

# 國立臺北科技大學

## 九十七學年度四年制二、三年級轉學生招生考試

系所組別：四技三年級光電工程系

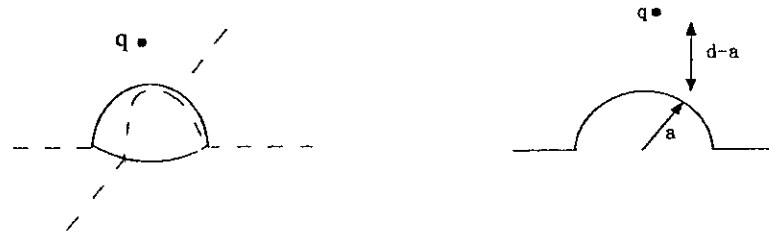
### 第三節 專業科目（二）電磁學 試題

第一頁 共一頁

#### 注意事項：

1. 本試題共 7 題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. A long, straight coaxial cable has an inner wire of radius  $a$  with a surface charge density  $\sigma_a$  and an outer cylindrical shell of radius  $b$  with a surface charge density  $\sigma_b$  C/m<sup>2</sup>. What must be the relation between  $a$  and  $b$  in order that  $E$  vanishes for  $r > b$ ? [15%]
2. A conductor at potential  $V = 0$  has the shape of an infinite plane except for a hemispherical bulge of radius  $a$  as shown in the figure. A point charge  $q$  is placed above the center of the bulge, a distance  $d$  from the plane (or  $d - a$  from the top of the bulge). What is the force on the charge? [15%]



3. Two straight, infinite wires carry the same current  $I$  along the  $+x$  axis and  $+y$  axis, respectively. What is the magnetic field at  $z = +d$  on the  $z$  axis? [15%]
4. (a) Please describe the main characters of diamagnetic, paramagnetic, and ferromagnetic materials. [10%]  
(b) What is curie temperature? [5%]
5. Write down the boundary conditions that exist at the interface of free space and a magnetic material of infinite permeability. [10%]

6. A uniform plane wave ( $E_i, H_i$ ) of an angular frequency  $\omega$  is incident from air on a very large, perfectly conducting wall at an angle of incidence  $\theta_i$  with perpendicular polarization. Find the current induced on the wall surface. [15%]
7. For an  $a \times b$  rectangular waveguide operating at the  $TM_{11}$  mode, derive the expressions for the surface current densities on the conducting walls. [15%]