

國立臺北科技大學

九十四學年度電腦與通訊研究所入學考試

電磁學試題

填准考證號碼

第一頁 共二頁

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注意事項：

1. 本試題共 5 題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在答案卷之答案欄內，否則不予計分。

1. (a) Write down the Maxwell's equations in differential forms. (4%)
(b) What are the vector magnetic potential and the Biot-Savart law? (6%)
(c) Can TEM waves exist in a single-conductor hollow waveguide? Why? (6%)
(d) Can either m or n subscript of TM_{mn} mode in rectangular waveguides be zero? Why?(6%)
2. Plane wave incident normally on a plane dielectric boundary as shown in Fig.1 with electric field

$$E_i(z) = a_x E_{i0} e^{-j\beta_1 z}$$

η_1 and η_2 represent the intrinsic impedances of medium 1 and medium 2, respectively. β_1 and β_2 represent the phase constants of medium 1 and medium 2, respectively.

- (a) Write down the reflection coefficient Γ and transmission coefficient τ . (6%)

- (b) Find the total electric field E_I and the total magnetic field H_I in medium 1 with the symbol Γ . (16%)
- (c) Find the transmitted wave E_t and H_t in medium 2 with the symbol τ . (8%)

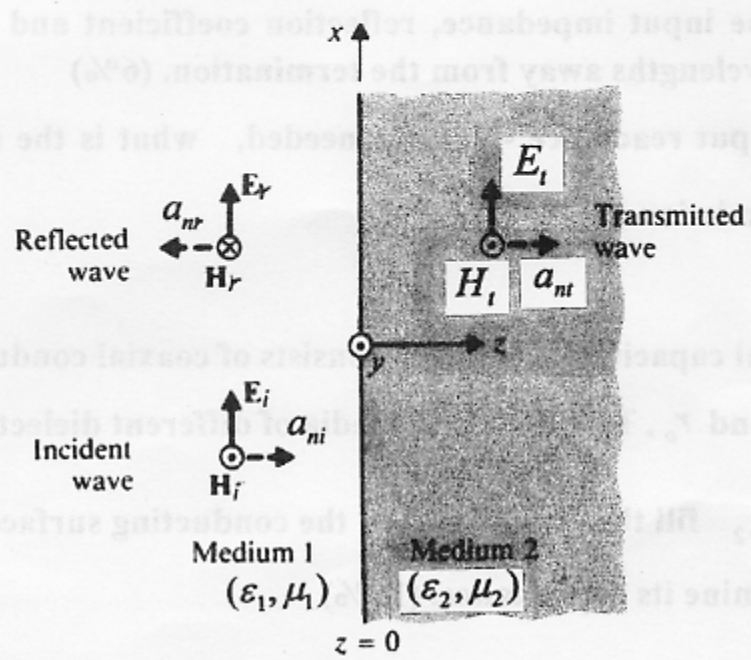


Fig.1

3. Determine the mutual inductance between a very long, straight wire and a conducting equilateral triangular loop as shown in Fig.2. (15%)

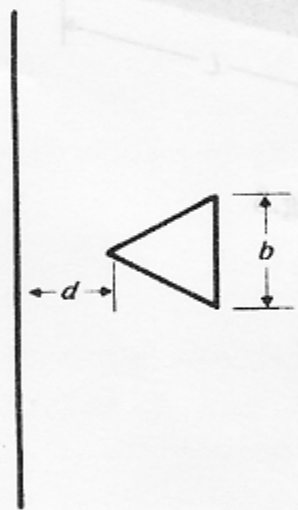


Fig.2

注意：背面尚有試題

4. A 75Ω lossless transmission line is terminated in a short-circuit.
- Find the input impedance, reflection coefficient and VSWR that is one and half wavelengths away from the termination. (6%)
 - Find the input impedance, reflection coefficient and VSWR that is 4.25 wavelengths away from the termination. (6%)
 - If an input reactance $-j75\Omega$ is needed, what is the shortest length of transmission line? (6%)
5. A cylindrical capacitor of length L consists of coaxial conducting surfaces of radii r_i and r_o . Two dielectric media of different dielectric constants ϵ_{r1} and ϵ_{r2} fill the space between the conducting surfaces as shown in Fig.3. Determine its capacitance. (15%)

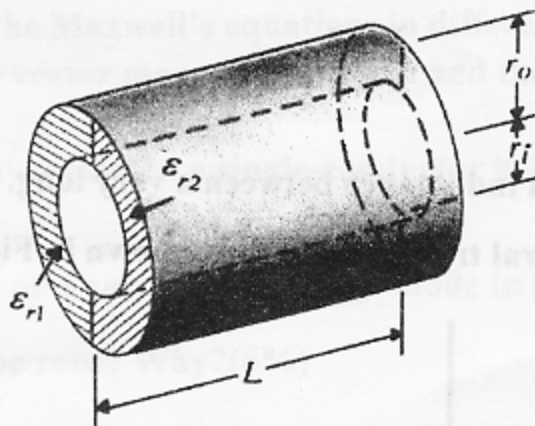


Fig.3