八十五學年度核子工程與工程物理系（所）＿＿＿＿組碩士班研究生入學考試

科目電磁學 科號3806 共二頁第一頁 *請在試卷【答案卷】內作答

1. (15%) Find the charge distribution of an electrostatic potential V in a homogeneous medium, where $V(R)=(q/R)\exp(-aR)$ with q and a are constants, and R is the radius in spherical coordinates.

2. (15%) Prove that the energy required to assemble a uniform sphere of charge of radius b and volume charge density q is equal to the potential energy of the sphere.

3. (15%) Determine the capacitance per unit length between two long, parallel, circular conducting wires of radius a and b. The axes of the wires are separated by a distance D.

4. (15%) A long dielectric cylinder of radius b and dielectric constant ϵ_r is placed along the z-axis in an initially uniform electric field $\vec{E}_o = \hat{a}_x E_o$. Determine the potential V and E both inside and outside the dielectric cylinder.

5. (5%) What is meant by a cutoff frequency of a waveguide?

6. (5%) What are the three most common types of guiding structures that support TEM waves?

7. (10%) Show that the instantaneous Poynting vector of a circularly polarized plane wave propagating in a lossless medium is a constant that is independent of time and distance.

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科目 電磁學 科號 3806 共 二 頁第 二 頁 *請在試卷【答案卷】內作答

8. Prove that the Lorentz condition for potentials,

$$\nabla \cdot \vec{A} + \mu \epsilon \frac{\partial V}{\partial t} = 0$$

(15%) is consistent with the equation of continuity.

9. Explain why magnetic flux lines leave the surface of a

(5%) ferromagnetic medium perpendicularly.