

Enrolment No.

211018090

S₀(UEE03B11):EEB.TECH 3rd SEMESTER, MIDTERM EXAMINATION, 2022

SUBJECT: Electrical Measurement & Measuring Instruments

CODE NO:-UEE03B11

Time: 1 Hour

Total Marks: 20

Group-A

[1×4=4]

Answer all the questions

1. Why eddy current damping is not possible in moving iron instruments?
2. How is gravity control inferior to spring control?
3. What is the advantage of using Ayrton or universal shunt in multi-range ammeters?
4. Why the secondary of CT should not be open circuited when primary is connected to load?

Group-B

[2×5=10]

Answer all the questions

1. The inductance of a moving iron ammeter is given by the expression $L = (20 + 100 \cdot 3\theta^2) \mu\text{H}$, where θ is the deflection in radians from zero position. Determine the deflection of ammeter for a current of 10 A if the spring constant is $8 \times 10^{-6} \text{ Nm/radian}$.
2. Show that for ac operation, the time constants of the shunt and the ammeter must be equal for an accurate readings at all frequencies.
3. Derive the expression for capacitance to be connected across the multiplier of a moving iron voltmeter so as to make its circuit non-inductive for frequencies upto 125 Hz.
4. Prove that the deflecting torque (under ac operation) of an electro-dynamometer type instrument is given by $T_d = I_1 I_2 \cos \phi \frac{dM}{d\theta}$.
5. Explain the working principle of a co-axial vane type moving iron instrument.

Group-C

[1×6=6]

Answer any one from the following questions

- (a) A moving coil instrument, whose resistance is 5Ω and whose working current is 0.015 A, is to be used, with a manganin shunt, to measure 100A. Calculate the error caused by a 10°C rise in temperature when (i) copper moving coil is connected directly across the manganin shunt (ii) a 100Ω manganin resistance is used in series with the instrument moving coil. The temperature coefficient of copper and manganin are $0.004/^\circ\text{C}$ and $0.00015/^\circ\text{C}$ respectively.

- (b) Design a universal shunt to provide an ammeter with current ranges of 10 mA, 20 mA and 30 mA. A basic meter with an internal resistance of 40Ω and full-scale deflection current of 1 mA is to be used.

[3+3=6]

- (a) Draw the equivalent circuit and phasor diagram of a current transformer. Derive the expression for its ratio error.
- (b) The coil of a 200 V moving iron voltmeter has a resistance of 500Ω and an inductance 0.8 H. The instrument reads correctly at 50 Hz ac supply and takes 100 mA at full scale deflection. Calculate (i) the percentage error in the instrument reading when it is connected to 200 V dc supply (ii) the capacitance of the capacitor necessary to eliminate the frequency error.

[3+3=6]
