

(f) The length, width and thickness of the control spring of an instrument are 390 mm, 0.52 mm and 0.075 mm. The Young's Modulus of the spring material is 110 GN/m^2 . Determine the torque exerted by the spring when it is turned through 80 degree.

2 Attempt any two parts of the following : $10 \times 2 = 20$

(a) Explain construction and working of Electrodynamicmeter type wattmeter. Considering the error due to the inductance of pressure coil also derive the expression for "correction factor".

(b) A permanent magnet moving coil type full wave bridge rectifier ammeter is used to measure current in a load connected across a supply of voltage :

$$v = 5 \sin \theta + 0.2 \sin 3\theta$$

Determine the reading of the ammeter, if its resistance is 30Ω . Assume dynamic resistance of each diode as 35Ω under forward biased condition.

(c) Explain the construction and derive the expression for deflecting torque of single phase induction type energy meter. Also show that the deflection is maximum when the phase angle between two fluxes is 90° .

3 Attempt any two parts of the following : $10 \times 2 = 20$

(a) The circuit for measurement of effective resistance and self-inductance of an iron cored coil is as follow : arm ab, the unknown impedances; arm bc a pure resistance R_3 ; arm cd, a lossless capacitor C_2 ; arm da, a capacitor C_2 in series with a resistance R_2 . Under balance conditions $R_3 = 10 \Omega$, $R_2 = 842 \Omega$, $C_2 = 0.135 \mu\text{F}$ and $C_4 = 1 \mu\text{F}$. Calculate the value of effective resistance and self inductance at a supply frequency of 100 Hz. Also derive the equations of balance and draw the phasor diagram under balance condition.

(b) A current transformer with a bar primary has 250 turns in its secondary winding. The resistance and reactance of the secondary circuit are 1.4Ω and 1.1Ω respectively including the transformer winding. When 5A current flows in the secondary winding, the magnetizing mmf is 80 AT and the iron loss is 1.1 W. Determine :

- (i) Ratio error
 - (ii) Phase angle error.
- (c) Explain any two of the following :
- (i) Saturable core frequency meter.
 - (ii) Methods of measurement of High value resistance.
 - (iii) Methods of power measurement in 3 phase system.