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# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech IV Semester End Examinations (Regular) - May, 2018

Regulation: IARE – R16

## ELECTRICAL MEASUREMENTS AND INSTRUMENTATION

Time: 3 Hours

(EEE)

Max Marks: 70

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the question must be answered in one place only

### UNIT – I

- (a) Discuss construction and working of moving iron type instrument with neat sketch. [7M]

(b) Explain the role of capacitance potential dividers in extending the range of an electrostatic voltmeter. [7M]
- (a) A PMMC ammeter has the following specification coil dimension are 1cm X 1cm. Spring constant is  $0.15 \times 10^{-6}$  N-m/rad, Flux density is  $1.5 \times 10^{-3}$  wb/m<sup>3</sup>. Determine the number of turns required to produce a deflection of  $90^\circ$  when a current 2mA flows through the coil. [7M]

(b) A moving coil instrument gives a full scale deflection of 10mA, when the potential difference across its terminal is 100mV. Calculate [7M]

  - The shunt resistance for a full scale deflection corresponding to 100A
  - The resistance for full scale reading with 1000V.

Calculate the power dissipation in each case?

### UNIT – II

- (a) Explain the working of Crompton's potentiometer with neat sketch. [7M]

(b) A basic slide wire potentiometer has a working battery voltage of 3.0 V with negligible internal resistance. The resistance of slide wire is 400 Ohms and its length is 200 cm. A 200 cm scale is placed along the slide wire. The slide wire has 1 mm scale divisions and it is possible to read up to 1/5 of a division. The instrument is standardized with 1.018 V standard cell with sliding contact at 101.8 cm mark. Calculate [7M]

  - working current
  - The resistance of series rheostat
  - The measurement range and
  - The resolution of instrument

4. A duo – range potentiometer is designed for two ranges: X 1 and X 0.1. the main dial consists of 15 steps of 20 ohms each, and the slide wire has a resistance of 30 ohm. The standard cell voltage is 1.019V. The potentiometer is designed to have a measuring range of 1.65V d.c. on the X 1 range, calculate

- (a) The value of measuring current on each range and resistance of range resistors  $R_1$  and  $R_2$ . [7M]
- (b) The current supplied by battery for each range and resistance of rheostat if battery has a voltage of 6.0 V. [7M]

### UNIT – III

5. Two wattmeters connected to measure the input to a balanced 3 phase circuit indicate 2000 W and 500 W respectively. Find the power factor of the circuit:

- (a) When both readings are positive [7M]
- (b) When later reading is obtained after reversing the connections to the current coil of first instrument. [7M]

6. (a) Explain the working of single phase induction type energy meter with a neat sketch. [7M]

- (b) The power flowing in a 3 phase 3 wire balanced load system is measured by two wattmeter method. The reading of wattmeter A is 7500W and of wattmeter B is -1500W. If the voltage of the circuit is 400V, what is the value of capacitance which must be introduced in each phase to cause the whole of the power measured to appear on wattmeter A. The frequency is 50Hz. [7M]

### UNIT – IV

7. (a) Derive equation for unknown capacitance using Desauty's bridge. [7M]

- (b) Derive the expression for unknown capacitance using Schering bridge. [7M]

8. (a) Derive the expression for unknown resistance using kelvin double bridge. [7M]

- (b) A maxwell's capacitance bridge is used to measure an unknown inductance in comparison with capacitance. The various values at balance, [7M]

$$R_2 = 400\Omega, R_3 = 600 \Omega, R_4 = 1000 \Omega, C_2 = 0.5\mu F.$$

Calculate the values of  $R_1$  and  $L_1$ . Calculate the value of storage factor (Q) of coil frequency is 1000 Hz.

### UNIT – V

9. (a) Describe the characteristics of choice transducers and write its applications. [7M]

- (b) Explain different accessories of cathode ray oscilloscope with a neat sketch. [7M]

10. (a) Describe the salient features of thermistors its applications. [7M]

- (b) Calculate the velocity of the electron beam in an oscilloscope if the voltage applied to its vertical deflection plates is 2000V. Also calculate the cutoff frequency if the maximum transit time is  $\frac{1}{4}$  of a cycle. The length of horizontal plates is 50 mm. [7M]

