B. E. ELECTRICAL ENGINEERING 2ND YEAR 1ST SEMESTER EXAMINATION, 2018

SUBJECT: - ELECTRICAL MEASUREMENT & MEASURING INSTRUMENTS

Time: Three hours

Full Marks 100
(50 marks for each part)

Use a separate Answer-Script for each part

PART-I

Question No. 1 (carries 20 marks) is compulsory and attempt two more (15 marks each) from the rest.

1. a) The sensitivity of Wheatstone bridge is defined as ratio of   1
   (i) Deflection of the galvanometer to the unit fractional change in the value of unknown resistance
   (ii) Square of the deflection of the galvanometer to the unit fractional change in the value of unknown resistance
   (iii) Deflection of the galvanometer to the twice of the unit fractional change in the value of unknown resistance
   (iv) Unit fractional change in the value of unknown resistance to the deflection of the galvanometer

   b) The dielectric loss of a capacitor can be measured by   1
   i) Owen bridge   ii) Schering bridge
   iii) Wien bridge   iv) Maxwell bridge

   c) The *Gauge Factor* and *Transverse sensitivity* of a strain gauge should be   1
   i)   High and Low respectively   ii)   High and High respectively
   iii) Low and Low respectively   iv)   Low and High respectively

   d) In a Kelvin's double bridge two sets of readings are taken when measuring a low resistance, one   1
   with the current in one direction and the other with direction of current reversed. This is done to
         i) eliminate the effect of contact resistance
         ii) eliminate the effect of resistance of leads
         iii) correct for changes in battery voltage
         iv) eliminate the effect of thermo-electric emfs

   e) The bridge sensitivity for Wheatstone bridge based strain measurement using one active and   1
   one dummy strain gauge is
   i)   1   ii)   0.5
   iii) 0.25   iv)   none of these

   f) What is **phantom loading** in the context of calibration of wattmeter?   3
   g) Define **gauge factor** of a strain gauge. How is it related to **Poisson's ratio, μ**?   3
   h) What do you mean by **"standardization"** of a dc potentiometer?   3
   i) How do iron losses in a specimen of magentic material depend on excitation frequency?   3
   j) Why is reference (cold) junction compensation used for thermocouple?   3

[Turn over

B. E. ELECTRICAL ENGINEERING 2ND YEAR 1ST SEMESTER EXAMINATION, 2018

SUBJECT: - ELECTRICAL MEASUREMENT & MEASURING INSTRUMENTS

Time: Three hours

Full Marks 100
(50 marks for each part)

Use a separate Answer-Script for each part

2. a) What are the precautions to be taken in a high voltage Schering Bridge? 3

    b) A standard cell of 1.0186V used with a dc potentiometer balances at 50 cm. Calculate (i) emf of a cell that balances at 70 cm; (ii) The percentage error of a voltmeter measuring a voltage which balances at 65 cm when reading 1.35V; (iii) The percentage error in an ammeter that reads 0.45A when balance is secured at 43.5 cm while measuring potential difference across a 2 ohm resistor in the ammeter circuit. 5

    c) Derive the expression of measurement sensitivity for a Wheatstone bridge method based strain measurement with four active gauges. 7

3. a) A capacitor with an electrostatic voltmeter of infinite resistance and 10 µF capacitance connected across it, 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 the test capacitor? 5

    b) A Crompton potentiometer has a coarse dial with 15 steps, where each step represents 0.1 V and each dial resistance is 10 ohms. The fine dial is 11 ohms with 200 divisions. How can it be transformed into a dual range potentiometer with multiplying factors X1 and X 0.1. 5

