1. How is Poynting Theorem derived from Maxwell's equations? Write Poynting Theorem in derivative form and in integral form. State briefly the physical meaning of each term in the integral form. (20%)

2. A dielectric slab with permittivity ϵ_1 can slide freely between a pair of capacitor plates held under constant potential difference V (Fig. 1) Find the force on the slab when it is inserted partway. Neglect edge effect. The permittivity of air is ϵ_2. (20%)

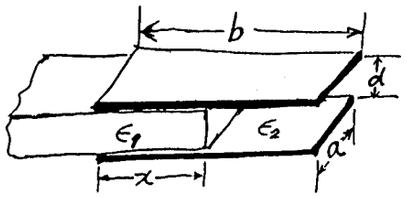

Fig. 1

3. A positive charge Q is placed above the ground of infinite extention as shown in Fig. 2. Find the charge distribution on the ground. (20%)

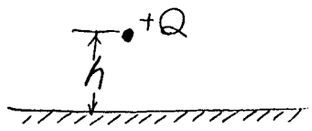

Fig. 2

4. A uniform plane wave with electric field $\vec{E} = \hat{i} E_0 e^{j(\omega t - \beta z)}$ travels in the z-direction as shown in Fig. 3 in medium 1 which is air. If medium 2 is perfect conductor, find the total electric field in medium 1. (20%)

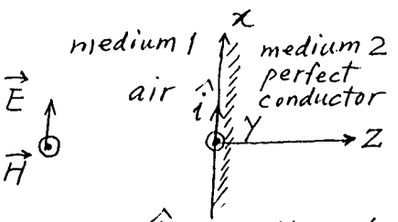

Fig. 3 $\hat{i}$ is unit vector in x-direction

5. Find the capacitance of a coaxial cable with length L as shown in Fig. 4. The radii of the inner and outer conductor are a and b respectively, and the permittivity of the medium between the inner and outer conductor is ϵ. (20%)

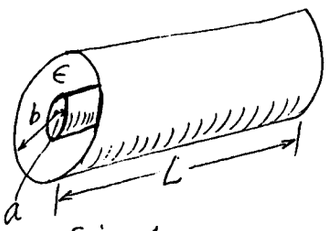

Fig. 4