

Total number of printed pages-5

53 (IE 402) ELM I

2017

**ELECTRICAL MEASUREMENTS
AND INSTRUMENTS**

Paper : IE 402

Full Marks : 100

Time : Three hours

***The figures in the margin indicate
full marks for the questions.***

Answer **any five** questions.

1. (a) Describe the different methods used for producing the following torques in an electrical instrument : 9
- (i) Deflecting torque
 - (ii) Controlling torque
 - (iii) Damping torque.

Contd.

- (b) Explain the dynamic behaviour of a galvanometer with relevant mathematical expressions. Also, discuss the conditions when the galvanometer shows Overdamped, Critically damped and Underdamped behaviour. 8
- (c) Define indicating, recording and integrating instruments. 3
2. (a) Describe the construction and basic principle of operation of the following instruments : 7×2=14
- (i) Moving iron
 - (ii) Electrostatic instruments.
- (b) Show that in an electro-dynamometer type instrument, the deflection θ in case of D.C operation is given by the relation

$$\theta = \frac{I_1 I_2}{K} \frac{dM}{d\theta}. \quad 6$$

3. (a) A moving coil instrument has the following data :

number of turns = 170, width of coil = 20mm, depth of coil = 30mm, flux density in the gap = 0.2 wb/m^2 . Calculate the deflecting torque when carrying a current of 15mA. Also, calculate the deflection of the pointer when the control spring constant is $2 \times 10^{-6} \text{ Nm/degree}$. 4

- (b) Explain the working of thermocouple type instrument with a suitable diagram. 6

- (c) Describe the constructional feature and working of single phase Induction meter. Also show that in a single phase Induction type energymeter, the speed of rotation of the disc is directly proportional to power. 10

4. (a) A PMMC meter with a full scale reading of $50 \mu\text{A}$ and an internal resistance of 1500Ω is available. How can it be used as a voltmeter of following ranges ?

(i) 0-10V

(ii) 0-100V. 5

- (b) Draw the equivalent circuit and phasor diagram of a current transformer. 4
- (c) Draw the circuit diagram of a Wheatstone bridge and derive the conditions of balance. Also derive the expression for bridge sensitivity of the Wheatstone bridge. 6
- (d) Describe a method for the measurement of insulation resistance. 5
5. (a) Describe the fall of potential method for measurement of earth resistance. 6
- (b) Explain the Murray loop test for localization of ground and short circuit faults in cables. 7
- (c) Draw the circuit diagram of a Crompton's potentiometer and explain its working. Describe the steps used when measuring an unknown resistance. 7
6. (a) Discuss the applications of D.C potentiometers using suitable diagrams. 8

(b) Draw the circuit diagram of Maxwell's inductance capacitance bridge and explain using mathematical relations how it can be used for the measurement of unknown inductance.

6

(c) Describe how an unknown capacitance can be measured with the help of D'Sauty's bridge.

6

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

(i) Electrodynamometer wattmeter

(ii) Megger

(iii) A.C. Potentiometer.

(b) Explain how Wien's bridge can be used for experimental determination of frequency using a circuit diagram and relevant mathematical relations.

6