

八十四學年度 核子工程研究所 組碩士班研究生入學考試

科目 電磁學 科號 3306 共 1 頁第 1 頁 *請在試卷【答案卷】內作答

1. A cylindrical-like capacitor consists of an outer conductor whose inner radius increases uniformly from b with a very small angle θ ($\ll 1$), and an inner conductor whose radius is a . The space between the conductors is filled with a dielectric of permittivity ϵ , and the length of the capacitor is L .

(15%) (a). Determine the capacitance of this capacitor.

(5%) (b). Determine the resistance between two conductors.

2. Two concentric metal shells of radii a and b ($a > b$), and the outer shell is with charge q .

(10%) (a). Determine the electric field with respect to r , if the inner shell is not grounded.

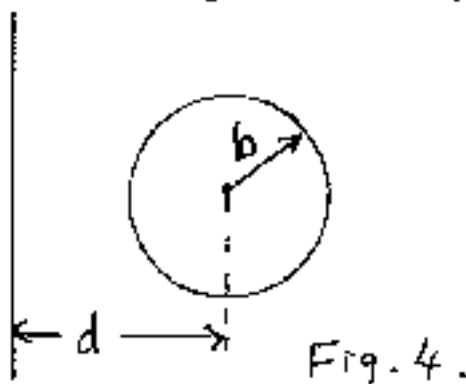
(10%) (b). Determine the charge on the inner shell, if the inner shell is grounded.

3. An insulated conducting sphere of radius a has a net charge q , on its surface. A point charge q_2 is placed d distance from the center of the sphere, where $d > a$.

(10%) (a). Find the force between the charges.

(10%) (b). Find the surface charge density of the sphere.

4. (10%) Determine the mutual inductance between a very long, straight wire and a conducting circular loop, as shown in Fig.4.



5. (10%) In a time-varying situation how do we define a good conductor? A lossy dielectric?

6. (10%) Prove that, under the condition of no reflection at an interface, the sum of the Brewster angle and the angle of refraction is $\pi/2$ for perpendicular polarization ($\mu_1 \neq \mu_2$), and parallel polarization ($\epsilon_1 \neq \epsilon_2$).

7. (10%) Explain the single-stub method for impedance matching on a transmission line.