53 (IE 402) EMSI

2021

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)* Deduce the expression for deflection θ of a galvanometer under dynamic conditions. What is the condition for critical damping ? 8

   (b) Describe the working of vibration galvanometer using a suitable diagram. 7

Contd.

(c) How a PMMC meter with a current rating of $10\,mA$ and internal resistance of $20\,\Omega$ can be used for measurement of current in the range of $1A$ and voltage in the range of $100V$? 5

2. (a) Differentiate between attraction type and repulsion type moving iron instruments. 4

(b) Deduce the expression for deflection θ in an electrodynamometer type instrument under DC and AC conditions. 10

(c) Describe the working of thermocouple type instrument using a suitable diagram. 6

3. (a) Explain the basic principle of working of electrostatic instruments using a suitable diagram. Also deduce the expression for deflection θ. 7

(b) What are the main causes of error in an electrodynamometer wattmeter? Explain. 6

(c) What do you mean by standardisation of a potentiometer? How can potentiometer be used for the measurement of unknown e.m.f.? 7

4. *(a)* Describe the working of single-phase induction type energy meter with a suitable diagram. Find the expression for the total number of revolution of the disc. 10

(b) A meter, whose constant is 1000 revolutions per kWh, makes 8 revolution in 30 seconds. Calculate the load in kW. 4

(c) How voltmeter and ammeter is calibrated using potentiometer? Explain with a diagram. 6

5. *(a)* Describe a suitable bridge method for measurement of — 10

(i) inductance

(ii) capacitance

Also, write relevant expressions in each case.

(b) The four arms of a bridge are : arm ab, a pure resistance; arm bc, a resistance of 500Ω in parallel with a capacitor of $1\mu F$; arm cd, a resistance of 1000Ω in series with a capacitor of $0.5\mu F$; and arm DA, a resistance of 600Ω. Calculate the frequency at which the bridge will be in balanced condition. Also, calculate the value of resistance in arm ab. 5

(c) Describe a suitable method for testing of energy meter. 5

6. (a) Explain Kelvin's double bridge method for measurement of low resistance. Also write relevant mathematical expressions. 7

(b) How can insulation resistance be measured using direct deflection method ? Explain. 6

(c) What are the types of faults in a cable ? Discuss a suitable method for localization of cable faults. 7

7. (a) Write short notes on : ***(any two)*** 7×2=14

(i) Electrodynamometer Wattmeter

(ii) Megger

(iii) Ballistic galvanometer.

(b) Describe a method for measurement of earth resistance. 6