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

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

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

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Describe the construction & working of a PMMC instrument. Derive the equation for deflection if the instrument is spring controlled.
   (b) A moving coil milli-voltmeter has a resistance of 200 Ω & the full scale deflection is reached when a potential difference of 100 mV is applied across the terminals. The moving coil has effective dimensions of 30 mm x 25 mm and is wound with 100 turns. The flux density in the air gap is 0.2 wb/m^2. Determine the control constant if the final deflection is 100^o & a suitable diameter of copper wire for the coil winding if 20% of the total instrument resistance is due to the coil winding. Resistivity of copper is 1.7 x $10^{-8}\Omega$m [8+8]

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. (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. [8+8]

4. (a) Describe the construction & working of a Merz price maximum Demand indicator
   (b) A single phase induction type energy meter is adjusted to read correctly at unity pf. It is observed that 1/4 full load current at 0.5 lagging pf the effective voltage magnet flux lags behind the current magnet flux by 27^0, Will it introduce any error in the measurement? If so, calculate thepersentage error introduced. [10+6]

5. Describe a direct reading frequency meter for measuring a frequency of the order of either
   (a) 50 cycles per second (or)

(b) 500 cycles per second
Suggest a suitable method for calibrating the instrument. [16]

6. (a) What are the different factors which affect the precision measurement of medium resistances with wheat stone bridge? Explain how their effects are minimized/eliminated

(b) A wheat stone bridge is used for measuring the value of change of resistance of a strain gauge which forms one of the arms of the bridge. All the arms of the bridge including the strain guage have a resistance of 100Ω each. The maximum allowable power dissipation from the strain gauge is 250 MW. Determine the value of maximum permissible current through the strain gauge and maximum allowable value of bridge supply voltage. Suppose a source of 20V is available, find the value of series resistance to be connected between the source and the bridge to limit the input voltage of the bridge to permissible level. [8+8]

7. (a) Give advantages and disadvantages of Maxwell's Inductance capacitance bridge

(b) The four arms of a Maxwell's capacitance bridge at balance are : arm ab, an unknown inductance L_1, having a resistance R_1, arm bc, a non-inductive resistance of 1000Ω , arm cd, a capactitor of 0.5μF in parallel with a resistance of 1000Ω, arm da, a resitance of 1000Ω. Find the inductance L1 of arm ab.

[8+8]

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

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

⋆ ⋆ ⋆ ⋆ ⋆

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

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

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

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. [8+8]

2. (a) Explain briefly about the characteristics of current transformers. What are the causes of errors in current transformers?
   (b) A current transformer has a single turn primary and a 200 turns secondary winding. The secondary winding supplied a current of 5A to Non-inductive burden of 1Ω resistance. The requisite flux is set up in the core by an mmf of 80A. The frequency is 50Hz and the net cross section of the core is 1000mm? Calculate the ratio and Phase angle of the transformer. Also find the flux density in the core. Neglect the effects of magnetic leakage, iron losses and I^2 R losses. [8+8]

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. [8+8]

4. (a) Describe the construction & working of two element Induction type energy meter
   (b) The constant for a three phase, 3 element integrating wattmeter is 0.12 revolution of disc per kwh. If the meter is normally used with a potential transformer of ratio 22,000/110V & a current transformer of ratio 500/5A, find the error expressed as a percentage of the correct reading from the following test figures for the instrument only Line voltage = 100V; current = 5.25A; pf = 1 time to complete 40 revolutions = 61Sec. [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 $\underline{\angle 32^{o}V}$ 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) Derive the equations for balance in the case of Maxwells inductance bridge for the measurement of self Inductance

   (b) Arm ab consists of a coil with inductance L_1 and resistance r_1 in series with a non inductive resistance R. Arm bc and ad are each a non-inductive resistance of 100Ω. Arm ad consists of standard variable inductor L of resistance 32.7Ω. Balance is obtained when L_2=47.8mH and r=1.36Ω. Find the resistance and inductance of the coil in arm ab [8+8]

