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Question Paper Code: AEE008



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech IV Semester End Examinations (Regular / Supplementary) - May, 2019

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

1. (a) Describe the different methods of producing controlling torque in analog indicating instruments. List their advantages and disadvantages. [7M]
(b) A meter of resistance 50 ohms has a full scale deflection of 4 mA. Determine the value of shunt resistance required in order that full scale deflection should be [7M]
 - i. 15mA
 - ii. 20A
 - iii. 1000A
2. (a) How is the current range of a PMMC instrument extended with the help of shunts? Describe a method of reducing errors due to temperature changes in the shunt connected instruments. [7M]
(b) A moving coil instrument gives a full scale deflection. When the current is 40 mA and its resistance is 25Ω , calculate the value of the shunt to be connected in parallel with the meter to enable it to be used as an ammeter for measuring currents up to 50A. [7M]

UNIT – II

3. (a) Discuss the usage of dc potentiometer in calibration of voltmeter and ammeter. [7M]
(b) A co-ordinate type potentiometer is used for determination of impedance of a coil and following readings were obtained. Voltage across 1.0Ω resistor in series with coil: +0.238 V on its phase dial and -0.085 V on its quadrature dial. Voltage across 10:1 potential divider used with the coil: +0.3375 V on its phase dial and +0.232 V on quadrature dial. Calculate resistance and reactance of coil. [7M]
4. (a) Draw the equivalent circuit and phasor diagram of a Current Transformer. Derive the expression for ratio and phase angle errors. [7M]
(b) Design a volt ratio box with a resistance of 20 ohms/V and ranges 3 V, 10 V, 30 V, 1000 V. The volt ratio is to be used with a potentiometer having a measuring range of 1.5 V. [7M]

UNIT – III

5. (a) Derive the constructional details of an Electrodynamometer type wattmeter. Derive the expression for torque when the instrument is used on a.c. and also explain why it is necessary to make the potential coil purely resistive? [7M]

- (b) 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 circuit:
- When both the readings are positive
 - When the latter reading is obtained after reversing the connections to the current coil of a first instrument. [7M]
6. (a) Describe the construction and working of a two element Induction type energy meter. [7M]
- (b) A 230 V single phase watt hour meter has a constant load of 4 A passing through it for 6 hours at unity power factor. If the meter disc makes 2208 revolutions during this period. What is the meter constant in revolutions per kWh? Calculate the power factor of the load if the number of revolutions made by meter are 1472 when operating at 230 V and 5 A for 4 hours. [7M]

UNIT – IV

7. (a) Obtain bridge sensitivity for a Wheatstone bridge for any change in arm resistance. [7M]
- (b) A cable is tested by loss of charge method using ballistic galvanometer with following results: Discharged immediately after electrification deflection: 200 divisions, discharged after 30 sec after electrification [7M]
- Deflection: 126 divisions
 - When in parallel with a resistance of $10\text{M}\Omega$, deflection 100 divisions.
- Calculate the insulation resistance of the cable.
8. (a) Explain how Wien's bridge can be used for experimental determination of frequency. Derive the expression for frequency in terms of bridge parameters. [7M]
- (b) Consider Maxwell's capacitance bridge to measure an unknown inductance in comparison with capacitance. The values at balance: $R_2=400\Omega$, $R_3=600\Omega$, $R_4=1000\Omega$, $C_4=0.5\mu\text{F}$. Calculate R_1 and L_1 and Q-factor if supply frequency is 1000Hz. [7M]

UNIT – V

9. (a) Describe the properties of used for piezoelectric transducers. Derive expression for voltage and charge sensitivities. [7M]
- (b) A resistive position transducer with a resistance of 10 K ohms and shaft strokes of 10 cm is applied with a voltage of 5V. When the wiper is 3 cm from the end, What is the output voltage. [7M]
10. (a) Describe the measurement of phase and frequency of signals using CRO. [7M]
- (b) An electrically deflected CRT has a final anode voltage of 2000V and parallel deflecting plates 1.5 cm long and 5mm apart. If the screen is 50 cm from the centre of deflecting plates, find beam speed, deflection sensitivity of tube and deflection factor of tube. [7M]

