Code No: 07A50201 **R07** **Set No. 2**

III B.Tech I Semester Examinations,May 2011
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) Explain how 3-phase power can be measured with the help of a wattmeter. Explain with a phasor diagram.
   (b) A 3 phase 500 V motor load has a power factor of 0.4. Two wattmeters connected to measure the input. They show the input to be 30 kW. Find the reading of each instrument. [8+8]

2. (a) Explain about Pressure coil inductance in an Electrodynamometer Wattmeter.
   (b) A wattmeter reads 5.54 kW when its current coil is connected in the red phase and its voltage coil is connected between the neutral and red phase of a symmetrical 3 phase system supplying a balanced load of 30 A at 400 V. What will be the reading of the instrument if the current coil remains unchanged and voltage coil be connected between blue and yellow phases. The phase sequence is RYB. What does this figure represent? [8+8]

3. When two wattmeter method is used for measurement of power in a three phase balanced circuit, comment upon the readings of the two wattmeters under following conditions. Support your answer by drawing phasor diagrams. Assume that the system is star (Wye connected).
   (a) When the power factor is unity.
   (b) When the power factor is zero lagging.
   (c) When the power factor is 0.5 lagging.
   (d) When the power factor is 0.3 lagging. [16]

4. (a) Explain the substitution method of measurement of medium resistances. List the factors on which the accuracy of the method depends
   (b) A 4 terminal resistor of approximately $100\mu\Omega$ resistance was measured by means of a Kelvin's bridge having the following component resistances. Standard resistor = $100.03\mu\Omega$;
   Inner ratio arms = 100.31Ω and 200Ω; Outer ratio arms = 100.24Ω and 200Ω; Resistance of link connecting the standard and the unknown resistance $=700\mu\Omega$. Calculate the unknown resistance to the nearest $0.01\mu\Omega$. [16]

5. (a) Draw the circuit diagram and phasor diagram of Owen's bridge under balance conditions. Derive the equations under balance conditions.

(b) An Owen's bridge is used to measure the properties of a sample of sheet steel at 2 KHz. At balance, arm AB is test specimen; arm BC is R3 = 100 Ω; arm CD is C4 = 0.1μF and arm DA is R2 = 834 Ω in series with C2 = 0.124μF. Calculate the effective impedance of the specimen under test conditions.[8+8]

6. A manufacturer lists grain oriented steel sheet 0.3 mm thick. The resistivity of material is 50×10^{-8} Ω / m. The hysteresis loop is essentially rectangular in form, with a coercive force of 12 A/m for all peak values of flux densities between 0.8 to 1.6 Wb/m^2. A sinusoidal flux density of 1 Wb/m^2(peak) at 100 Hz is used. The density of material is 7650Kg/m^3. Find the total loss per Kg. [16]

7. (a) With a neat sketch, explain the construction and working of a 3-ϕ dynamometer power factor meter. Draw the phasor diagram.

   (b) A current transformer has a bar primary and 200 secondary winding turns. The secondary winding burden is an ammeter of resistance 1.2 Ω and reactance 0.5 Ω, the secondary winding has a resistance of 0.2 Ω and reactance 0.3 Ω. The core requires the equivalent of an mmf of 100 A for magnetization and 50 A for core losses.

      i. Find the primary winding current and ratio error when the ammeter in the secondary winding circuit indicates 5 A.
      ii. How many turns could be reduced in the secondary winding in order that the ratio error be zero for this condition? [8+8]

8. (a) Explain with the help of suitable diagrams, how a D.C. potentiometer can be used for

      i. Calibration of voltmeter
      ii. Calibration of ammeter

   (b) A single range potentiometer has a 18 step dial switch where each step represents 0.1V. The dial resistors are 10Ω. The slide wire of the potentiometer is circular and has 11 turns and a resistance of 11Ω each. The slide wire has 100 divisions and interpolation can be done to 1/4th of division.The working battery has a voltage of 6V and negligible internal resistance. Calculate

      i. The measuring range of a potentiometer
      ii. the resolution
      iii. Working current and
      iv. Setting of rheostat. [16]

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Code No: 07A50201 **R07** **Set No. 4**

III B.Tech I Semester Examinations,May 2011
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. Describe the constructional details and principle of operation of a electrodynamometer type wattmeter. [16]

2. (a) What are the special features that are incorporated into the electrodynamometer wattmeter for making a low power factor type of wattmeter?

