

國立中央大學 105 學年度碩士班考試入學試題

所別： 機械工程學系光機電工程碩士班 光機組(一般生)

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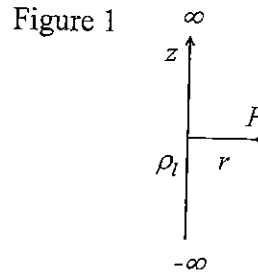
科目： 電磁學

本科考試可使用計算器，廠牌、功能不拘

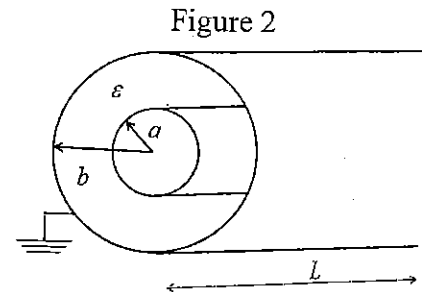
*請在答案卷(卡)內作答

1. State the following laws and write the equations: (24%)
 (a) Coulomb's Law, (b) Gauss's Law, (c) Ohm's Law, and (d) Joule's Law.

2. Consider an infinitely long, straight, line charge of a uniform density ρ_l in air (Figure 1). Determine the electric field intensity at a point P , which is at a distance r from the line. (10%)

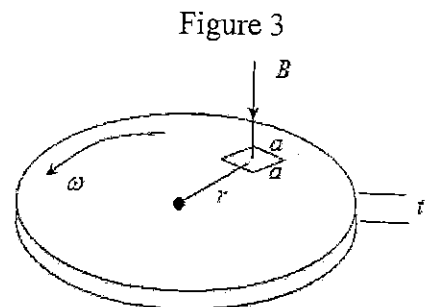


3. Consider a very long coaxial cable (Figure 2). The inner conductor has a radius a and is maintained at a potential V_0 . The outer conductor has an inner radius b and is grounded. Assume the dielectric material between the two conductors has a permittivity of ϵ . Please drive (a) the potential distribution in the space between the conductors (8%) and (b) the capacitance per unit length. (8%)



4. A straight wire 10 cm long, carrying a current of 5.0 A, is in a uniform field of 0.50 T. What is the force on the wire when it is (a) at right angles to the field (2%) and (b) at the 30° to the field? (3%)
5. Two long parallel wires are 10 cm apart and carry currents of 3 A and 6 A in the same direction. Compute the force between the wires per meter of wire length. (5%)

6. A metal disk of conductivity σ and thickness t is rotating about an axis. A magnetic B applies perpendicular to the plane of the disk over a small area a^2 (Figure 3). The area a^2 is at a distance r from the axis. Show that an approximate expression for the torque tending to slow down the disk at instant angular velocity ω is $\tau = B^2 a^2 r^2 \omega \sigma t$. (15%)



7. Describe the Snell's law of refraction and its mathematic expression. (10%)
8. A uniform planar wave has the electrical field $\vec{E} = \vec{a}_x 10^{-2} \times \cos(4\pi \times 10^8 t - kz + \phi)$ (V/m). When it propagates in a lossless medium with the relative permittivity $\epsilon_r = 2.25$ and the relative permeability $\mu_r = 1$, \vec{E} has the maximum value at $t = 0$ and $z = 0.5$ m. Find (a) the wavenumber k , (5%) (b) the initial phase ϕ , (5%) and (c) the instantaneous magnetic field \vec{H} . (5%)