



Prerequisite 1 : Assignment Fundamentals of Electromagnetism and Signal Processing

Problem Statement:

As a researcher conducting experiments in a laboratory focused on electromagnetism and torque phenomena, you're tasked with analyzing the behavior of magnetic dipoles and the effects of external forces on them. Your research aims to understand and quantify various parameters related to magnetic dipoles and torque within experimental setups.

Tasks to be Performed:

1. Moment of force (torque):

Given:

- Force (F) = 10 N
- Perpendicular distance (d) from the line of action of the force to pivot = 0.5 meters

2. Square Waveforms:

Given:

- Frequency (f) = 50 Hz
- Duty cycle (D) = 75%

For a square waveform signal used in the experiment, find the period and duration of the high state (logic level 1) of the square wave.

3. Magnetic dipole moment (m) of a tiny magnet:

Given:

- Number of turns in the coil (N) = 100
- Current flowing through the coil (I) = 0.5 A
- Area of the coil (A) = 0.02 m^2

4. Magnetic Dipole Moment:

Given:

- Pole strength (m) = 2 A-m
- Distance between the north and south poles (d) = 0.01 m

5. Magnetic moment:

Given:

- Magnetic moment (m) = 3 A-m^2
- External magnetic field (B) = 0.5 T

6. Magnitude of torque:

Given:

- Position vector (r) = 0.2 meters
- Force vector (F) = 15 N
- Angle between the force vector and the lever arm vector (θ) = 30 degrees

7. Magnetic dipole potential energy:

Given:

- Magnetic dipole moment (μ) = 4 A-m^2
- Magnetic field strength (B) = 0.8 T
- Angle between the magnetic dipole moment (μ) and the magnetic field (B) (θ) = 45 degrees