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Ex/BESUS/ EE-402/06

B.E. (EE) Part-II 4th Semester Examination, 2006

Measurement-I

(EE-402)

Time : 3 hours **Full Marks : 100**

Use separate answerscript for each half.
Answer SIX questions, taking THREE from each half.
Two marks are reserved for neatness in each half.

FIRST HALF

1. a) What is meant by capacitance multipliers? How it can be used to extend the range of an electrostatic voltmeter? Explain.

   b) A moving coil milliammeter has a resistance of 5 ohms and a full scale deflection of 15 mA. Determine the value of shunt resistance to be used so that the instrument could measure current upto 600mA at 20°C. What is the percentage error in the instrument when operating at 40°C? Given temperature ~~luiffiiiuii uf ibMsmict uf tuppei - 0.004 pui "C~~ at 20*CT" [8+8]

2. a) Derive the expressions for ratio and phase angle errors of potential transformers.

   b) A current transformer has a single turn primary and a 200 turns secondary winding. The secondary winding supplies a current of 5 amps, to a non-inductive burden of 1 ohm resistance. The requisite flux is set up in the core of an m.m.f. of 80 amp. The frequency is 50 Hz and the net cross-section of the core is 1000 mm^2.

   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^2R losses. [8+8]

3. a) Describe the working principle and construction of an Induction type energymeter. What are the errors in induction type energymeter, and how are they compensated?

   b) The power in a single phase high voltage circuit is measured by using instrument transformers with voltmeter, ammeter and wattmeter. Observed readings of the instruments (assuming no errors) are 115 V, 4.5 A and 200 watts. Characteristics of the transformers are follows :

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P.T.: nominal ratio : 11500/115 V; ratio correction factor 0.995; phase angle, -25 .
C.T. : nominal ratio : 25/5 A, ratio correction factor 0.997, phase angle, +15 .
Neglecting the voltage phase angle in the voltmeter calculate the true power. [10+6]

4. a) Explain how power can be measured in a three-phase circuit with the help of two wattmeters. Illustrate your answer with the help of a phasor diagram for a balanced star (Wye) connected load.

b) An energy meter is designed to make 100 revolutions of disc for one unit of energy. Calculate the number of revolutions made by it when connected to load carrying 40 amp. at 230 volt and 0.4 power factor for an hour. If it actually makes 360 revolutions, find the percentage error. [8+8]

5. Write short notes (any four) : [4x4]

i) Burden of C.T.
ii) Bondel's theorem
iii) Absolute method for testing of potential transformer
iv) Extension of instrument range by using multiplier
v) Short circuit cable fault by any one of the methods.

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SECOND HALF

\The questions are of equal value.]

6. a) What are the different operating forces required for proper operation of deflecting type of instrument? Describe in brief the production of such forces.

b) Compare (i) the attraction type moving iron (MI) instrument with repulsion type ML, (ii) Permanent magnet moving coil ammeter with rectifier type ammeter.

c) The torque of an ammeter is proportional to the current through it, then discuss the nature of scale of the meter for different types of controlling torque.

7. a) Describe the operating principle (with constructional details) of a dynamometer type wattmeter. Derive the necessary expressions.

b) i) Justify the statement - "No load test and load test of a single phase transformer can not be performed with same wattmeter".

ii) Explain the term multiplication factor of a wattmeter in details.

c) What is error of a wattmeter envolved from the connection point of view.

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b) Use simplex method to solve the L.P.R :

Maximize $Z = X] + x_2 + 3x_3$ subject

to $3xj + 2x_2 + x_3 < 3$

$2x, + x_2 + 2x_3 < 2$

and $x, , x_2 , x_3 > 0$ (5+6)

8. a) Solve: $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = x\, e^x \sin x.$

b) Solve the Cauchy's homogeneous linear differential equation

$$dx^z \qquad dx$$

c) Solve : $\frac{dX}{dx} + a^2y = \sec ax$ (4+3+4)

9. a) Draw the Histogram, Frequency polygon, frequency curve and the ogive less than and more than type from the following distribution of marks obtained by 49 students

Class (marks of group):	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45
Frequency:	5	6	15	10	5	4	2	2

b) Find the mean, mediun, first quartile of the following frequency distribution.

Class:	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55
Frequency:	8	15	39	47	52	41	28	16	4

(6+5)

10. a) Define a Convex set.

b) If Xj, x_2 be real, show that

$X = \{(xj, x_2) : X] + 2x_2 < 5\}$ is a Convex set.

c) Find the extreme points of the following set

$S = \{(x, y) \mid x^2 + y^2 < 25\}$. (2+5+4)

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