

國立臺北科技大學九十五學年度碩士班招生考試

系所組別：1901、1902 光電工程系碩士班不分組

第二節 電磁學 試題

填准考證號碼

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第一頁 共二頁

注意事項：

1. 本試題共六題，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。

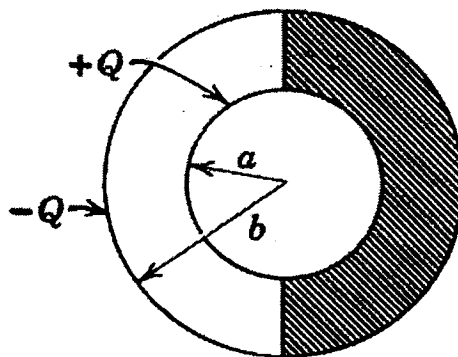
1. (15pts)

Two equal charges are placed at a distance $2d$ apart. Find, approximately, the minimum radius of a grounded conducting sphere placed midway between them that would neutralize their mutual repulsion.

2. (20pts)

A spherical capacitor consists of two concentric conducting spheres of inner and outer radii a and b , respectively. The empty space between the spheres is half-filled by an isotropic dielectric of permittivity ϵ , as shown in the figure. If the inner sphere has total charge Q and the outer sphere has total charge $-Q$, find:

- (1) the electric field \mathbf{E} and electric displacement \mathbf{D} everywhere between the spheres; (7pts)
- (2) the surface charge density distribution on the inner sphere; (7pts)
- (3) the total capacitance of this system. (6pts)



3. (15pts)

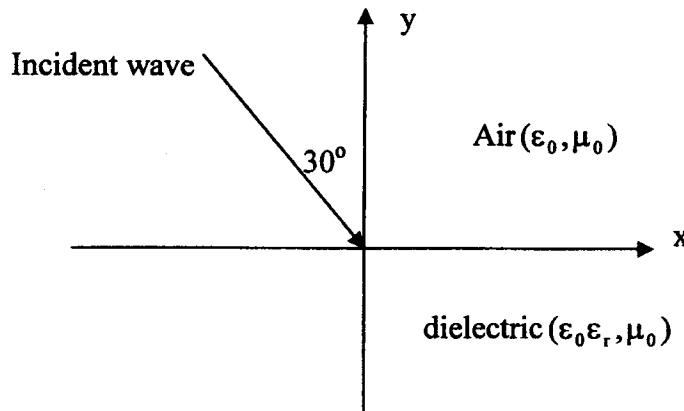
A rectangle of perfectly conducting wire with sides a and b (taking $b > a$), mass M , and self-inductance L , moves with an initial velocity v_0 in its plane, directed along side b , from a region of zero magnetic field into a region with a field B_0 which is uniform and perpendicular to the plane of the rectangle. Describe the motion of the rectangle as a function of time as detailed as you can.

4. (20pts)

A uniform plane TM wave with a frequency 80MHz from the air is incident on the boundary of the dielectric (with relative dielectric constant $\epsilon_r = 4$) and air. As shown in the figure, the angle of incidence is 30 deg. The amplitude of the electric field for the incident wave is 10^{-3} (V/m).

(a) Write the instantaneous expressions for the reflected wave ($\vec{E}_r(\vec{r}, t), \vec{H}_r(\vec{r}, t)$)

(b) Write the instantaneous expressions for the transmitted wave ($\vec{E}_t(\vec{r}, t), \vec{H}_t(\vec{r}, t)$)



5. (15pts)

The standing-wave ratio on a lossless $100(\Omega)$ transmission line terminated in an unknown load impedance is found to be 3.0. The distance between successive voltage minima is 20 cm, and the first minimum is located at 5 cm from the load. Determine the load impedance of the transmission line.

6. (15pts)

An air-filled metallic rectangular waveguide has a cross section of $a \times b$. Write the electric and magnetic fields for the dominant mode in the case $a < b$

注意：背面尚有試題

