Code No: V3109 **R07** **Set No: 1**

III B.Tech. I Semester Supplementary Examinations, April/May – 2013

ELECTRICAL MEASUREMENTS

(Electrical and Electronics Engineering)

Time: 3 Hours **Max Marks: 80**

Answer any FIVE Questions

All Questions carry equal marks

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1. a) Discuss about the requirements for the construction of multipliers and how the temperature effects can be eliminated in voltmeters?
   b) Discuss about the shape and scale of moving iron instruments.
   c) The inductance of a moving iron instrument is given by $L= (10+5\theta-\theta^2)$ μH where θ is the deflection in radians from zero position. The spring constant is 12 x 10^{-6}Nm/rad. Estimate the deflection for a current of 5A.

2. a) Explain the effect of secondary burden on the ratio and phase errors of a current transformer?
   b) A 1000/5A, 50 Hz current transformer has a secondary burden comprising a non inductive impedance of 1.6 Ω. The primary winding has one turn. Calculate the flux in the core and ratio error at full load. Neglect leakage reactance and assume the iron loss in the core to be 1.5 W at full load. The magnetizing mmf is 100 A.

3. Write short notes on the following
   a) Errors in power measurements due to connections of wattmeter in different ways
   b) Two wattmeter method of measuring 3 phase power
   c) Extension of wattmeter range by instrument transformers

4. a) Draw a neat circuit diagram of a single phase watt hour meter and explain its working.
   b) What are the various sources of errors and how they are compensated?
   c) A large consumer has a KVA demand and a KVAh tariff measured by "Sine" and "cosine" watthour type meters each equipped with a Merz price demand indicator. The tariff is Rs.40 per month per KVA of demand plus 30 paise per KVAh. Determine the monthly bill for 30 days based upon the following readings: 'Sine' meter advances by 90,000 reactive KVAR demand indicator 150 KVAR, 'cosine' meter advances by 120,000 kwh & demand indicator by 200kw. What is the average monthly pf and the total cost per unit?

5. a) Explain the reasons why d.c. potentiometers cannot be used for a.c. measurement. Explain the modifications that are needed in a d.c. potentiometer to be used for a.c. applications.
   b) In the measurement of power by a polar potentiometer, the following readings were obtained : Voltage across a 0.2 Ω standard resistance in series with the load = 1.46 V 32^0 Voltage across a 200:1 potential divider across the line = 1.37 V 56^0. Estimate the current, voltage, power and power factor of the load.

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6. a) What are the different factors that affect the precision measurement of medium resistances with Wheatstone bridge. Explain how their effects are minimized.
   b) The four arms of a Wheatstone bridge are as follows. AB = 1KΩ, BC = R, CD = 5KΩ and DA = 1KΩ. A galvanometer is connected between BD and a dc voltage source between AC. The Thevenin source generator voltage E_0 is given by 24mV and the galvanometer current is 13.6μA. Calculate the value of R.

7. a) Describe how relative permittivity of a specimen of insulating material can be determined using a schering bridge.
   b) A sheet of bakelite 4.5 mm thick is tested at 50Hz between electrodes 0.12 m in diameter. The schering bridge employs a standard air capacitor C_2 of 106 pF capacitance, a non-reactive resistance R_4 of 1000/π ohms in parallel with a variable capacitor C_4, and a non-reactive variable resistance R_3. Balance is obtained with C_4=0.5μF and R_2=260 Ω. Calculate the power factor, capacitance and relative permittivity of sheet.

8. a) Explain the methods of separation of iron losses into their two components: eddy current and hysteresis losses.
   b) The iron loss in a sample is 300W at 50Hz. with eddy current loss component 5 times as big as the hysteresis loss component. At what frequency will the iron loss be double if the flux density is kept the same?

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Code No: V3109 **R07** **Set No: 2**

III B.Tech. I Semester Supplementary Examinations, April/May – 2013

ELECTRICAL MEASUREMENTS

(Electrical and Electronics Engineering)

Time: 3 Hours **Max Marks: 80**

Answer any FIVE Questions

All Questions carry equal marks

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1. a) How is the current range of a PMMC instrument extended with the help of shunts? Describe a method of reducing errors due to temperature changes in the shunt connected instruments.
   b) The coil of a 300 V moving iron voltmeter has a resistance of 500 Ω and an inductance of 0.8 H. The instrument reads correctly at 50 Hz a.c supply and takes 100 mA at full scale deflection. What is the percentage error in the instrument reading when it is connected to 200 V d.c supply.

