70-1

淡江大學96學年度碩士班招生考試試題

系別：電機工程學系　　科目：電　磁　學(含電磁波)

准帶項目請打「V」	
V	簡單型計算機

本試題共 1 頁

(I) [20] Use differential form to prove the identity $\nabla \times (\nabla V) = \mathbf{0}$ for any scalar field V.

(II) [25] For the one dimensional wave equation $\frac{\partial^2 U}{\partial z^2} = \frac{1}{u^2}\frac{\partial^2 U}{\partial t^2}$ to have the solution $U(z,t) = U_0 \cos(kz - \omega t)$, give the relation required between k, ω, and u, assuming k, ω, and u are all real and positive.

(III) [25] Referring to Figure 1, let $\mathbf{E} = E\mathbf{a}_z$ denote the amplitude of the electric vector of a plane harmonic wave incident upon a plane boundary ($x-z$ plane) separating two media with indices of reflection $n_2 > n_1$. Then, $\mathbf{E}' = E'\mathbf{a}_z$ and $\mathbf{E}'' = E''\mathbf{a}_z$ denote the amplitudes of the reflected and transmitted waves respectively. The incident, reflected, and transmitted magnetic fields $\mathbf{H}$, $\mathbf{H}'$, and $\mathbf{H}''$ are parallel to the $x-y$ plane as shown. The absolute values of these magnetic fields are $H = |\mathbf{H}|$, $H' = |\mathbf{H}'|$, and $H'' = |\mathbf{H}''|$. Apply boundary conditions to determine the relationship between E, E', E'' and relationship between H, H', H'' in terms of the incident angle θ and the refracted angle ϕ.

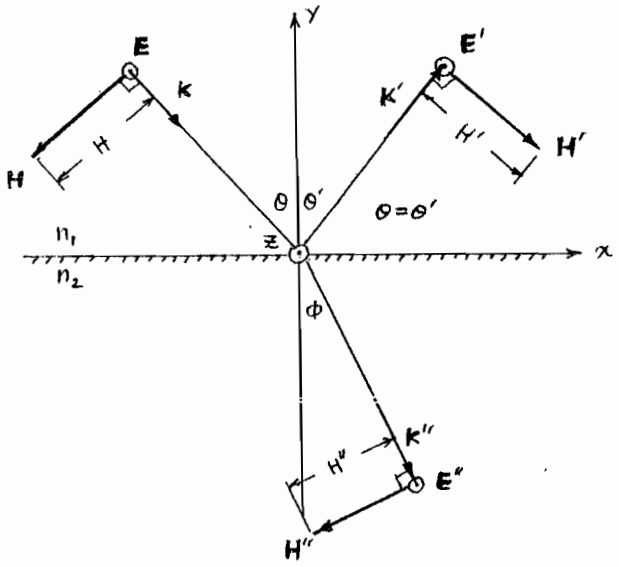

FIGURE 1

(IV) [30] Consider an endfire array of 5 isotropic elements spaced half-wavelength apart with excitation amplitude ratios 1:1:2:1:1. (a) Determine the normalized array factor. (b) Find the phase difference between elements.
[Hint: $\psi = (2\pi d/\lambda)\cos\phi + \xi$, where d is the antenna spacing, ϕ is the angle measured from the array line, and ξ is the phase difference]