淡江大學九十一學年度碩士班招生考試試題

系別：電機工程學系　　科目：電 磁 學 （含電磁波）

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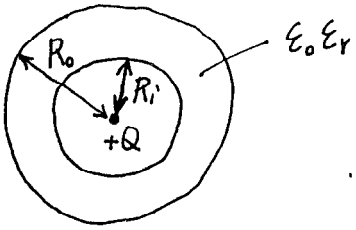
計算機	字典
X	X

(一) 20% a point charge Q is located at the center of a spherical dielectric shell (with inner radius R_i and outer radius R_o)

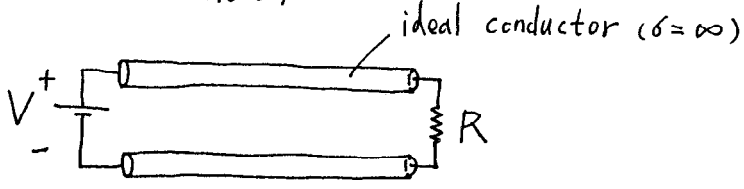


① use Gauss law to calculate the $\bar{E}$ field in the region $R_i < R < R_o$

② calculate the polarization surface charge density ρ_{ps} and the total polarization surface charge Q_i at $R = R_i$

③ use Q and Q_i to recalculate the $\bar{E}$ field in the region $R_i < R < R_o$ compare and comment your result with part ①.

(二) 20% For the electric circuit below,



① Start with $\nabla \times \vec{E} = 0$ to show that Kirchhoff voltage law (KVL) can be derived from the above equation for static case (d.c. case)

② repeat the above procdure for time varying case (when the d.c. source is replaced by an a.c. source)
What do you find out about the KVL for a.c. case.

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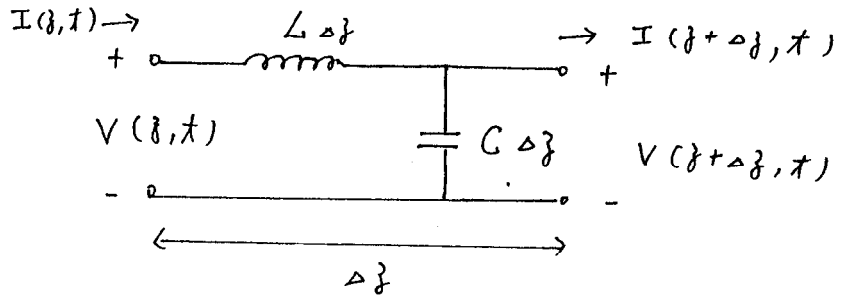
(三) The following equivalent circuit is usually used to analyze a 20% transmission line segment Δz



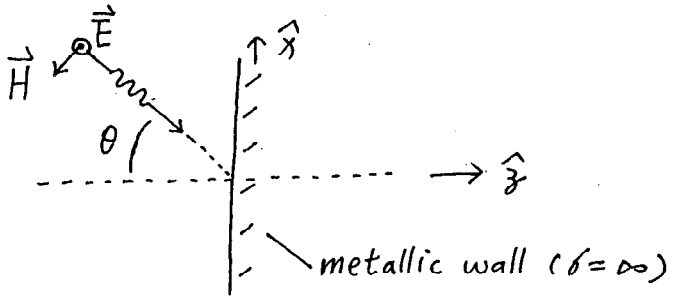
① derive the telegraphist's equations for V and I

② decouple the telegraphist's equations to obtain the wave equation for V

③ demonstrate that $f(t-\frac{z}{u})$ is a suitabe solution of the above wave equation, where $u = 1/\sqrt{LC}$

④ what is the physical meaning of the solution

(四) A plane wave is incident on an ideal metallic wall with incidence 20% angle θ



① will the incident plane itself get into the metallic wall (assume $\sigma = \infty$)

② Explain the physical mechanism that excites the reflected wave (no mathematics)

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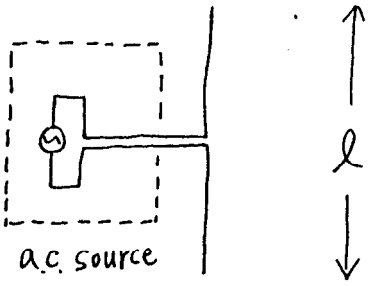
③ Write down the mathematical expression for the E field and H field of the incident wave.

五、A handset uses a dipole antenna as shown below 20%



① How do you explain the current flow on the wire that likely violates the Kirchhoff current law

② write down the mechanism that causes the antenna radiation