2. a) Describe the constructional details and working of a single phase electrodynamometer type of power factor meter. Prove that the special displacement of moving system is equal to the phase angle of the system.
   b) The exciting current of a ring core current transformer of ratio 1000/5A when operating at full primary current and with a secondary burden of non inductive resistance of 1 Ω is at a power factor of 0.4. Calculate (i) the phase displacement between primary and secondary winding currents. (ii) the ratio error at full load, assuming that there has been no compensation.

3. a) Explain the errors caused due to pressure coil inductance and pressure coil capacitance in electro dynamometer wattmeter.
   b) Discuss the shape of scale of electro dynamometer wattmeters with the help of a neat sketch.

4. a) Draw a neat sketch showing the construction of a single phase induction type energy meter. Give the theory & operation of the instrument
   b) An energy meter is designed to make 100 revolutions of the disc for one unit of energy. Calculate the number of revolutions made by it when connected to a load carrying 40A at 230 volts at 0.4 pf for an hour. If it actually makes 360 revolutions, find the percentage error.

5. a) Describe the construction and working of a co-ordinate type a.c. potentiometer. How is it standard? Explain how an unknown voltage can be measured with it.
   b) Discuss the source of errors with respect to a.c potentiometers.

6. a) Describe with a neat diagram the working of a Carey Foster Slide wire bridge method.
   b) In a Carey Fosters bridge a resistance of 1.0125 ohms is compared with a standard resistance of 1.0000, the slide wire has a resistance of 0.250 Ω in 100 divisions. The ratio arms nominally 10 Ω each are actually 10.05 and 9.95 respectively. How far (in scale divisions) are the balance positions from those which would obtain of arms ratio were true to their nominal value? The slide wire is 100cm long.

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7. a) Give advantages and disadvantages of maxwell's inductance-capacitance bridge.
   b) A bridge consists of arm ab, a choke coil having a resistance R_1 and inductance L_1. arm bc a non-inductive resistance R_3. arm cd a mica condenser C_4 in series with a non-inductive resistance R_4 and arm da a non inductive resistance R_2. When this bridge is fed from a source of 500Hz, balance is obtained under following conditions: R_2=2410 Ω, R_3=750 Ω, C_4=0.35μF, R_4=64.5 Ω. The series resistance of capacitance is = 0.4 Ω. Calculate the resistance and inductance of the choke coil. The supply is connected between a and c and the detector is between b and d.

8. a) Explain in detail how measurement of leakage factor can be done using flux meter?
   b) In loss tests on a sample of iron laminations the following results were recorded:
   (i). 60 Hz, 250 v total iron loss=200 W (ii) 40 Hz,100 v, total iron loss=40 W. calculate the eddy current and hysteresis loss for each test. The Stienmetz index is 1.6.

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Code No: V3109 **R07** **Set No: 3**

III B.Tech. I Semester Supplementary Examinations, April/May – 2013

ELECTRICAL MEASUREMENTS

(Electrical and Electronics Engineering)

Time: 3 Hours **Max Marks: 80**

Answer any FIVE Questions

All Questions carry equal marks

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1. a) Describe the constructional details of an attraction type moving iron instrument with the help of a neat diagram. Derive the equation for deflection if spring control is used and comment upon the shape of scale.
   b) An electrostatic voltmeter reading upto 2000 V is controlled by a spring with a torsion constant of 5×10^{-6} Nm/rad has a full scale deflection of 90^0. The capacitance at zero voltage is 15 pF. What is the capacitance when the pointer indicates 2000 V?

2. a) What are the different methods of measurement of frequency in the power frequency range. Explain the working of a mechanical resonance type frequency meter.
   b) Justify "Never open the secondary winding circuit of a current transformer while its primary winding is energized".

