QUES 04:-

a. A circular coil of 30 turns and radius 8.0 cm, carrying a current of 6.0 A is suspended vertically in a uniform horizontal magnetic field of magnitude 1.0 T. The field lines make an angle of 60° with the normal to the coil. Calculate the magnitude of the counter torque that must be applied to prevent the coil from turning.

b. Would your answer change if the circular coil in (a) were replaced by a planar coil of some irregular shape that encloses the same area?

Sol.

a. Given, N = 30, I = 6.0 A, B = 1.0 T, α= 60°

r = 8.0 cm = $8 \times 10^{-2} m$

Area of the coil, $A = \pi r^2$

$= \frac{22}{7} \times (8 \times 10^{-2})^2$

$A = 2.01 \times 10^{-2} m^2$

Now, $\tau = NBIA \ \sin\alpha$

$= 30 \times 6.0 \times 1.0 \times (2 \times 10^{-2}) \times \sin 60°$

$\tau = 30 \times 6 \times 1 \times 2 \times \frac{\sqrt{3}}{2} \times 10^{-2} = 3.12 Nm$

b. Since the torque on the planar loop does not depend upon the shape, in this case the area of the loop is the same, hence, the torque will remain unchanged.