

國立臺灣科技大學
八十七學年度碩士班招生考試試題

所 別： 電子工程技術研究所
學程別：

組別：系統組

科目：電磁學

1. The electric field of a uniform plane wave propagating in free space is given by $\vec{E} = \hat{x}10\sin(3\pi \times 10^8 t - \pi z) + \hat{y}10\cos(3\pi \times 10^8 t - \pi z)$ (V/m). Find (15%)
 - (1). the phase velocity and the direction of propagation (5%)
 - (2). the corresponding magnetic field \vec{H} .
2. Maxwell's equations in time harmonic wave are given by

$$\nabla \times \vec{E} = -j\omega\mu\vec{H}$$

$$\nabla \times \vec{H} = (\sigma + j\omega\epsilon)\vec{E}$$
 where σ, μ and ϵ are the medium conductivity, permeability and permittivity respectively. Assume these parameters being real. Find the attenuation constant α , phase constant β and wavelength λ . (15%)
3. A lossless transmission line of characteristic impedance 50Ω is terminated by a load impedance $Z_L = 15 - j20\Omega$. Find (20%)
 - (1). reflection coefficient at the load (5%)
 - (2). SWR on the line (5%)
 - (3). line impedance at $d=0.05\lambda$ from the load.
4. A rectangular waveguide extending in the z -direction and having the dimensions $a=4$ cm and $b=2$ cm has a dielectric discontinuity at $z=0$ as shown in Fig. prob4. For TE_{10} wave of frequency $f=5000$ MHz incident from section I, find the reflection coefficient at $z=0$. (20%)

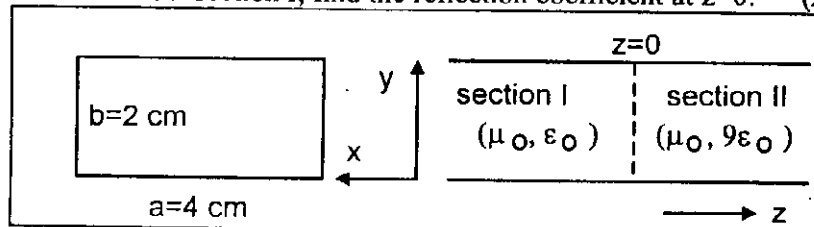


Fig. prob4

5. Determine the force per unit length between two infinitely long parallel conducting wires carrying currents I_1 and I_2 in the opposite directions as shown in Fig. prob5. The wires are separated by a distance d . (15%)

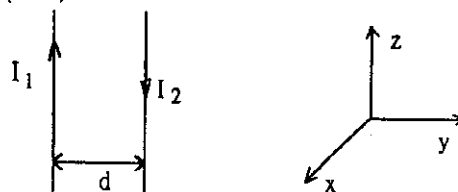


Fig. prob5

6. Consider a plane boundary between air region and iron having the material characteristics of $\epsilon=\epsilon_0$ and $\mu=500\mu_0$. Assuming in free space $\vec{B}_1 = \hat{x}0.5 - \hat{y}10$ (mT), find \vec{B}_2 in the iron and the angle that \vec{B}_2 makes with the interface. (15%)