III B.Tech. I Semester Supplementary Examinations, May -2005
ELECTRICAL MEASUREMENTS
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What are the different types of instruments that are used as ammeters and voltmeters? What are the errors that occur in ammeters and voltmeters?
   (b) Describe how can we obtain different voltage ranges by using a multirange dc voltmeter. Discuss about sensitivity and loading effects of PMMC voltmeters.

2. (a) Describe the working of a Quadrant Electrometer. Derive the deflection in the case of
      i. Heterostatic connection and
      ii. Idiostatic connection. If the instrument is spring controlled, which of these instruments can be used for measurement of low voltages?
   (b) The spring constant of 3000V electrostatic voltmeter is $7.06x10^{-6}$ Nm/rad. The full scale deflection of the instrument is 80^0. Assuming the rate of change of capacitance with angular deflection to be constant over the operating range, calculate the total change of capacitance from zero to full scale.

3. Explain the following errors for electro dynamometer wattmeters.
   (a) Mutual inductance effects
   (b) Errors due to connections
   (c) Eddy currents
   (d) Stray Magnetic fields
   (e) Vibration of Moving system
   (f) Tempetature errors

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 no. of revolutions made by it when connected to a load carrying 20A at 230volts at 0.8 pf for an hour. If it actually makes 360 revolutions, find the percentage error.

5. (a) Explain the reasons why a separate standard cell dial circuit is provided in modern d.c. potentiometers.
   (b) A slide wire potentiometer has a battery of 4V and negligible internal resistance. The resistance of slide wire is 100Ω and its length 200cm. A standard cell of 1.018V is used for standardizing the potentiometer and the rheostat is adjusted so that balance is obtained when the sliding contact is at 101.8cm.

6. (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 0.2Ω standard resistance in series with the load = 1.46 $\angle 32^oV$

   Voltage across a 200:1 potential divider across the line = 1.37$\angle 56^oV$

   Estimate the current, voltage, power and power factor of the load.

7. (a) Derive the equations for balance in the case of Maxwells Inductance capacitance bridge. Give its advantages. Draw the phasor diagram for balanced conditions.

   (b) An a.c bridge circuit is working at 1000Hz. Arm ab is 0.2μF pure capacitance, arm bc is a 500Ω pure resistance, arm cd contains an unknown impedance and arm da has a 300Ω resistance in parallel with a 0.1μF capacitor. Find the R and C (or) L constants of arm cd considering it as a series circuit.

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. 60hz,250v total iron loss=200w

      ii. 40hz,100v, total iron loss=40w.

      calculate the eddy current and hysteresis loss for each test. The Stienmetz index is 1.6

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Code No: RR310202 **Set No.2**

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Time: 3 hours **Max Marks: 80**

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1. (a) What are the different types of instruments that are used as ammeters and voltmeters? What are the errors that occur in ammeters and voltmeters?
   (b) Describe how can we obtain different voltage ranges by using a multirange dc voltmeter. Discuss about sensitivity and loading effects of PMMC voltmeters.
2. (a) Explain the constructional features used in potential transformers to reduce the ratio and phase angle errors.
   (b) Explain the characteristics of potential transformers in detail
3. (a) Describe the construction & working of electro dynamo meter wattmeter. Derive the expression for torque when the instrument is used on a.c.
   (b) The pressure coil of an electro dynamo meter wattmeter has a resistance of 6600Ω. When the voltage applied to the pressure coil is 120V and a current of 20A flows in the series coil, the deflection is 160^0. What additional resistance must be connected in the pressure coil circuit to make the meter constant equal to 20W per degree.
4. (a) Draw a neat circuit diagram of a single phase watt hour meter and explain its working. What are the various sources of errors and how they are compensated?
   (b) 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. Describe the construction, principle of operation of a duo-range potentiometer by drawing its circuit diagram. Also explain its advantages
6. 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?
7. (a) Explain what is meant by sliding balance. How is this condition avoided by choosing variables for manipulation of balance i.e. why variables are so chosen that the two equations for balance are independent of each other?

(b) Why is it preferable in bridge circuits, that the equations for balance are independent of frequency? Explain

8. (a) Describe briefly the different types of tests that are used for testing of magnetic materials.

(b) Explain the principle of operation of Ballistic galvanometer with neat circuit diagram?