    c) A strain gauge forms one arm of the bridge shown in the figure below and has a nominal resistance without any load as $R_s = 1k\Omega$. Other bridge resistances are $R_1 = R_2 = R_3 = 1k\Omega$. During certain measurement of strain, when the bridge is excited by voltage source (V_i) of 10 V, the strain gauge resistance increases by 1Ω. Find the voltage V_0 across the detector. 5
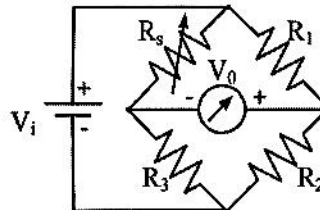
4. a) The total iron loss in a sample is 300 watts at 50 Hz, with a loss component due to eddy current 5 times of that due to hysteresis. At what frequency will the iron loss double itself, if the peak flux density is kept the same? 4

    b) Comment on relative merits and demerits of Ring specimens and square shaped specimens for magnetic tests. 4

    c) Why is it difficult to measure low resistances using Wheatstone's bridge? Explain how the problem is overcome in measuring low resistance by the use of Kelvin's double bridge. 7

5. Write Short Notes on:

    a) Insulation Megger 7.5

    b) Series and Shunt type ohmmeters 7.5

B.E. ELECTRICAL ENGINEERING 2ND YEAR 1ST SEMESTER EXAMINATION, 2018

SUBJECT: - ELECTRICAL MEASUREMENT & 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- II	Marks
	Answer any Five only.	
1.	Answer any *Two* from the following:	2x5=10
	a) "Universal shunt is used to alter the full scale current only for a PMMC meter." – Justify in favour of or against the statement.	
	b) "Logarithmic decrement is an indirect measure of the settling time of an under damped instrument." – Justify in favour of or against the statement.	
	c) "Reading of a moving iron instrument is subjected to waveform error." – Justify in favour of or against the statement.	
2.	a) A resistance of 50 ohm is connected in series with one rectifying device, one permanent magnet moving coil ammeter and one electrodynamometer type ammeter. The entire circuit is connected across a sinusoidal ac supply of 100 V. The resistance of rectifying device is 50 ohm in one direction and 250 ohm in other direction. Calculate the readings of two ammeters.	
	b) What happens to the reading of a PMMC voltmeter if one of its control springs snaps?	7+3
3.	a) A moving iron instrument has full scale current of 100mA. It is converted to a 250V voltmeter by using series resistance made of a material having negligible resistance temperature coefficient. The meter has a resistance of 300 ohm at 20°C and an inductance of 100mH. After carrying a current steadily for a long time, the resistance of the coil increases to 369 ohm due to self heating. Calculate the error due to self heating when the meter is subjected to a voltage of	
	(i) 250V at 50Hz (ii) 250V at 60Hz.	
	b) Why does the inductance of a moving iron instrument vary with deflection?	7+3

4.	a) A correctly adjusted, single phase, 240V induction watthour meter has a constant of 600 revolutions per kWh. Determine the speed of the disc, for a current of 10A at a power factor of 0.8 lagging. If the lag adjustment is altered so that the phase angle between voltage coil flux and applied voltage is 86°, calculate the error introduced at (i) unity power factor (ii) 0.5 power factor lagging b) "Series coil is used to compensate the friction torque in an induction type watthour meter." – State clearly whether the statement is true or false and justify your comment.	7+3
5.	a) A Current Transformer has a bar primary and 200 turns secondary. An ammeter of resistance 1.3Ω and reactance of 0.8Ω is connected as burden across the secondary winding having a resistance of 0.4Ω and reactance of 0.7Ω. The magnetizing and loss ampere turns are 80 and 40, respectively. Find the primary current, the ratio-error and phase angle when secondary current is 8A. b) State three differences between a measuring CT and a protection CT.	7+3
6.	a) Figure-1 An electrodynamometer type wattmeter with ideal current coil (CC) and pressure coil (PC) has been inserted in a circuit, as shown in Figure-1. What will the wattmeter read? b) How do you compensate the effect of inductance of the pressure coil of an electrodynamometer type wattmeter? Justify your solution.	7+3
7.	Write short note on any *One*: a) Measurement of power at high current and high voltage b) Tuning of vibration galvanometer	10