

UNIVERSITY OF ENERGY AND NATURAL RESOURCE
SCHOOL OF ENGINEERING
ELECTRICAL & ELECTRONIC ENGINEERING
ELNG 202 ELECTRICAL MEASUREMENTS & INSTRUMENTATION
Second Mid-Semester Exams March 2016

Attempt ALL Questions. TIME: 1hr

Q1. The inductance of a moving-iron ammeter with a full scale deflection of 90° at 1.5A is given by $L = (200 + 40\theta - 4\theta^2 - \theta^3) \mu H$ where θ is the deflection in radian from zero position. Estimate the angular deflection of the pointer for a current of 1A [5marks]

Q2. A moving-coil ammeter has a fixed shunt of 0.02Ω . With a coil resistance of $R = 1000\Omega$ and a potential difference of 500mV across it. Full scale deflection is obtained.

- (a) To what shunted current does it correspond 500×10^{-3}
 (b) Calculate the value of R to give full scale deflection when shunted current I is (i) 10 A (ii) 75A [10 marks]

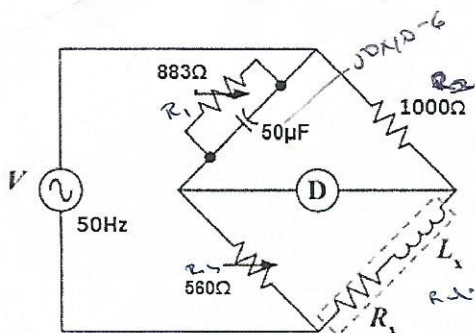
Q3. The angle of deflection in radians from the zero position of Moving-Iron Instruments is given as below; [10 marks]

$$\theta = \frac{1}{2} \frac{I^2}{K_c} \frac{dL}{d\theta}$$

Derive this expression.

Hint: (-Electrical energy supplied = change in stored energy + Mechanical work done,
 -At steady state equation Control Torque (T_c) = deflection Torque (T_d))

Q4. Determine the values of R_x and L_x of the bridge circuit at balanced condition shown below [10 marks]



$$L_x = \frac{R_1 R_2}{R_3}$$

$$R_x = \frac{R_2 \times R_1}{R_3} \times \frac{50 \times 10^{-6}}{560 \times 10^{-6}}$$

$$R_x = \frac{883 \times 1000}{560} \times \frac{50}{560} = 0.04165$$

$$R_x = \frac{R_2}{R_1} \times R_1$$

$$\frac{R_1}{R_3} = \frac{R_2}{R_x}$$

$$\text{But } R_4 = R_2 \times L_x$$

$$\frac{5.02 \times 10^{-4}}{560} = \frac{1500}{R_x \times L_x}$$

$$R_x \times L_x = 5.02 \times 10^{-4} = 560000$$

$$11.155 = 5.578$$

DESMOND AMPOFO

$$R_{th} = I_m R_s + I_m R_m$$