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Code No: RR310202 **Set No.3**

III B.Tech. I Semester Supplementary Examinations, May -2005
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(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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1. (a) Derive the expression for deflection for a rotary type electro static instrument using spring control. Comment upon the scale of the instrument.
   (b) An electrostatic voltmeter is constructed with six parallel, Semi circular fixed plates equispaced at Ymm intervals and five inter leaved semi circular movable plates that move in planer midway between the fixed plates in air. The instrument is spring controlled. If the radius of movable plates is 40mm, calculate the spring constant if 10kV corresponds to full scale deflection of 100^0. Neglect edge effects and plate thickness. The permittivity of air is 8.85 x 10^{-12}F/M

2. (a) With neat sketch, explain how high currents and voltages can be measured with the help of instrument transformers. Describe the advantages of instrument transformers for extension of range of current and voltage on high voltage a.c. systems.
   (b) A current transformer with 5 primary turns has a secondary burden consisting of a resistance of 0.16Ω and an inductive resistance of 1.12Ω . When the primary current is 200A, the magnetizing current is 1.5A and the iron loss current is 0.4A. Determine the expressions used, the number of secondary turns needed to make the current ratio 100:1 and also the phase angle under these conditions.

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 no. of revolutions made by it when connected to a load carrying 20A at 230volts at 0.8 pf for an hour. If it actually makes 360 revolutions, find the percentage error.

5. (a) Describe the working and construction of a potentiometer with the help of a diagram.
   (b) A basic slide wire potentiometer has a working battery voltage of 3.0V with negligible internal resistance. The resistance of slide wire is 400Ω and its length is 200cm. A 200cm scale is placed along the slide wire. The slide wire

has 1mm scale divisions and it is possible to read up to 1/5 of a division. The instrument is standardized with 1.018V standard cell with sliding contact at the 101.8cm mark on scale calculate

i. working current
ii. the resistance of series rheostat
iii. the measurement range
iv. the resolution of instrument

6. (a) What are the various limitations of wheat stone bridge for measurement of high and low resistances
   (b) Derive an expression for current through the galvanometer connected in wheatstone bridge for a small unbalance
   (c) Describe the substitution method of measurement of medium resistances. List the factors on which the accuracy of the method depends upon

7. (a) Describe how an Inductance can be measured in terms of capacitance, by using owen's bridge. Draw the phasor diagram and explain
   (b) Give the advantages and disadvantages of owen's bridge.

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. 60hz,250v total iron loss=200w
      ii. 40hz,100v, total iron loss=40w.
      calculate the eddy current and hysteresis loss for each test. The Stienmetz index is 1.6

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1. (a) A moving coil instrument whose resistance is 25Ω gives a full-scale deflection with a current of 1mA. This instrument is to be used with a manganin shunt to extend its range to 100mA. Calculate the error caused by a 10^0C rise in temperature when :
   i. Copper moving coil is connected directly across the manganin shunt.
   ii. A 75 ohm manganin resistance is used in series with the instrument moving coil . The temperature coefficient of copper is $0.004/^0$C & that of manganin is $0.00015/^0$C.
   (b) Give brief description about Multi range Ammeters.

2. (a) Explain heterostatic and idiostatic connections of a quadrant electrometer with the help of neat sketches and derive the torque equations for both the connections.
   (b) Discuss about the advantages and disadvantages of Electrostatic instruments.

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 circuit diagram of a single phase watt hour meter and explain its working. What are the various sources of errors and how they are compensated?
   (b) 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 Resonance type synchroscope
   (b) In a deflection frequency meter working on the principle of electrical resonance, there are two parallel circuits each consisting of an inductance and capacitance in series. One circuit has C_1=1μF and is tuned to a frequency f_1=60Hz. The other has C_2=1.5μF and is tuned to a frequency, f2 below 50Hz.. The resistance of each circuit is R_1=R_2=100 ohms. What must be the inductance

of the second circuit, and to what frequency must it be tuned, in order that the current in both the circuits shall be same at a frequency of 50Hz.

6. 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?

7. (a) Discuss in detail about high voltage schering bridge

   (b) The Four arms of a bridge are :
   arm ab : an imperfect capacitor C_1 with an equivalent series resistance of r
   arm bc : a non inductive resistance R_3
   arm cd : a non-inductive resistance R_4,
   arm da : an imperfect capacitor C_2 with an equivalent resistance of r_2 series with a resistance R_2
   A supply of 450Hz is given between terminal a and c and the detector is connected between b and d. At balance : R_2=4.8Ω, R_3=2000Ω, R_4=2850Ω and C_2=0.5μF and r_2=0.4Ω. Calculate the value of C_1 and r_1 and the dissipating factor

8. (a) Explain the methods of seperation of iron losses into their two components: eddy current and hysteresis losses.

   (b) If the maximum value fo flux density is maintained constant and

      i. frequency is varied keeping the form factor constant.

      ii. form factor is varied keeping the frequency constant.

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