



E&M. 3.

A circular wire loop with radius 0.10 m and resistance $50\ \Omega$ is held in place horizontally in a magnetic field $\vec{B}$ directed upward at an angle of 60° with the vertical, as shown in the figure above. The magnetic field in the direction shown is given as a function of time t by $B(t) = a(1 - bt)$, where $a = 4.0\text{ T}$ and $b = 0.20\text{ s}^{-1}$.

- (a) Derive an expression for the magnetic flux through the loop as a function of time t .
- (b) Calculate the numerical value of the induced emf in the loop.
- (c)
- Calculate the numerical value of the induced current in the loop.
 - What is the direction of the induced current in the loop as viewed from point P ?
☐ Clockwise ☐ Counterclockwise
Justify your answer.
- (d) Assuming the loop stays in its current position, calculate the energy dissipated in the loop in 4.0 seconds.
- (e) Indicate whether the net magnetic force and net magnetic torque on the loop are zero or nonzero while the loop is in the magnetic field.
- Net magnetic force: ☐ Zero ☐ Nonzero
- Net magnetic torque: ☐ Zero ☐ Nonzero
- Justify both of your answers.

STOP
END OF EXAM