

國立臺北科技大學 107 學年度碩士班招生考試

系所組別：2402 光電工程系碩士班

第二節 電磁學 試題 (選考)

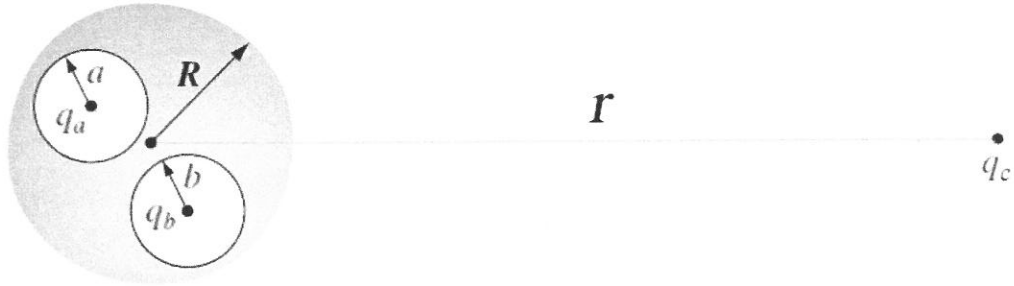
第一頁 共一頁

注意事項：

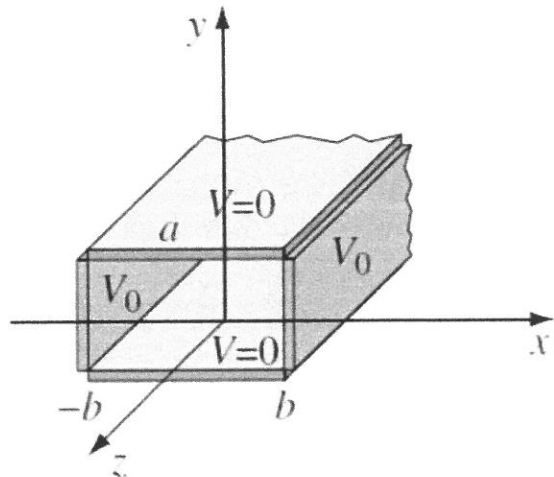
1. 本試題共 6 題，共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. Two spherical cavities, of radii a and b , are hollowed out from the interior of a neutral conducting sphere of radius R as shown in the figure. Point charges, $+q_a$ and $+q_b$, are placed at the center of each cavity. There is another charge $+q_c$ at a large distance r ($r \gg R$) away from the conductor. What forces act on each of the following objects: (5% each)

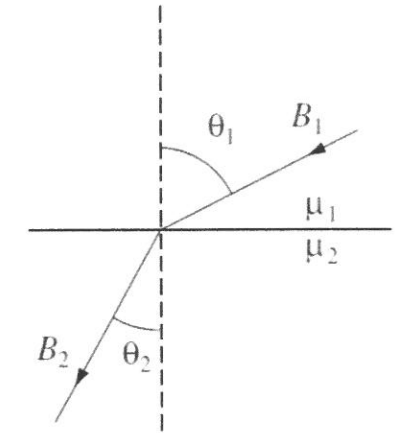
- (a) the conductor
- (b) q_a
- (c) q_c



2. Two infinitely-long grounded metal plates, at $y = 0$ and $y = a$, are connected at $x = \pm b$ by metal strips maintained at a constant potential V_0 , as shown in the figure (a thin layer of insulation at each corner prevents them from shorting out). Find the potential inside the resulting rectangular pipe. (20%)



3. At the interface between one linear magnetic material and another the magnetic field lines bend (see the figure). Assuming there is no free current at the boundary, what is the ratio $\frac{\tan \theta_1}{\tan \theta_2}$ in terms of the permeabilities μ_1 and μ_2 ? (10%)



4. A long cable carries current in one direction uniformly distributed over its circular cross section with radius R . The current returns along the surface (there is a very thin insulating sheath separating the currents). Find the self-inductance per unit length. (15%)
5. Please write down the four Maxwell's equations in both differential and integral forms. (20%)
6. The \vec{E} -field of a uniform plane wave propagating in a dielectric medium is given by $\vec{E}(t, z) = \hat{a}_x 2 \cos(10^8 t + \frac{z}{\sqrt{3}}) - \hat{a}_y \sin(10^8 t + \frac{z}{\sqrt{3}})$ (V/m). (5% each)
 - (a) Determine the wavelength of the wave.
 - (b) What is the dielectric constant of the medium?
 - (c) What is the propagating direction?
 - (d) Find the corresponding \vec{H} -field?