

9. (a) Explain with the help of a neat circuit diagram, the working of a dual slope DVM. What are the advantages of dual slope DVM over ramp type DVM?
- (b) A saw-tooth voltage has a peak value of 160 V and a time period of 3.6 seconds. Calculate the error when measuring this voltage with an average reading voltmeter calibrated in terms of rms value of a sinusoidal wave.
- (6 + 2) + 4 = 12**

ELECTRICAL & ELECTRONIC MEASUREMENT (ELEC 2103)

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) A voltage of 200 V produces a deflection of 90° in a PMMC spring controlled instrument. If the same instrument is provided with gravity control, what would be the deflection?
 (a) 90° (b) 45°
 (c) cannot be determined from the given data (d) 64.2°
- (ii) Fluid friction damping can be used in
 (a) horizontally mounted instruments
 (b) vertically mounted instruments
 (c) both in horizontally and vertically mounted instruments
 (d) none of the above.
- (iii) In spring controlled moving iron instruments, the scale is
 (a) uniform
 (b) cramped at the lower end and expanded at the upper end
 (c) expanded at the lower end and cramped at the upper end
 (d) cramped both at the lower and upper ends.
- (iv) Turns compensation is used in current transformers primarily for reduction of
 (a) both ratio and phase angle errors (b) phase angle error
 (c) neither ratio error nor phase angle error (d) ratio error.
- (v) Creep in a single phase induction type energy meter may be due to
 (a) overcompensation for friction (b) overvoltage
 (c) vibrations (d) all of the above.
- (vi) If C is the capacitance of any capacitor and R is the internal resistance of that capacitor, the loss angle ($\tan \delta$) is
 (a) ωRC (b) $1/\omega RC$ (c) $R/\omega C$ (d) $\omega C/R$.

- (vii) An rms reading voltmeter can accurately measure voltages of
 - (a) sine waveforms
 - (b) square waveforms
 - (c) saw tooth waveforms
 - (d) all of these.
- (viii) Kelvin double bridge is used to measure
 - (a) very low resistance
 - (b) medium resistance
 - (c) high resistance
 - (d) very high resistance.
- (ix) In electronic voltmeter, the range of input voltages can be extended by using
 - (a) functional switch
 - (b) input attenuator
 - (c) rectifier
 - (d) balanced bridge dc amplifier.
- (x) A battery has high internal resistance. It's EMF is found to be 0.9 V with a potentiometer. The actual EMF of the battery is
 - (a) 0.9 V
 - (b) >0.9 V
 - (c) < 0.9 V
 - (d) either (a) or (c).

Group – B

- 2. (a) Define the terms Indicating Instrument, Recording Instrument and Integrating Instrument with suitable examples.
 - (b) Explain why electro-dynamometer type instrument can be used both on a.c. and d.c.? Mention the main sources of errors in it.
- (2 + 2 + 2) + (4 + 2) = 12**
- 3. (a) Explain with figure and phasor diagram how shaded pole method is used for proper operation of an induction type instrument.
 - (b) What are accuracy and precision in electrical measurement? What are absolute error and limiting error in making measurement?
- 6 + (3 + 3) = 12**

Group – C

- 4. (a) Considering the effect of pressure coil inductance in an electro-dynamometer type wattmeter derive the expression of correction factor.
- (b) The current coil of a wattmeter is connected in series with an ammeter and an inductive load. A voltmeter and the pressure coil are connected across a 100 Hz supply. The ammeter reading is 4.5 A and the voltmeter and wattmeter readings are respectively 240 V and 23 W. The inductance of voltage circuit is 10 mH and its resistance is 2000 Ω. If the voltage drops across the ammeter and the current coil are negligible, what is the percentage error in wattmeter reading?

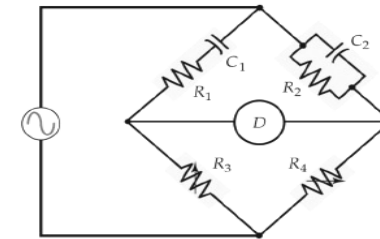
5 + 7 = 12

- 5. (a) How Instrument Transformer (CT and PT) is used for extension of instruments' range?
- (b) Derive the expression for ratio error in a current transformer.
- (c) The exciting current of a ring core current transformer, of ratio 1000/5 A when operating at full primary current and with a secondary burden of non-inductive resistance of 1 Ω is 1 A at a power factor of 0.4. Calculate the ratio error at full load, assuming that there has been no compensation.

3 + 4 + 5 = 12

Group – D

- 6. (a) Draw and describe how an unknown capacitance can be measured with the help of Schering bridge. Draw the phasor diagram at balance condition.



- (b) In the above bridge $R_3=2 \text{ k}\Omega$, $R_4=1 \text{ k}\Omega$, $C_1=C_2=0.1 \text{ }\mu\text{F}$. To obtain the bridge balanced with $\omega=4000 \text{ rad/sec}$ what should be the values of R_1 and R_2 ?
- (2 + 3 + 3) + 6 = 12**

- 7. (a) Draw the circuit diagram of a Crompton's DC potentiometer and explain it's working principle.
- (b) A basic potentiometer has 200 cm slide wire with a resistance of 100 Ω. A 4 V battery in series with a variable resistance R_1 provides current through the slide wire. The standard cell potentiometer is 1.018 V and the potentiometer is calibrated when the sliding contact is set to 101.8 cm from the zero voltage end of the slide wire. Calculate R_1 and current through R_1 .

6 + 6 = 12

Group – E

- 8. (a) Describe the Varley loop test for localisation of ground faults in cables.
- (b) Draw and describe the working principle of a peak reading electronic voltmeter.

7 + 5 = 12