

**ELECTRICAL AND ELECTRONIC MEASUREMENTS
(AEIE 2203)**

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
any 5 (five) from Group B to E, taking at least one from each group.*

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

**Group – A
(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) Electrostatic-type instruments are primarily used as
 - (a) ammeters
 - (b) voltmeters
 - (c) wattmeters
 - (d) ohmmeters
 - (ii) Ratio error in a current transformer can be reduced by
 - (a) using good quality, low loss steel for core
 - (b) placing primary and secondary windings closer to each other
 - (c) using thick conductors for secondary winding
 - (d) all of these
 - (iii) Which of the following is the desirable dynamic characteristics of a measurement system?
 - (a) Fast response, fidelity and measuring lag
 - (b) Fast response and measuring lag
 - (c) Fidelity and measuring lag
 - (d) Fast response and fidelity
 - (iv) Creeping is observed in
 - (a) voltmeter
 - (b) ammeter
 - (c) wattmeter
 - (d) energy meter
 - (v) Unknown frequency is measured by using
 - (a) Maxwell's bridge
 - (b) Schering bridge
 - (c) Heaviside Campbell bridge
 - (d) Wien's bridge
 - (vi) De Sauty's bridge is used for measurement of
 - (a) high Q inductances
 - (b) low Q inductances
 - (c) lossless capacitors
 - (d) capacitors with dielectric losses

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- (vii) In dual trace oscilloscope for measuring the low frequency signal the best selected mode is
(a) alternate mode (b) chop mode
(c) x-y mode (d) sweep mode
- (viii) The advantage of Varley loop test over Murray loop test is
(a) they can be used for localizing of short circuit faults
(b) they can be used for localizing of earth faults
(c) the loop resistance can be experimentally determined
(d) their accuracy is higher
- (ix) For a PLL capture range is
(a) greater than lock range (b) equal to lock range
(c) less than lock range (d) all of these may happen
- (x) In measurement made using a Q-meter, high impedance elements should preferably be connected in
(a) star (b) delta
(c) series (d) parallel

Group – B

2. (a) List 3 advantages and 3 disadvantages of electro-dynamometer type instruments.
(b) Briefly describe the damping systems used in analog instruments.
(c) Draw and explain the electrical equivalent circuit of current transformer.
(d) Explain fidelity and speed of response.

3 + 3 + 4 + 2 = 12

3. (a) The law of deflection of a moving iron ammeter is given by $I = 4\theta^n$ ampere, where θ is the deflection in radian and n is a constant. The self-inductance when the meter current is zero is 20 mH. The spring constant is 0.32 N-m/rad.
(i) Determine an expression for self-inductance of the meter as a function of θ and n .
(ii) With $n = 0.75$, calculate the meter current and the deflection that corresponds to a self-inductance of 70 mH.
(b) With a neat diagram explain the working of a single phase induction type energy meter.
(c) A single phase induction type energy meter is tested for 30 minutes run at a supply voltage of 230 V and a load current of 10 A at 0.8 lagging power factor. The dial reading at start was 57.35 and at the end of test was 58.25. The meter constant is 1200 revolutions/kWh. The meter made 890 revolutions during this period. Find out the (i) error in registration and (ii) error in rpm of the meter.

(2 + 2) + 4 + (2 + 2) = 12

Group – C

4. (a) Why the localisation of cable faults is important for low distribution voltage level underground cable? Describe with suitable schematic diagram the Varley loop test for localizing ground fault and short circuit fault in low voltage cable.
- (b) A ground fault is located by Varley loop test. The sound and faulty cables are identical and have a resistance of $0.5\ \Omega$ per kilometer. The ratio arms are set at $15\ \Omega$ and $40\ \Omega$. The values of variable resistance connected with the faulty cable are $20\ \Omega$ and $10\ \Omega$ at the two positions of the selector switch. Determine the length of each cable and the distance of fault from the test end.

$(2 + 5) + 5 = 12$

5. (a) Why Wheatstone bridge is not used for the measurement of low resistances below $1\ \Omega$? What are the difficulties in the measurement of high resistances?
- (b) A low resistance of approximately $150\ \Omega$ was measured by Kelvin's double bridge. The bridge has the following resistance components: Standard resistance = $100\ \mu\Omega$, inner ratio arms = $15\ \Omega$ and $30\ \Omega$, outer ratio arms = $40\ \Omega$ and $60\ \Omega$. If the resistance of the connecting leads from standard to unknown resistance is $800\ \mu\Omega$, calculate the unknown resistance under this condition.

$(2 + 2) + 4 + 4 = 12$

Group – D

6. (a) Which type of signal is applied to the horizontal deflection amplifier prior to horizontal deflecting plate system of a CRO? What is the purpose of delayed time base oscilloscope?
- (b) How can the phase difference between two input sine wave signals having same frequencies be measured by using CRO? How is it possible to measure the phase difference for the signals having different frequencies?
- (c) Explain the operation of 10:1 attenuation probe used for CRO?

$(1 + 1) + (4 + 2) + 4 = 12$

7. (a) What is the advantage of thermocouple type true r.m.s. voltmeter over other ac electronic voltmeter? With the circuit diagram of it show how it is advantageous.
- (b) With a neat block diagram explain how PLL is used as FM demodulator.

$(2 + 5) + 5 = 12$

Group – E

8. (a) Design a digital frequency meter circuit for the measurement of frequency in MHz range and explain the operation of it.

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- (b) What are the errors in measuring frequency by digital frequency meter? Find out the percentage error in measuring frequency of the signals having frequencies 1MHz and 100Hz.

7 + (2 + 3) = 12

9. (a) How series connection method of Q meter is used to find impure capacitance and inductance and their Q values.

- (b) Explain the operation of successive approximation type digital voltmeter.

7 + 5 = 12

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AEIE	https://classroom.google.com/c/MzExOTY0MjE2/a/Mzc0MjE5NDg3MDM1/details