

B.Tech 5th Semester Exam., 2017

ELECTRICAL INSTRUMENTS AND
MEASUREMENTS

Time : 3 hours

Full Marks : 70

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Instructions :

- (i) The marks are indicated in the right-hand margin.
- (ii) There are **NINE** questions in this paper.
- (iii) Attempt **FIVE** questions in all.
- (iv) Question No. 1 is compulsory.

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1. Choose the correct option (any seven) : $2 \times 7 = 14$

(a) In a Kelvin's double bridge, two sets of readings are taken when measuring a low resistance, one with the current in one direction and the other with direction of current reversed. This is done to

- (i) eliminate the effect of contact resistance

(ii) eliminate the effect of resistance of leads
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(iii) correct for changes in battery voltage

(iv) eliminate the effect of thermoelectric e.m.fs

(b) If the damping in a d'Arsonval galvanometer is only due to electromagnetic effects, the resistance required for critical damping is

(i) $\frac{G^2}{\sqrt{kJ}}$ akubihar.com

(ii) $\frac{G}{\sqrt{kJ}}$

(iii) $\frac{G}{2\sqrt{kJ}}$

(iv) $\frac{G^2}{2\sqrt{kJ}}$

(c) In ratio-error, k_n stands for

(i) nominal ratio

(ii) actual ratio

(iii) ratio error

(iv) ratio correction factor

- (d) Frequency can be measured by using
 - (i) Maxwell's bridge
 - (ii) Schering bridge
 - (iii) Heaviside Campbell bridge
 - (iv) Wien's bridge
- (e) The angle through which coil turns when a deflection of 42 mm is observed on the scale of a galvanometer placed at a distance of 0.6 m from the mirror is
 - (i) 0.35 rad
 - (ii) 0.29 rad
 - (iii) 0.042 rad
 - (iv) 0.6 rad
- (f) The resistance can be measured most accurately by akubihar.com
 - (i) voltmeter-ammeter method
 - (ii) bridge method
 - (iii) multimeter
 - (iv) megger
- (g) No eddy current and hysteresis losses occur in
 - (i) electrostatic instruments
 - (ii) PMMC instruments
 - (iii) moving-iron instruments
 - (iv) electro-dynamometer instruments

- (h) The e.m.f. of Western standard cell is measured using
 - (i) moving-iron meter
 - (ii) moving-coil meter
 - (iii) digital voltmeter
 - (iv) potentiometer
- (i) Potentiometer is an _____ instrument.
 - (i) indicating akubihar.com
 - (ii) comparison
 - (iii) calibrating
 - (iv) recording
- (j) Which of the following bridges is frequency sensitive?
 - (i) Wheatstone bridge
 - (ii) Maxwell bridge
 - (iii) Anderson bridge
 - (iv) Wien bridge

- 2. (a) Explain the principle of DC potentiometer with the help of diagram. 7

- (b) A moving-coil instrument has a resistance of $3\ \Omega$ and gives full-scale reading of $25\ \text{mA}$. Calculate (i) the shunt resistance for a full-scale deflection corresponding to $125\ \text{A}$ and (ii) the series resistance for full-scale reading will be $625\ \text{V}$. Also find power consumption in each case. 7

3. Explain the construction and working of a ballistic galvanometer and prove

$$Q = \frac{G}{J} Q_0 e^{-\frac{D}{2J}t} \sqrt{\frac{J}{S}} \sin \sqrt{\frac{S}{J}} t$$

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4. (a) What do you understand by low, medium and high resistance? Explain Wheatstone bridge. akubihar.com 7
- (b) A $150\ \text{V}$ moving-iron voltmeter has an inductance of $0.75\ \text{henry}$ and a total resistance of $2000\ \text{ohm}$. It is calibrated to read correctly on a $50\ \text{Hz}$ circuit. What series resistance would be necessary to increase its range to $600\ \text{V}$? akubihar.com 7

5. Explain moving-iron instrument. Explain any one type of moving irons. 14

6. (a) Explain digital multimeter with the help of block diagram. 7
- (b) Explain digital voltmeter with the help of block diagram. 7
7. (a) Explain B-H curve with the help of diagram. 7
- (b) The coil of a moving-coil voltmeter is $40\ \text{mm}$ long and $30\ \text{mm}$ wide and has 100 turns on it. The control spring exerts a torque of $240 \times 10^{-6}\ \text{N-m}$ when the deflection is 100 divisions on full scale. If the flux density of the magnetic field in the air gap is $1.0\ \text{Wb/m}^2$, estimate the resistance that must be put in series with the coil to give one volt per division. The resistance of the voltmeter coil may be neglected. 7

8. Explain wattmeter. Explain any one type of wattmeters. akubihar.com 14

9. Write short notes on the following (any two): $7 \times 2 = 14$

- (a) Volt-ratio box
 (b) Current transformer
 (c) d'Arsonval galvanometer
 (d) A/D converters