

Total number of printed pages—4

53 (IE 402) EMSI

2021

**ELECTRICAL MEASUREMENTS AND  
INSTRUMENTS**

Paper : IE 402

Full Marks : 100

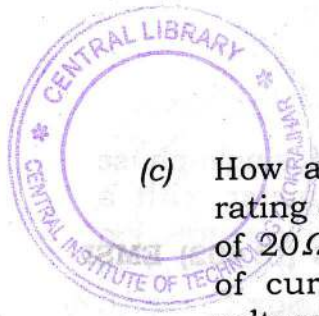
Time : Three hours

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

Answer **any five** questions.

1. (a) Deduce the expression for deflection  $\theta$  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  $10\text{ mA}$  and internal resistance of  $20\Omega$  can be used for measurement of current in the range of  $1\text{ A}$  and voltage in the range of  $100\text{ V}$ ? 5
2. (a) Differentiate between attraction type and repulsion type moving iron instruments. 4
- (b) Deduce the expression for deflection  $\theta$  in an electro-dynamometer 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  $\theta$ . 7
- (b) What are the main causes of error in an electro-dynamometer 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  $500\Omega$  in parallel with a capacitor of  $1\mu F$ ; arm  $cd$ , a resistance of  $1000\Omega$  in series with a capacitor of  $0.5\mu F$ ; and arm  $DA$ , a resistance of  $600\Omega$ . 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) Electro-dynamometer Wattmeter
- (ii) Megger
- (iii) Ballistic galvanometer.
- (b) Describe a method for measurement of earth resistance. 6

