Classify & define galvanometer sensitivity.	
(m)	State limitations of low & high resistance measurement.	
(n)	Define standardization of potentiometer.	
(o)	Name suitable a.c bridge for measurement of self-inductance of high & low Q-factor coil, mutual inductance, lossy capacitance.	
[2]	**Answer *any two* from this module**	**[2×10]**
(a)	Derive the expression of ratio error & phase angle error for current transformer drawing a neat phasor diagram.	[4+4+2]
(b)	What are the adjustments carried out for induction energy meter for correct measurement? Draw a neat sketch of induction energy meter.	[6+4]
(c)	Briefly explain how do you extend current & voltage range of a d.c & a.c instrument with circuit diagram.	[5+5]
[3]	***Answer any two* from this module**	**[2×10]**
a)	Explain measurement of lossy capacitance using any suitable a.c bridge with phasor diagram.	[8+2]
b)	Draw a neat sketch of Ballistic galvanometer. Briefly explain the measurement of magnetic flux density of a ring shaped magnetic material using Ballistic galvanometer with a neat circuit diagram.	[2+8]
(c)	Explain measurement of low resistance using any suitable bridge with stating necessary precautions for correct measurement.	[8+2]
[4]	**Answer *any four* from this module**	**[4×10]**
(a)	A 300 volt MI voltmeter is intended for 50 Hz has an inductance of 0.6 H & resistance of 2 kΩ. Find the series resistance to extend the range of instrument to 600 volt. If the 600 volt, 50 Hz instrument is used to measure a d.c voltage, find the d.c voltage when the scale reading is 300 volt.	[10]
(b)	For a standard Maxwell's inductance-capacitance bridge data are following: Supply frequency is 50 Hz. 1st arm: having an unknown self inductance L_1 with unknown equivalent series resistance r_1 & known non-inductive series resistance R_1=150 Ω, 2nd arm: having a resistance R_2=300 Ω, 3rd arm: having a non-inductive resistance R_3=450 Ω, 4th arm: having non-inductive resistance R_4=2kΩ with parallel capacitance C_4=0.6μF. Calculate value of unknown L_1, r_1 & Q- factor at balance condition.	[10]
(c)	At it's rated load of 50 VA, turns ratio 100/10, a current transformer has an iron loss of 0.4 watt & a magnetizing current of 1A. Calculate its ratio error & phase angle error when supplying rated output to a meter having a ratio of resistance to reactance is 8. [Assume turn's ratio= nominal ratio, neglect secondary winding burden].	[10]
(d)	A basic slide wire d.c potentiometer has a working battery voltage of 4 volt with negligible internal resistance. The resistance of slide wire is 300 Ω & its length is 300 cm. A 300 cm scale is placed along the slide wire. The slide wire has 1mm scale division & possible to read up to 1/5 th of a division. The instrument is standardized with 1.018 volt standard cell with sliding contact at 101.8 cm mark on scale. Calculate the measurement range & the resolution of the instrument.	[10]
(e)	A galvanometer gives a deflection of 200 mm on linear scale at distance 3 m for a steady current of 1.5 μA. The period of oscillation is 6 seconds & moment of inertia of moving system is 1.5×10^{-6} kg-m^2. Calculate the external coil circuit resistance necessary to obtain critical damping, assuming air damping to be negligible & galvanometer resistance R_g =250 Ω. Calculate current sensitivity, voltage sensitivity & meg ohm sensitivity.	[10]