國立成功大學82學年度医工所碩士班招生考試(電磁學 試題) 共 1 頁 第 1 頁

(1) Explain the following terms:(25%)
(a) Helmholtz's theorem; (b) Gauss's theorem; (c) Stokes's theorem; (d) Lenz's law; (e) Brewster's angle.

(2) Four uniform line charges, ρ_1, ρ_2, ρ_3, and ρ_4, each of length L, form a square in sequence. Assuming $\rho_1=2\rho_2=2\rho_3=\rho_4$, determine the electric field intensity at the center of the square.(15%)

(3) An infinitely long, thin, conducting circular cylinder of radius b is split in four quarter-cylinders, as shown in Figure 1. The quarter-cylinders in the second is grounded, and those in the first, third, and fourth quadrants are kept at potentials V_o, $-V_o$, and V_o respectively. Determine the potential distribution both inside the outside the cylinder.(15%)

(4) For a small rectangular loop with sides a and b that carries a current I. (a) Find the vector magnetic potential **A** at a distance point p(x,y,z). (b) Determine the magnetic flux density **B**.(15%)

(5) Consider a lossless transmission line. (a) Determine the line's characteristic resistance so that it will have a minimum possible standing-wave ratio for a load impedance 40+j30 (Ω). (b) Find the minimum standing-wave ratio and the corresponding voltage reflection coefficient. (c) Find the location of the voltage minimum nearest to the load.(15%)

(6) Magnetocardiography is a technique, which uses a device so-called SQUID, to measure the magnetic field around the chest for representing the activity of the heart. Explain the underlying principles of electromagnetism.(15%)

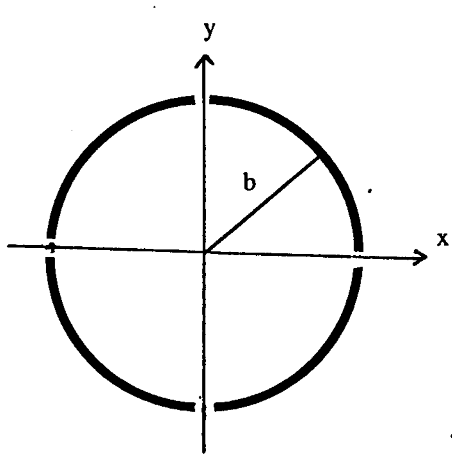

Figure 1