國立雲林科技大學
101 學年度碩士班暨碩士在職專班招生考試試題

系所：電子光電所
科目：電磁學

1. Suppose a propagating electric field is given by
$E(z, t) = 34e^{-0.002z}\cos(2\pi\times10^9 t - 10\pi z + 45°)$ V/m. Find
(a) the initial amplitude, (b) the attenuation constant, (c) the wave frequency,
(d) the wavelength and (e) the phase shift in radians, including the unit. (15%)

2. (a) Find out the integral $\int\frac{dx}{(x^2+a^2)^{3/2}}$ (5%)

(b) A segment of line charge ρ_L = 10 nC/m exists on the x-axis from x = -3.0 m to x = +3.0 m. Determine **E** at the point (0.0, 3.0, 0.0)m. (12%)

3. (a) Find the inductance per unit length (L/h) internal to a solid conductive wire with radius a, and with current I distributed evenly over the cross section. (6%)
(b) A coaxial cable (coax) consists of a pair of cylindrical metallic shells of inner radius a and outer radius b. Determine the inductance per unit length (L/h) of the coax. (6%)
(c) Consider a coaxial cable with solid inner conductor of radius a and a conductive outer shell at radius b, filled with nonmagnetic material (μ_r = 1). Find the total inductance per unit length (L/h). (6%)

4. The magnetic flux density increases at the rate of 10 Wb/m^2/s in the z direction. A 10×10 cm square conducting loop, centered at the origin in the x-y plane, has 10 Ω of distributed resistance. Determine the direction (with a sketch) and magnitude of the induced current in the conducting loop. (12%)

5. Find $\bar{H}$, if a uniform current density $\bar{J} = \hat{a}_z J_0(\text{A/m}^2)$, or a vector magnetic potential

$\bar{A} = \hat{a}_z \frac{-\mu_0 J_0}{4}(x^2 + y^2)(\text{Wb/m})$ are given. (12%)

6. If $\bar{D} = 2r\hat{a}_R C/m^2$, find the total electric flux leaving the surfaces of the cube where $0 < x, y, z < 0.4$m. (10%)

7. What are the Maxwell equations in integral form? (8%)

8. The surface x = 0 separates two perfect dielectrics (no free charge). For x > 0, let ε_{r1} = 3, while ε_{r2} = 5 where x < 0. Find $\bar{D}_2$, for x < 0, if $\bar{E}_1 = 80\hat{a}_x - 60\hat{a}_y - 30\hat{a}_z$ V/m for x > 0. (8%)