

**ELECTRICAL & ELECTRONIC MEASUREMENTS
(ELE2103)**

Time Allotted : 2½ hrs

Full Marks : 60

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
any 4 (four) from Group B to E, taking one from each group.*

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

Group – A

1. Answer any twelve:

12 × 1 = 12

Choose the correct alternative for the following

- (i) The pointer of an indicating instrument should be
(a) Very thin and light in weight (b) Very heavy in weight
(c) Weight does not matter for the pointer (d) Thick and heavy in weight
- (ii) Horizontally mounted moving iron instruments use
(a) eddy current damping (b) fluid friction damping
(c) electromagnetic damping (d) air friction damping
- (iii) In the single phase induction meter, in order to obtain true value of energy, the shunt magnet flux should lag behind the applied voltage by
(a) 90° (b) 0° (c) 45° (d) 30°
- (iv) A 1mA ammeter has a resistance of 100Ω. It is to be converted to a 1A ammeter. The value of the shunt resistance required is
(a) 0.001Ω (b) 0.1001Ω (c) 100000Ω (d) 100Ω
- (v) The resistances of potential transformer winding is minimized by using
(a) Thick conductors and small length of turns
(b) Thin conductors and small length of turns
(c) Thin conductors and large length of turns
(d) Thick conductors and large length of turns
- (vi) The method/methods suitable for the measurement of low resistance is/are
(a) Ammeter-voltmeter method (b) Kelvin's double bridge method
(c) Potentiometer method (d) All of these
- (vii) The role of the permanent magnet in a megger is to _____
(a) generate power (b) provide voltage
(c) balance the circuit (d) provide field

- (viii) Electronic voltmeters which use rectifiers employ negative feedback. This is done
 (a) to increase overall gain (b) to improve stability
 (c) to decrease overall gain (d) to overcome non linearity of diode
- (ix) Linear ramp technique is based on _____
 (a) voltage measurement (b) time measurement
 (c) current measurement (d) heat measurement
- (x) A PMMC meter has an internal resistance of 200Ω and the current required for its full scale deflection is $50\mu\text{A}$. The meter is capable of measuring on its own a maximum voltage of
 (a) 5mV (b) 10mV (c) 2.5mV (d) $10\mu\text{V}$

Fill in the blanks with the correct word

- (xi) The transformation ratio of CT is _____.
- (xii) The number of electromagnets used in an induction type energy meter is _____.
- (xiii) The torque which helps the pointer to come back to zero position is _____.
- (xiv) _____ type of instrument is suitable for very high voltage measurement.
- (xv) In successive approximation type voltmeter, the resolution is given by _____.

Group - B

2. (a) What are the advantages and disadvantages of Electrostatic Instrument?
[[CO1](Remember/LOCQ)]
- (b) Define Absolute error and Limiting error.
[[CO2](Understand/LOCQ)]
- (c) A 0-150 V voltmeter has a guaranteed accuracy of 1% of full scale reading. The voltage measured by this instrument is 85 V. Calculate the limiting error in percent.
[[CO2](Analyse/IOCQ)]
5 + 4 + 3 = 12
3. (a) Derive the torque equation and explain the working principle of the permanent magnet moving coil (PMMC) instrument.
[[CO1](Analyse/IOCQ)]
- (b) For a certain dynamometer ammeter the mutual inductance M varies with deflection θ (expressed in degrees) as $M = -6\cos(\theta + 30^\circ)$ mH. Find the deflecting torque produced by a direct current of 50mA corresponding to a deflection of 60° .
[[CO1](Evaluate/HOCQ)]
- (c) Define accuracy and precision.
[[CO2](Remember/LOCQ)]
(3 + 3) + 4 + 2 = 12

Group - C

4. (a) A wattmeter has a current coil of 0.03Ω resistance and a pressure coil of 6000Ω resistance. Calculate the percentage error if the wattmeter is so connected that i) the current coil is on the load side, ii) the pressure coil is on the load side. The load takes 20A at a voltage of 220V and 0.6 power factor in each case.
[[CO3](Analyse/IOCQ)]

- (b) Explain the working principle of a single phase induction type energy meter with phasor diagram. [[CO2](Analyze/IOCQ)]
6 + 6 = 12
5. (a) A CT of turns ratio 1:199 is rated as 1000/5A,25 VA. The core loss and magnetising component of the primary current are 4 and 7 A under rated conditions. Determine the phase angle and ratio errors for the rated burden and rated secondary current at 0.8 p.f leading. Neglect the resistance and leakage reactance. [[CO4](Evaluate/HOCQ)]
- (b) Draw the equivalent circuit and phasor diagram of the potential transformer. [[CO4](Remember/LOCQ)]
6 + 6 = 12

Group - D

6. (a) Using Maxwell Inductance Capacitance Bridge, which range of inductance can be measured and why? [[CO5](Analyse/HOCQ)]
- (b) Derive the equation of balance for an Owen's Bridge with a diagram. [[CO5](Remember/LOCQ)]
- (c) With suitable diagrams explain the standardisation method of AC co-ordinate type AC potentiometer. [[CO4](Remember/LOCQ)]
3 + 3 + 6 = 12
7. (a) A uniform potentiometer wire of length 150 cm and resistance 75 Ω is connected in series with a resistor(R) and a 6 V supply battery. A standard cell of emf 1.020 V is balanced at a length of 45.0 cm from the zero end of the wire.
- (i) Determine the value of the series resistance(R) and the current flowing in the circuit.
- (ii) An unknown cell is connected to the potentiometer and gives balance at 78.5 cm. Calculate the emf of this unknown cell. [[CO4](Analyse/HOCQ)]
- (b) Draw the phasor diagram of Schering Bridge at balance condition. [[CO5](Apply/IOCQ)]
7 + 5 = 12

Group - E

8. (a) Write short notes on Varley Loop Test to locate cable faults. [[CO5](Remember/LOCQ)]
- (b) 2 volt is measured using an 8 bit successive approximation type voltmeter where reference voltage is taken as 10V. What is the digital output and how much error is present in the reading and what is the resolution of that meter? [[CO6](Analyse/HOCQ)]
5 + 7 = 12
9. (a) A half wave rectified voltage is applied to an average reading voltmeter with a scale calibrated in terms of the rms value of a sine wave. Calculate the error in the meter indication. [[CO6](Analyse/HOCQ)]
- (b) What are the advantages and disadvantages of dual slope ramp type digital voltmeter over single slope ramp type digital voltmeter? [[CO6](Apply/IOCQ)]

(c) Describe with diagram the working of dual slope ramp type digital voltmeter.

[[CO6](Remember/LOCQ)]

4 + 3 + 5 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	37.5	30.2	32.3