系組： 光電系

准考證號碼：□□□□□□
（請考生自行填寫）

科目： 電磁學

注意事項	一、 請先檢查准考證號碼、報考系(組)別、考試科目名稱，確定無誤後再作答。 二、 所有答案應寫於答案紙上，否則不予計分。 三、 作答時應依試題題號，依序由上而下書寫，作答及未作答之題號均應抄寫。

1. An annular, disc of radius a carries a uniform surface charge density ρ_s, as shown in Figure 1. Determine the electric field $\bar{E}(z)$ in the vacuum at any point on the z axis. (15%)
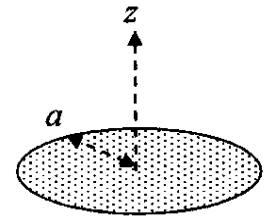

Fig. 1

2. Find the magnetic flux density $\bar{B}(z)$ at a point on the z axis of a circular loop of radius b that carries a direct current I in the vacuum, as shown in Figure 2. (15%)
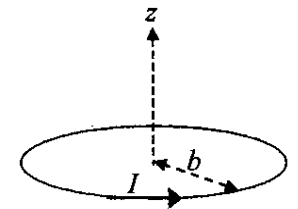
3. A cylindrical capacitor consists of an inner conductor of radius a and an outer conductor of radius b. The space between the conductors is filled with a dielectric of permittivity ε, and the length of the capacitor is L. Determine the capacitance of the capacitor. (15%)

Fig. 2

4. Two large parallel conducting plates are separated by a distance d and maintained at potentials 0 and V_0, as shown in Figure 3. The vacuum region between the plates is filled with a continuous distribution of electrons having a volume density of charge $\rho = \rho_0(d-y)/d$, where ρ_0 is constant. Determine the potential at any point between the plates. (20%)
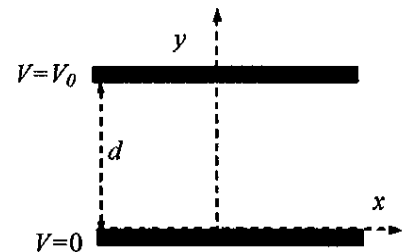

Fig. 3

5. A uniform plane wave with the electric field $\bar{E}=\bar{a}_x E$ propagates in a lossless simple medium with the relative permittivity $\varepsilon_r=8$ and relative permeability $\mu_r=1$ in the $+z$-direction. Assume that E is sinusoidal with a frequency 100 (MHz) has a maximum value of $+10^{-3}$ (V/m) at $t=0.5$(s) and $z=1$(m). Write the instantaneous expression for the magnetic field $\bar{H}$ for any t and z. [Hint: $\varepsilon_0 = 10^{-9}/36\pi$ (F/m) and $\mu_0 = 4\pi \times 10^{-7}$ (H/m)] (15%)

6. Given $\bar{E}_i(z,t)=\bar{a}_x 48\cos(10^8 t-\beta_1 z)$(V/m) in air that impinges normally on a lossless medium with $\varepsilon_{r2}=2.25$, $\mu_{r2}=1$ in the $z \geqq 0$ region, determine the transmitted magnetic field $\bar{H}_t(z,t)$. (20%)