

Name :

Roll No. :

Invigilator's Signature :

**CS/B.Tech (EIE)/SEM-3/EE-302 (EI)/2009-10
2009**

ELECTRICAL MEASUREMENTS & INSTRUMENTS

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

**GROUP - A
(Multiple Choice Type Questions)**

1. Choose the correct alternatives for any ten of the
following : $10 \times 1 = 10$

- i) Shaft encoder is used for the measurement of
 - a) angular velocity
 - b) linear position
 - c) linear velocity
 - d) linear acceleration.
- ii) The strain gauge having the highest gauge factor is
 - a) constantan
 - b) isoelastic
 - c) platinum tungsten
 - d) semi-conductor.
- iii) An instrument is said to be deadbeat when it is
 - a) critically damped
 - b) overdamped
 - c) underdamped
 - d) none of these.

- iv) The torque/weight ratio of Dynamometer instrument is
 - a) small
 - b) high
 - c) medium
 - d) none of these.
- v) Maxwell's inductance-capacitance bridge is used for measurement of inductance of
 - a) low Q coils
 - b) medium Q coils
 - c) high Q coils
 - d) low and medium Q coils.
- vi) A differential transformer is a
 - a) constant pressure transducer
 - b) constant displacement transducer
 - c) variable inductance transducer
 - d) variable pressure transducer.
- vii) The sensitivity of a voltmeter with a full scale indication of $500 \mu\text{A}$ with an internal resistance of 250Ω without multiplier is
 - a) $2000 \Omega/\text{V}$
 - b) $50,000 \Omega/\text{V}$
 - c) $1000 \Omega/\text{V}$
 - d) $20,000 \Omega/\text{V}$.

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- viii) When two-wattmeter method of measurement of power is used to measure power in a balanced 3-phase circuit, if the wattmeter reading is zero, then
- power consumed in the circuit is zero
 - the power factor of the circuit is zero
 - power factor is unity
 - power factor is 0.5.
- ix) An energy meter having a meter constant of 1200 resolutions per W is found to make 5 resolutions in 75 seconds. The load power is
- 500 watt
 - 100 watt
 - 200 watt
 - 1000 watt.
- x) A moving iron ammeter may be compensated for frequency errors by a
- shunt resistance
 - series inductance
 - shunt capacitance
 - series resistance.
- xi) A meggar is used for measurement of
- low valued resistance
 - medium valued resistance
 - high valued resistance, particularly insulation resistance
 - all of these.

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- xi) The most serious source of error in ac bridge measurement is
- eddy currents
 - leakage currents
 - residual imperfectness
 - stray field.
- xii) Synchro is
- a parabolic transducer
 - an angular position transducer
 - a synchronizing transducer
 - a variable pressure transducer.

GROUP - B
(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. What is 'skin effect' ? What type of instrument is build using this effect ? Describe. 5
3. A moving coil milliammeter having a resistance of 10Ω gives full scale deflection when a current of 5 mA is passed through it. Explain how this instrument can be used for measurement of
- current upto 1 A 3
 - voltage upto 5 V 2

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8. a) Draw the Wien bridge and with the help of phasor diagram describe how the frequency is measured. What are the main errors of this type of instrument ?

- b) Two ratio arms of a Kelvin double bridge are

$P = Q = p = q = 1000 \Omega$. The input $emf (E) = 100 \text{ V}$ & the resistance of 5Ω is included in battery circuit. The galvanometer have a resistance of 500Ω . The bridge is proper balanced when the standard resistance is 0.001Ω . The resistance of linkwire from unknown resistance to standard resistance may be neglected. Determine

- i) unknown resistance
- ii) current through unknown resistance
- iii) If the galvanometer having a sensitivity of $200 \text{ mm} / \mu\text{A}$, the unknown resistance is changed by 0.1% from its balance resistance, what is the deflection in the galvanometer ? 7 + 3 + 5

9. a) Draw the basic circuit, equivalent circuit and phasor diagram for current transformer (C.T.) 1 + 2 + 2

- b) Derive the expression for transformation ratio and phase angle using the above phasor diagram for C.T. 5 + 2

- c) Why is secondary of C.T. never kept open ? 3

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10. a) Describe an inductive type transducer and state its advantages and disadvantages.

- b) The O/P of an LVDT is connected to a 5 V voltmeter through an amplifier whose amplification factor is 250. An O/P of 2 mV appears across the terminals of LVDT when the core moves through a distance of 0.5 mm . Calculate the sensitivity of the LVDT and that of the whole set-up. The millivoltmeter scale has 100 divisions. The scale can be read to $\frac{1}{5}$ of a division. Calculate the resolution of the instrument in mm. 10 + 5

11. Write short notes on any *three* of the following : 3 × 5

- a) Frequency meter
- b) Murray loop test
- c) Q-meter
- d) Energy meter
- e) Thermal type instrument.