8. Describe the Lloyd Fisher square for measurement of Iron losses in a specimen of laminations. Describe how correction for resistance of wattmeter pressure coil and resistance of secondary winding are applied. How is the true value of flux density obtained in the laminations determined? [16]

⋆ ⋆ ⋆ ⋆ ⋆

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

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

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

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Explain the working of a moving iron ammeter with the help of a neat diagram. Derive the expression for the deflecting torque of a moving iron ammeter in terms of current and rate of change of inductance with deflection.
   (b) What are the main sources of errors in the instrument and the methods adopted to reduce the same. [8+8]

2. (a) .Explain the constructional features of current transformers with the help of neat sketches.
   (b) A 1000/5A, 50Hz current transformer has a secondary burden comprising a non inductive impedance of 1.6Ω. 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 1.5W at full load. The magnetizing mmf is$100A_T$. [8+8]

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 [16]

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. (a) Explain how "true zero is obtained in a crompton's potentiometer.
   (b) What are the applications of potentiometers

(c) With a neat circuit diagram explain salient features of a self balancing potentiometers [4+4+8]

6. (a) What is meant by critical damping, and to what extend should this condition be approached in the case of an ordinary moving coil type of instrument?

   (b) The coil of a moving coil galvanometer has 300 turns and is suspended in a uniform magnetic field of $0.1wb/m^2$ by phosphor bronze strip, of which the torsion constant is $2\times\ 10^{-7}$ newton metre per radian. The coil is 2 cm wide and 2.5cm high, with a moment of inertia of $1.5\ \times 10^{-7}$kg-m^2. If the galvanometer resistance is 200Ω, calculate the value of the resistance which, when connected across the galvanometer terminals, will give critical damping. Assume the damping to be entirely electromagnetic. [8+8]

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+8]

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? [6+10]

⋆ ⋆ ⋆ ⋆ ⋆

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

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

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Derive the expression for capacitance to be connected across the multiplier of a moving iron voltmeter so as to make its circuit non inductive for frequencies up to 125Hz.

   (b) The copper coil of a 150V moving iron voltmeter has a resistance of 400 ohm and 15^0C and an inductance of 0.75H. The current for full scale deflection is 0.05A. The temperature coefficients of resistance for copper and eureka at 15^0C are $0.004/^0$C and $0.00001/C^0$ respectively. Calculate

      i. The percentage increase of resistance of this instrument per degree rise in temperature

      ii. The indication when 150V at 100Hz is applied, the instrument having been previously calibrated on direct current. [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 the 3 voltmeter method of power measurement with the help of vector & connection diagrams

   (b) In a dynamometer wattmeter the moving coil has 500 turns of mean diameter 30mm. Estimate the torque if the axes of the field & the moving coils are at

      i. 60^0

      ii. 90^0 when the flux density produced by field coils is 15 x $10^{-3} wb/m^2$, the current in moving coil is 0.05A & the power factor is 0.866. [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. Describe the construction and working of a Weston type synchroscope. How is it assured that the

   (a) Incoming machine has the same voltage as that of the bus bars and also whether they are in phase with each other (or) note

   (b) Incoming machine has the same phase sequence as the busbars to which it has to be connected.

   (c) Frequency of the incoming machine is same as that of the busbars.

   (d) Incoming machine is Faster or slower than the bus bars. [8+8]

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) Discuss the advantages and disadvantages of Anderson's bridge.

   (b) The arms of Five node bridge are as follows :
   arm ab : an unknown impedance (R_1, L_1) in series with a
   non-inductive variable resistor x_1
   arm bc : a non inductive resistor R_3 = 100A
   arm cd : a non inductive resistor R_4=200A
   arm da : a non inductive resistor R_2=250Ω
   arm de : a non inductive variable resistor r
   arm ec : a loss-less capacitor C=1 μF,
   and arm be : a detector An a.c. supply is connected between a and c. Calculate the resistance and inductance R_1,L_1, when under balanced conditions r_1=43.1Ωand r=229.7Ω [8+8]

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? [6+10]

⋆ ⋆ ⋆ ⋆ ⋆