   (b) A wattmeter reads 5.54 kW when its current coil is connected in the red phase and its voltage coil is connected between the neutral and red phase of a symmetrical 3 phase system supplying a balanced load of 30 A at 400 V. What will be the reading of the instrument if the current coil remains unchanged and voltage coil be connected between blue and yellow phases. The phase sequence is RYB. What does this figure represent? [8+8]

3. (a) Derive the torque equation for an electrodynamometer type of wattmeter. Comment upon the shape of scale if spring control is used. How is it that a uniform scale is obtained when the scale span is about -45^0 to 45^0 of the position where there is zero mutual inductance between fixed and moving coils?

   (b) A 3 phase 500 V motor load has a power factor of 0.4. Two wattmeters connected to measure the input. They show the input to be 30 kW. Find the reading of each instrument. [8+8]

4. (a) Explain how power can be measured in a 3 phase circuit with the help of two wattmeters.

   (b) Illustrate your answer with the help of phasor diagram for a balanced star connected load. [8+8]

5. (a) State the advantages and disadvantages of Maxwells bridge?

   (b) State the limitations of L.V. Schering bridge.

   (c) Explain the common sources of error in A.C. bridges. How they are eliminated.

   (d) Why there are two conditions of balance in A.C. bridges, where as there is only one in D.C. bridges. [16]

6. (a) Draw the block diagram of a dual-slope digital volt meter and explain how it is advantageous to use dual slope A/D converter in DVM?

   (b) The inductance of a moving iron instrument is given by L = $(10 + 5\theta - \theta^2)\mu$H where θ is the deflection in radian from zero position. The spring constant is 12×10^{-6} Nm / rad. Estimate the deflection for a current of 5 amps. [8+8]

7. (a) Explain about the Testing of A.C meters by Phantom Loading (phase shifting device in the current circuit).

   (b) A 240 V, 5 A, single phase energy meter has a registration constant of 1200 revolutions per kWh. It is tested by means of a 240 V, 5A wattmeter having 500 scale divisions which can be read to 0.1 division and a stop watch which can be read to 0.01 second and which has negligible error. When tested at full load, the meter makes 40 revolutions in 99.8 s. If the human error in timing be taken as $\pm$ 0.05 s, estimate the limits within which the error of the meter may lie. The wattmeter is accurate to within 0.05 percent of its full scale reading. [8+8]

8. Expalin the constructional details of the following:

   (a) Ballastic galvanometer.

   (b) Flux meter. [8+8]

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Code No: 07A50201 **R07** **Set No. 1**

III B.Tech I Semester Examinations,May 2011
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) With help of neat sketch, explain about a reactive power measurement using single phase varmeter. Also draw the phasor diagram.
   (b) A 3 phase 500 V motor load has a power factor of 0.4. Two wattmeters connected to measure the input. They show the input to be 30 kW. Find the reading of each instrument. [8+8]
2. (a) What are the various errors in electrodynamometer type wattmeter? Explain them briefly.
   (b) A wattmeter reads 5.54 kW when its current coil is connected in the red phase and its voltage coil is connected between the neutral and red phase of a symmetrical 3 phase system supplying a balanced load of 30 A at 400 V. What will be the reading of the instrument if the current coil remains unchanged and voltage coil be connected between blue and yellow phases. The phase sequence is RYB. What does this figure represent?
   [8+8]
3. (a) Explain the working of a 3-phase wattmeter. Draw a neat sketch of the wattmeter and also its connections. Describe how the mutual effects between the two elements of the wattmeter are eliminated.
   (b) The power flowing in a 3-phase, 3 wire balanced load system is measured by two wattmeter method. The reading of wattmeter A is 7500 W and of wattmeter B is -1500 W.
      i. What is the power factor of the system?
      ii. If the voltage of the circuit is 400 V, what is the value of capacitance which must be introduced in each phase to cause the whole of the power measure to appear on wattmeter A. The frequency is 50 Hz. [8+8]
4. State and explain the application of A.C. potentiometers with the suitable diagrams.
   [16]
5. (a) What are the advantages of instrument transformers?
   (b) What happens if the secondary of C.T opens suddenly?
   (c) Explain any one method of testing of current transformer. [6+6+4]
6. (a) What are electrostatic instruments? What is the basic principle on which they operate?

