Electromagnetic Engineering

Final Exam (2023)

Time: 75 minutes

Q1. (8 points)

A.(4 points)

Given the torus in electromagnetic field in Fig. 1. The electrical field **E** can be expressed as $\mathbf{E}(x,y,z)=(x^3,y^3,z^3)$ and be satisfied the first Maxwell equation, i.e., $\nabla.\mathbf{E}=\frac{\rho}{\varepsilon}$. Find the electric flux, Φ, going through the torus

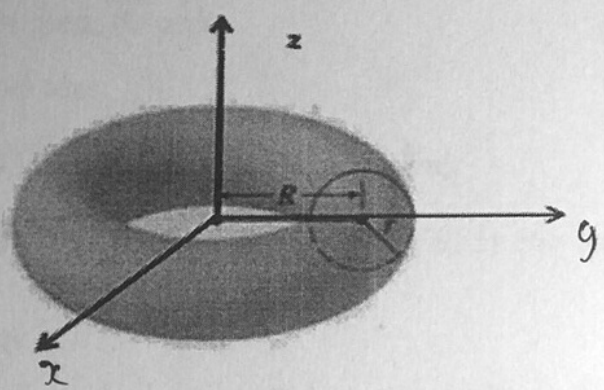

Fig. 1 The torus in the electromagnetic field

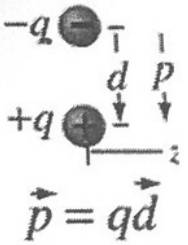

Fig. 2 Electric dipole

B. (4 points)

Assuming that the magnetic field $\mathbf{B}(R,t)=B_0.\left(\frac{t^2}{t_0}\right).\left(\frac{R}{R_0}\right).\hat{z}$. In this formula B_0, t_0, R_0 are constants. Find the induced emf in the torus. Find the direction of the current in the torus.

Q2. (2 point)

A electric dipole (Fig. 2) with its moment vector ***p*** rotates with the angular velocity ω, around an axis which is perpendicular to the vector ***p***. The rotating axis is coincide to the vector **B** , the uniform magnetic field. Find the drift velocity of the electric dipole in the magnetic field if the mass of the dipole is m and constant angular velocity.