

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 σ_a and an outer cylindrical shell of radius b with a surface charge density σ_b C/m². 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 ($\mathbf{E}_i, \mathbf{H}_i$) of an angular frequency ω is incident from air on a very large, perfectly conducting wall at an angle of incidence θ_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%]