



Printed Pages : 7

TEE302

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2048

Roll No.

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## B.Tech

(SEM III) ODD SEMESTER THEORY EXAMINATION 2009-10  
ELECTRICAL MEASUREMENTS & MEASURING INSTRUMENTS

Time : 3 Hours]

[Total Marks : 100

- Note :**
- (i) Attempt all the questions.
  - (ii) All questions carry equal marks.

1 Answer any **four** parts of the following : **5×4=20**

(a) Explain the following terms ;

- (i) Accuracy
- (ii) Precision
- (iii) Reproducibility
- (iv) Resolution
- (v) Range.

(b) A voltmeter having a sensitivity of  $200 \Omega/V$  reads 200 V on its 75 V scale when connected across an unknown resistor in series with milliammeter, reads to 10 mA.



Calculate :

- (i) Apparent resistance of the unknown resistor
- (ii) Actual resistance of the unknown resistor
- (iii) Error due to the loading effect of voltmeter.

(c) Differentiate between :

- (i) Primary and secondary standards
- (ii) Absolute and secondary instruments
- (iii) Direct and indirect measurements.

(d) two resistors  $R_1$  and  $R_2$  are connected in series and then in parallel. The values of resistances are :

$$R_1 = 100.0 \pm 0.1 \Omega \text{ and}$$

$$R_2 = 50 \pm 0.03 \Omega$$

Calculate the uncertainty in the combined resistance for both series and parallel arrangements.

- (e) Describe the construction and working of single phase induction type energymeter.
- (f) An electrostatic voltmeter reading upto 2000 V is controlled by a spring with a torsion constant of  $5 \times 10^{-6} \text{ Nm/rad}$  has a full scale deflection of  $90^\circ$ . The capacitance at zero voltage is 15 pF. What is the capacitance when the pointer indicates 2000 V ?

2 Answer any **four** parts of the following : **5×4=20**

- (a) Derive the equation for average power over a cycle in single phase load. Prove that it can be measured by a electro-dynamometer type wattmeter.
- (b) The following measurements were made on a voltmeter of the dynamometer type having a range of 60 V and a resistance of  $780 \Omega$ .

<i>Applied Voltage (V)</i>	30	40	50	60
<i>Deflection (degree)</i>	14	24	37	54
<i>inductance (mH)</i>	74.8	78.5	82.8	88.6

Calculate the deflecting torque when the applied voltage is 45 V.

(c) Explain special features incorporated in an electro-dynamometer type wattmeter so that it can be used for low power factor applications.

(d) Two wattmeters connected to measure the input to a balanced 3-phase circuit indicate 2000 W and 500 W respectively. Find the power factor of circuit :

(a) When both the readings are positive

(b) When the latter reading is obtained after reversing the connections to the current coil of first instrument.

(e) What is Phantom loading ? Explain with an example how is it more advantageous than testing with direct loading.

(f) The meter constant of a 230 V, 10 A watthour meter is 1800 revolutions per kWh. The meter is tested at half load and rated voltage and unity power factor. The meter is found to make 80 revolutions in 138 sec. Determine the meter error at half load.

3 Answer any **two** of the following :

**10×2=20**

(a) Derive the relationship in current transformer for calculating :

(i) Phase angle error

(ii) Ratio error.

(b) Write short technical notes on any two of the following :

(i) A.C. techometer

(ii) Kelvin's double bridge

(iii) Vibrating reed type frequency meter.

(c) A balanced bridge has the following components connected between its five nodes A, B, C, D and E :

Between A & B : 1000  $\Omega$  resistance

Between B & C : 1000  $\Omega$  resistance

Between C & D : an inductor

Between D & A : 218  $\Omega$  resistance

Between A & E : 469  $\Omega$  resistance

Between E & B : 10  $\mu F$  capacitance

Between E & C : a detector

Between B & D : ac power supply

Obtain the values of resistance and inductance of the unknown inductor. Derive the formula used.





4 Answer any **two** of the following :  $10 \times 2 = 20$

- (a) Describe the construction, and working of a co-ordinate type a.c. potentiometer. How is its standardized ? Explain how an unknown voltage can be measured with it.
- (b) The iron-loss in the sample is 360 W at 60 Hz with the eddy current component 6 times as large as the hysteresis-loss component. At what frequency will the iron-loss be doubled if the flux density is kept the same ?
- (c) Explain the methods of separation of iron losses into their two components : eddy current and hysteresis losses if the maximum value of flux density is maintained constant and (i) frequency is varied keeping the form factor constant (ii) form factor is varied keeping the frequency constant.

5 Answer any **two** of the following :  $10 \times 2 = 20$

- (a) Explain clearly the difference between operating principles of integrating type and successive approximation type of digital voltmeters.

- (b) Describe the principle of working and circuit diagram of digital oscilloscope. Also discuss the advantages and disadvantage of analog and digital type oscilloscopes.
- (c) A CRT has an anode voltage of 2000 V and parallel deflecting plates 2 cm long and 5 mm part. The screen is 30 cm from the centre of the plates. Find the input voltage required to deflect the beam through 3 cm. The input voltage is applied to the deflecting plates through amplifiers having an overall gain of 100.