3. a) Explain with the help of a neat circuit diagram, how the power & the power factor in a 3φ circuit can be measured by two wattmeter method. Explain how the readings of the two wattmeters change with load p.f?
   b) A balanced load is supplied from a 3Φ, 400V, 3 wire system whose power is measured by two wattmeters. If the total power supplied is 26 KW at 0.75 pf lagging, find the readings of each of the two wattmeters.

4. a) Explain the constructional details of 3-Φ energy meter.
   b) A correctly adjusted single phase 240Volts, induction watthour meter has a meter constant of 600 revolution per kwh. Determine the speed of the disc, for a current of 10 A 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 86^0. Calculate the error introduced at (i). unit pf (ii). 0.5 pf lagging.

5. a) Explain the operation of any one type of AC potentiometer.
   b) Explain clearly how such a potentiometer can be employed for measurement of unknown resistance and current.

6. Describe about the Kelvin double bridge for the comparison of small resistances. Explain the precautions followed for achieving highest precision.

7. a) Derive the general equations for balance of an a.c. bridge. Prove that "For balance in an a.c. bridge, both magnitude and phase have to be satisfied unlike a d.c. bridge where in only the magnitude condition is to be satisfied".
   b) Describe the sources and the null detectors that are used for a.c. bridges.

8. a) Prove that in a ballistic galvanometer, the charge is proportional to first swing of the moving coil.
   b) Explain the core loss measurements by bridges.

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Code No: V3109 **R07** **Set No: 4**

III B.Tech. I Semester Supplementary Examinations, April/May – 2013

ELECTRICAL MEASUREMENTS

(Electrical and Electronics Engineering)

Time: 3 Hours **Max Marks: 80**

Answer any FIVE Questions

All Questions carry equal marks

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1. a) Derive the expression for deflection for a rotary type electrostatic instrument using spring control. Comment upon the scale of the instrument. Why is it not widely used for sensitive low voltage measurements?
   b) A moving coil instrument gives a full scale deflection of 10 mA when the potential difference across its terminals is 100 mV. Calculate (i) the shunt resistance for a full scale deflection corresponding to 100 A (ii) the series resistance for full scale reading with 1000 V. Calculate the power dissipation in each case.

2. a) Describe the construction and working of a Weston type synchroscope. How is it assured that the (i) incoming machine has the same phase sequence as the busbars to which it has to be connected. (ii) incoming machine is faster or slower than the busbars
   b) List out the advantages and disadvantages of moving iron type power factor meter.

3. a) Derive the torque equation for an electrodynamometer type of wattmeter.
   b) In a dynamometer wattmeter the moving coil has 500 turns of mean diameter 30 mm. Estimate the torque if the axes of the field and the moving coils are at (a) 60^0 (b) 90^0 when the flux density produced by field coils is 15×10^{-3} Wb/m^2, the current in moving coil is 0.05 A and the power factor is 0.866.

4. a) Describe in details the working of a Trivector meter.
   b) What is phantom loading? Explain with an example how is it more advantageous than testing with direct loading.

5. a) Describe the construction and working of a polar type potentiometer. How is it standardized? What are the functions of the transfer instrument and the phase shifting transformer?
   b) Write the applications of A.C potentiometers?

6. a) Draw the circuit of Kelvin double bridge used for measurement of low resistances. Derive the condition for balance.
   b) A highly sensitive galvanometer can detect a current as low as 0.1 nA. This galvanometer is used in a whetstone bridge as a detector. The resistance of galvanometer is negligible. Each arm of the bridge has a resistance of 1KΩ. The input voltage applied to the bridge is 20V. Calculate the smallest change in the resistance which can be detected.

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7. Describe the working of Hay's bridge for measurement of inductance. Derive the equations for balance and draw the phasor diagram under conditions of balance. Why is this bridge suited for measurement of Inductance of high Q coils?

8. a) Explain the construction and operation of flux meter.
b) A flux meter is connected to a search coil having 500 turns and a mean area of 500 mm^2. The search coil is placed at the centre of a solenoid 1 metre long, wound with 800 turns. When a current of 5 A is reversed, there is a deflection of 25 scale divisions. Calculate the calibration in flux linkages per scale division.

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