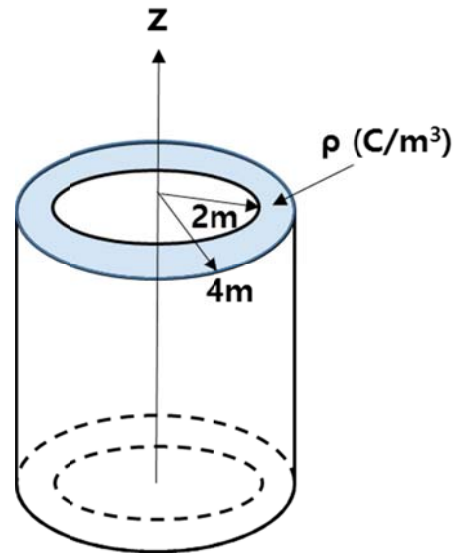


전자기학/초고주파 분야

박사과정 자격시험 (2016.5.00)

1. **(15점)** The volume in cylindrical coordinates between $r = 2\text{m}$ and $r = 4\text{m}$ contains a uniform charge density ρ (C/m^3). Use Gauss's to find D in the following regions:

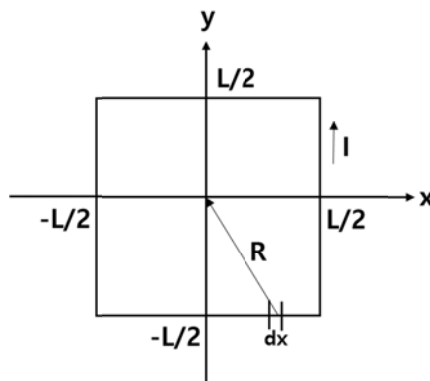
- (a) For $0 < r < 2\text{m}$
- (b) For $2\text{m} \leq r \leq 4\text{m}$
- (c) For $r > 4\text{m}$



2. **(15점)** In the region $r \leq 2$, $D = (5r^2/4)\mathbf{a}_r$, and for $r > 2$, $D = (20/r^2)\mathbf{a}_r$, in spherical coordinates find the charge density for:

- (a) $r \leq 2$
- (b) $r > 2$

3. **(20점)** Find H at the center of a square loop of side L .



4. [25pts] A uniform sinusoidal plane wave in air with the following phasor expression for electric field

$$E_i(x, z) = \hat{a}_y 10e^{-j(6x+8z)}$$

is incident on a perfectly conducting plane at $z = 0$.

- [5pts] Find the frequency and wavelength of the wave.
- [5pts] Write the instantaneous expressions for $E_i(x, z; t)$ and $H_i(x, z; t)$ using a cosine reference.
- [5pts] Determine the angle of incidence.
- [5pts] Find $E_r(x, z)$ and $H_r(x, z)$ of the reflected wave.
- [5pts] Find $E_1(x, z)$ and $H_1(x, z)$ of the total field.

5. [10pts] A 2 (m) lossless air-spaced transmission line having a characteristic impedance 50Ω is terminated with an impedance $40+j30 \Omega$ at an operating frequency 200 (MHz). Find the input impedance.

6. [15pts] Assume an infinitely long waveguide filled with an internal lossless medium (ϵ, μ) and its internal time-harmonic field propagates in $+z$ direction with propagation constant γ . Use time-harmonic Maxwell's equations in Cartesian coordinates in order to derive $E_x(x, y)$, $E_y(x, y)$, $H_x(x, y)$, $H_y(x, y)$ in terms of E_z and H_z , and $h^2 = \gamma^2 + k^2$, where $k = \omega\sqrt{\mu\epsilon}$ is a wavenumber in the waveguide.