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53 (IE 402) EMIN

2016

**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) In an electromechanical indicating instrument, how the following types of torques are produced? Give suitable examples in each case. 8
 - (i) Deflecting torque
 - (ii) Controlling torque
 - (iii) Damping torque

- (b) Describe the constructional features of d'Arsonval Galvanometer and Ballistic Galvanometer. 6

Contd.

- (c) A basic PMMC meter with a full scale reading of $50\mu A$ and an internal resistance of 1800Ω is available, how it can be converted to measure current upto $5A$ and voltage upto $25V$? 6

2. (a) Show that in a Moving Iron instrument deflection is given by : 10

$$\theta = \frac{1}{2} \frac{I^2 dL}{K d\theta}$$

Discuss the constructional features and operation of attraction type and repulsion type instruments.

- (b) Describe in brief the constructional features of electro-dynamometer type instrument and deduce the relation for deflection θ in case of a.c operation. 10

3. (a) In an electro-dynamometer wattmeter, deduce the relationship between deflection θ with respect to the measured power.

Discuss some of the major causes of error in electro-dynamometer wattmeter.

10

- (b) Explain in brief the basic principle of operation of single phase induction type energymeter. Also, show that the total number of revolutions of the disc in the energymeter is directly proportional to energy consumed. 10
4. (a) Explain the operation of the Current Transformer (CT) with a suitable diagram. Also, draw the equivalent circuit and phasor diagram. 7
- (b) Describe using a suitable diagram the basic principle of operation of D.C. potentiometer. Also, explain the procedure for standardisation in a D.C. potentiometer. 7
- (c) How a D.C. potentiometer can be used for the following? 6
- (i) Calibration of a voltmeter
 - (ii) Calibration of an ammeter
 - (iii) Determination of an unknown resistance.
5. (a) Explain the following methods for measurement of high resistance : 12
- (i) Direct Deflection method
 - (ii) Megger
- (b) Discuss the Fall of Potential method for the measurement of earth resistance using a suitable diagram. 5

- (c) Draw the circuit of a Wheatstone's bridge and derive the conditions for balance. 3
6. (a) Explain how Wien's bridge can be used for experimental determination of frequency. Derive the expression for frequency in terms of bridge parameters. 7
- (b) Explain using suitable diagram and relevant mathematical relations, how an Anderson's bridge can be used to determine unknown inductance. 7
- (c) Discuss the working of a low voltage Schering bridge. Derive the equation for unknown capacitance. 6
7. (a) Write short notes on : **(any three)** 18
- (i) Hot Wire Instruments
 - (ii) Drysdale Polar potentiometer
 - (iii) Kelvin's Double bridge
 - (iv) Hay's bridge
- (b) Differentiate between indicating, recording and integrating instruments. 2
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