

系所組別： 奈米科技暨微系統工程研究所乙組

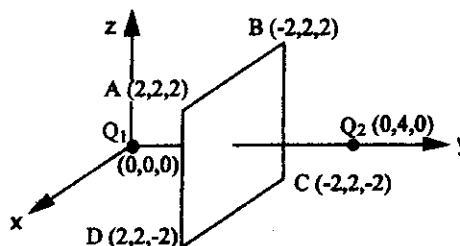
考試科目： 電磁學

考試日期： 0307 · 節次： 2

※ 考生請注意：本試題 可 不可 使用計算機

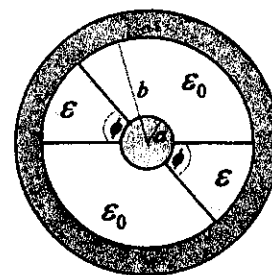
Problem 1 (20 Points)

In the accompanying diagram, $Q_1 = 5 \times 10^{-6} C$ and $Q_2 = -10 \times 10^{-6} C$. Find the total electric flux through the square $ABCD$ shown in the figure.



Problem 2 (20 Points)

The cross-sectional view of an air-filled coaxial capacitor with spacers made out of material with permittivity ϵ is shown in the figure. Find the capacitance (per unit length) of this coaxial line in terms of ϵ , a , b , and ϕ .



Problem 3 (20 Points)

(a) Find the magnetic flux density B at the center of a square loop carrying a current I . The side of the square loop is a meters long. (b) A circular loop that has radius b and that carries a current I produces the same magnetic flux density at its center. Find the ratio of b to a .

Problem 4 (20 Points)

A circular current loop with radius a ($\neq 0$) is located on the x - y plane and is centered at the origin. Find the optimal value of a to maximize the magnetic field at the position $(0, 0, d)$. Calculate this maximal magnetic field.

Problem 5 (20 Points)

(a) Prove that electromagnetic energy can not penetrate through a perfectly conducting surface. (b) The four Maxwell's equations are not independent. Please derive the Gauss's law for electric flux from the generalized Ampere's law.