

國立臺灣海洋大學 101 學年度研究所碩士班暨碩士在職專班入學考試試題

考試科目：電磁學及電磁波

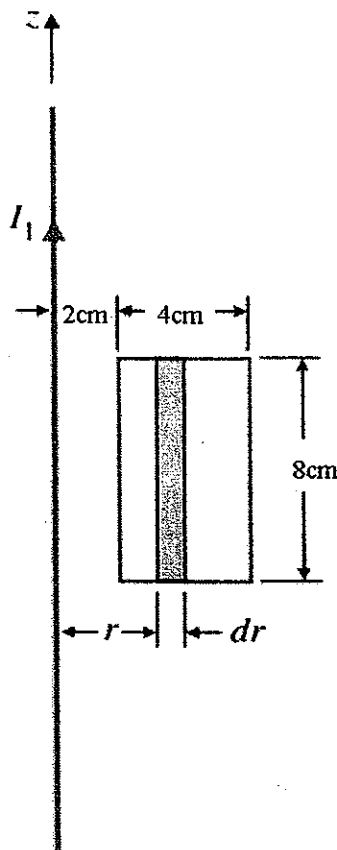
系所名稱：電機工程學系碩士班電波組

*可使用計算器

1. 答案以橫式由左至右書寫。2. 請依題號順序作答。

PART I : (共 50 分)

1. The radius of the core and the inner radius of the outer conductor of a very long coaxial transmission line are r_i and r_o , respectively. The space between the conductors is filled with two coaxial layers of dielectrics. The absolute permittivity of the dielectrics are ϵ_1 for $r_i < r < b$ and ϵ_2 for $b < r < r_o$. Determine its capacitance per unit length. (12%)
2. The space between two parallel conducting plates each having an area S is filled with an inhomogeneous ohmic medium whose conductivity varies linearly from σ_1 at one plate ($x=0$) to σ_2 at the other plate ($x=d$). A d-c voltage V_0 is applied across the plates. Determine
 - (a) the total resistance between the plates, and (15%)
 - (b) the surface charge densities on the plates. (8%)
3. Determine the mutual inductance between a conducting rectangular loop and a very long straight wire as shown in Figure. (15%)



PART II : (共 50 分)

1. A 200-MHz, right-hand circularly polarized plane wave with an electric field modulus of 10 V/m is normally incident in air upon a dielectric medium with $\epsilon_r = 4$, and occupying the region defined by $z \geq 0$.
 - (1) Write an expression for the electric field phasor of the incident wave, given that the field is a positive maximum at $z = 0$ and $t = 0$. (8%)
 - (2) Calculate the reflection and transmission coefficients. (6%)
 - (3) Write expressions for the electric field phasors of the reflected wave, the transmitted wave, and the total field in the region $z \leq 0$. (9%)
 - (4) Determine the percentage of the incident average power reflected by the boundary and transmitted into the second medium. (6%)

2. (1) The open-circuited and short-circuited impedances measured at the input terminals of a lossless transmission line are $-j54.6 (\Omega)$ and $j103 (\Omega)$, respectively. Find Z_0 of the line. (4%)
 - (2) The lossless transmission line in (1) is terminated at an unknown load Z_L , and we observe that the distance of the first voltage minimum from the load is 3 cm; the distance of the first voltage maximum from the load is 9 cm; and the standing wave ratio $S = 3$. Find Z_L . (10%)

- (3) A generator with $V_g = 100 (V)$ and $Z_g = 75 (\Omega)$ is connected to the load Z_L through the transmission line in (2) of length $l = 0.5 \lambda$. Find the time-average power delivered to the load. (7%)