(b) Discuss the working of a repulsion type electrostatic instrument with a neat sketch. [8+8]

7. (a) Draw the circuit diagram and phasor diagram under balanced conditions for the following bridges. Also derive the equations under balance conditions.
   i. Maxwell's bridge
   ii. Hay's bridge
   iii. Anderson's bridge. [8+8]

8. Write short notes on the following:
   (a) Constructional details of Flux meter.
   (b) Measurement of iron loss by A.C. potentiometer.
   (c) Principle of working of ballistic galvanometer. [6+5+5]

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Code No: 07A50201 **R07** **Set No. 3**

III B.Tech I Semester Examinations,May 2011
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. Describe the method of measurement of reactive power in three phase circuits using angle dynamometer type wattmeter. [16]

2. (a) Describe the following methods of measurement of reactive power in three phase circuits.
   i. Using two autotransformers.
   ii. Using a single electrodynamometer type wattmeter. [8+8]

3. (a) With help of neat sketch, explain about a reactive power measurement using two auto-transformers. Also draw the phasor diagram.
   (b) A wattmeter has a current coil of 0.1 Ω resistance and a pressure coil of 6500 Ω resistance. Calculate the percentage errors, due to resistance only with each of the two methods of connection of wattmeter when reading the input to an apparatus which takes
   i. 12 A at 250 V with unity power factor and
   ii. 12 A at 250 V and 0.4 power factor. [8+8]

4. (a) Explain the theory of flux meter. Also state its advantages and disadvantages.
   (b) Calculate the percentage change in the hysterisis and eddy current losses of a choke coil if other factors remain constant
   i. The formfactor of the applied voltage decreases by 20%
   ii. The frequency of the applied voltage increases by 20%, Neglect resistance of the choke coil. [8+8]

5. (a) Draw the circuit diagram of Desauty's bridge and phasor diagram under balance conditions. Derive the equations under balance conditions.
   (b) In a low voltage Schering bridge designed for the measurement of permitivity, the branch AB consists of two electrodes between which the specimen under test may be inserted; Arm BC is a non reactive resistor R3 in parallel with a standard capacitor C3; Arm CD is a non reactive resistor R4 in parallel with a standard capacitor C4; Arm DA is a standard air capacitor of capacitance C2. With out the specimen between the electrodes, balance is obtained with the following values, C3 = C4 =120pF, C2 = 150pF, R3 = R4 = 5000Ω. With the specimen inserted these values become C3 = 200pF, C4 =1000pF, C2 =900pF and R3=R4=50000 Ω. In each test w = 5000rad/sec. Find the relative permitivity of the specimen. [8+8]

6. (a) How a co-ordinate type A.C. potentiometer is standardized? Explain how an unknown voltage can be measured by using this potentiometer?
   (b) What are the sources of errors in the above potentiometer? [8+8]

7. (a) Explain the following:
      i. How the effects of contact resistance and resistance of the connecting leads are eliminated in the measurement of resistance by Kelvins double bridge?
      ii. Why is the voltmeter-ammeter method unsuitable for the precise measurement of the low resistance?
   (b) A four terminal resistance of approximately $50\mu\Omega$ was measured with the help of Kelvin double bridge under the following conditions: Value of standard resistance 100.03 $\mu\Omega$; Resistance of inner ratio arms 100.31 Ω and 200Ω; Resistance of outer ratio arms 100.24 Ω and 200Ω; Value of low resistance link $700\mu\Omega$. Calculate the magnitude of error in the measurement? [16]

8. (a) Explain the working of a 3-phase induction type energy meter.
   (b) A 230 V, single phase, watt hour meter has a constant load of 4 A, passing through it for 6 hours, at UPF. If the meter disc makes 2208 revolutions, during this period, what is the meter constant in revolutions/kwh. Calculate the power factor of the load, if the number of revolutions made by the meter are 1472 when operating at 230 V& 5A for 4 hours. [8+8]

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