Code No: RR310202 **Set No. 1**

III B.Tech I Semester Regular Examinations, November 2006
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) Derive the general torque equation of moving iron instruments.
   (b) Discuss about the shape and scale of moving iron instruments.
   (c) The inductance of a moving iron instrument is given by L=(10+5θ-θ^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. [6+4+6]

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. [8+8]

3. (a) Explain the following methods of measurement of reactive power in three phase circuits
      i. Two autotransformers method
      ii. A single electrodynamometer type wattmeter method
   (b) A dynamometer wattmeter measures power in a 50Hz, single phase circuit without error, at all power factors. The resistance of the voltage coil & its series resistance has a disturbed self capacitance equivalent to a shunt capacity of 20pf. What is the self inductance of the pressure coil? [10+6]

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? [8+8]

5. With a neat sketch explain the working and construction of electro resonance type power factor meters. Draw the phasor diagrams under different power factor conditions. [16]

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? [16]

7. (a) What are the different sources of errors in a.c. bridges? Explain the precautions taken and the techniques used for elimination/minimization of these errors.

   (b) Explain the function and working of wagner Earth devices. [8+8]

8. Describe a method of experimental determination of flux density in a specimen of magnetic material using a ballistic glavanometer [16]

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

III B.Tech I Semester Regular Examinations, November 2006
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) How is the current range of a PMMC instrument extended with the help of shunts? Give the essential requirements for the construction of shunts. Describe a method of reducing errors due to temperature changes in the shunt connected instruments.
   (b) Design an Ayrton shunt to provide an ammeter with current ranges of 1A, 5A, 10A & 20A. A basic meter with an internal resistance of 50W & a full scale deflection current of 1 mA is to be used. [8+8]

2. (a) Why electro static instruments cannot be used for measurement of low voltages while electromagnetic instruments can be? Illustrate your answer with some specific example comparing the energy densities produced in electrostatic instruments and electromagnetic instruments.
   (b) The movable range of a quadrant electrometer turns through 40 scale divisions when it is idiostatically connected to a potential of 100V. When it is used heterostatically with the quadrants connected to a small voltage "e"? and the needle to a 100v supply, the deflection is 15 scale divisions. Determine the voltage "e". [8+8]

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. [8+8]

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. [8+8]

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 [8+8]

6. A moving coil galvanometer has a sensitivity of 4 cm per micro ampere, with a scale of 1 metre distant, and the time of free oscillation is 2.8 seconds If the galvanometer is dead beat when the total circuit resistance (coil and external circuit) is 2500 ohms, find the moment of inertia of the moving system. Prove the formula used [16]

7. (a) What are the usual errors encountered in a.c. bridges and how are they eliminated
   (b) Explain how capacitance of an imperfect capacitor is measured using A.C. bridge and draw the phasor diagram for the balanced bridge [8+8]

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. [8+8]

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

III B.Tech I Semester Regular Examinations, November 2006
ELECTRICAL MEASUREMENTS
(Electrical & Electronic Engineering)

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

Answer any FIVE Questions
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1. (a) Discuss the following types of errors in moving iron instruments.
   i. Hysterisis error
   ii. Temperature error
   iii. Errors due to stray magnetic fields
   iv. Errors due to change of frequency.
   (b) Describe the working and constructional details of repulsion type moving iron instrument. Discuss its advantages and disadvantages [8+8]

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. [8+8]

3. (a) Explain how the power in a 3 phase system is measured by the use of
   i. only one wattmeter
   ii. two wattmeters. Indicate how the power factor is determined.
   (b) A non inductive resistance is connected in series with a coil across a 230V, 50Hz supply. The current is 1.8A and the potential difference across the resistance and the coil is 80 & 171 volts respectively. Calculate
   i. resistance & inductive reactance of the coil
   ii. the supply power & pf [8+8]

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. [8+8]

5. (a) Find the working current of the slide wire and the rheostat setting
   (b) If the slide wire has divisions marked in mm and each division can be interpolated to one fifth, calculate the resolution of the instrument.
   (c) What is standardization and explain with an example, how it is obtained. [6+4+6]

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 $\underline{\lfloor 32^{o}V}$ Voltage across a 200:1 potential divider across the line = 1.3756^{0}V. Estimate the current, voltage, power and power factor of the load. [8+8]

7. (a) Describe how relative permittivity of a specimen of insulating material can be determined using a schering bridge.

   (b) A sheet of bakelite 4.5mm 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 $1000/\pi$ 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=260Ω. Calculate the power factor, capacitance and relative permittivity of sheet. [8+8]

8. (a) Explain in detail about Ewing double bar permeameter.

   (b) Explain in detail about Fahy's simplex permeameter. [8+8]

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Code No: RR310202 **Set No. 4**

III B.Tech I Semester Regular Examinations, November 2006
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) How are moving iron instruments classified? Describe briefly the construction and working of Ballistic Galvanometer
   (b) Why the scale of a moving iron instrument is non uniform? Discuss briefly why the scale is compressed at lower and higher ends. [10+6]

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. [10+6]

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+6+6]

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. [8+8]

5. Describe the constructional details and working of a 1ϕ electro dynamometer type of power factor meter. And also prove that special displacement of moving system is equal to the phase angle of the system. [8+8]

6. Describe about the Kelvin double bridge for the comparison of small resistances. Explain the precauctions followed for achieving highest prescision [16]

7. (a) Give advantages and disadvantages of Hays bridge in details

(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. When this bridge is fed from a source of 500Hz, balance is obtained under following conditions: R_2=2410Ω, R_3=750Ω, C_4=0.35μF, R_4=64.5Ω. The series resistance of capacitance is = 0.4Ω. 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+8]

8. Describe the construction and working of

(a) Illiovici permeameter and

(b) Burrow's permeameter. [8+8]

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