國立中山大學106學年度碩士暨碩士專班招生考試試題

科目名稱：電磁學【電機系碩士班戊組、電波領域聯合】　　題號：482004

※本科目依簡章規定「可以」使用計算機（廠牌、功能不拘）（問答申論題）　　

1. (20%) The radius of the solid inner conductor and the inner radius of the very thin outer conductor of an air coaxial transmission line are r_i and r_o, respectively. A uniform current I flows in the inner conductor and returns via the thin outer conductor in the other direction. The permeability of free space μ_0 is $4\pi\times10^{-7}$ H/m. Determine the stored magnetic energy per unit length of the line.

2. (20%) Determine the capacitance of a spherical capacitor with an inner conducting sphere of radius a and an outer conductor of radius b. The permittivity of a dielectric medium between these two concentric spherical conductors is ε.

3. (20%)
   (a) (10%) Write down the **integral form** of time-harmonic Maxwell's equations.
   (b) (10%) Starting from these equations, **derive** all the boundary conditions at the interface between two different materials.

4. (20%) A uniform plane wave in air is incident on a lossless dielectric material at a 45° angle, as shown in Fig. P4. The transmitted wave propagates in a 30° direction with respect to the normal. The frequency is 300 MHz.
   (a) (6%) Find ε_2 in terms of ε_0.
   (b) (7%) Find the reflection coefficient and transmission coefficient.
   (c) (7%)Obtain the mathematical expressions for the incident, reflected and transmitted fields.

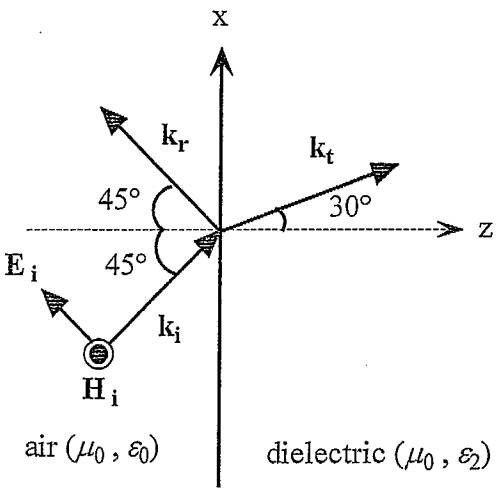

Fig. P4

5. (20%) Briefly answer the following questions.
   (a) (3%) What is the meaning of the polarization of a plane wave?
   (b) (2%) What is a uniform plane wave?
   (c) (3%) What is the skin effect? Discuss your knowledge about skin effect.

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(d)(2%) What is called a TEM wave?

(e)(3%) What is the dispersion effect for electromagnetic wave propagation?

(f) (2%) As far as you know, what are the factors that can cause the dispersion effect?

(g)(3%) What is a Smith chart and why is it still useful even though we can just use computers to do the transmission line calculations?

(h)(2%) What is a distortionless transmission line?