淡江大學九十學年度碩士班招生考試試題

系別：電機工程學系　　　　　　科目：電　磁　學（含電磁波）

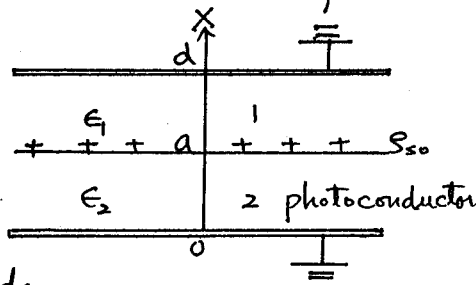| 准帶項目請打「○」否則打「×」	
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1. In the xerographic copying machine, the surface of the photo-
(20%) conductor is initially charged uniformly with S_{so} as shown in the figure. Neglect the fringing.
   a) Determine the potential function $V(x)$ and the electric field $\vec{E}$ in both regions.
   b) Find the stored electrostatic energy per unit surface area.
   c) Neglecting the fringing will violate one of the Maxwell's equation for static fields.
   Point out the equation and explain the violation.

2. A total charge Q is uniformly distributed on the surface of a
(20%) sphere of radius a. The center of the sphere is situated at the origin and the sphere is spinning around the z axis with a constant angular velocity ω.
   a) Find the magnetic dipole moment $\vec{m}$.
   b) Find the magnetic flux density $\vec{B}$ at a distant point $(r \gg a)$.

3. Measurements on a transmission line of $Z_0 = 50\,\Omega$ provide the
(15%) following data. First, with the short circuit termination, voltage minima are found to be 20 cm apart. Next, with the short circuit replaced by the unknown load, the standing-wave-ratio (SWR) is found to be 3 and a voltage minimum is found to be 14.2 cm from the load. Determine the load reflection coefficient Γ_L and the unknown load impedance Z_L.

◀ 注意背面尚有試題 ▶

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4. (30%) The electric field of a uniform plane wave propagating in a lossless nonmagnetic dielectric medium is given by

$$\vec{E}(t) = \vec{a_z}\, 10 \sin(3\pi \times 10^7 t - 0.2\pi x) - \vec{a_y}\, 10 \cos(3\pi \times 10^7 t - 0.2\pi x) \quad V/m$$

a) Find the wavelength λ and the phase velocity U_p of the wave.

b) Find the dielectric constant ϵ_r and the intrinsic impedance η of the medium.

c) Find the corresponding magnetic field $\vec{H}(t)$.

d) Describe the polarization of the wave.

e) Find the time-average Poynting vector.

5. (15%) A rectangular waveguide of dimensions $a = 5$ cm and $b = 2.5$ cm has a dielectric discontinuity as shown in the figure. A TE_{10} wave of frequency $f = 5$ GHz is incident on the discontinuity from the free space side. By using the transmission-line equivalent (i.e. the wave impedance of guide considered as the characteristic impedance of the line), find the standing-wave-ratio (SWR) in the free space section.