

國立中央大學九十一學年度碩士班研究生入學試題卷

所別： 通訊工程研究所 丙組 科目： 電磁學 共 1 頁 第 1 頁

1. Considering a Hertzian dipole of length dl carries a time-harmonic current $I \cos(\omega t)$ in \hat{a} direction.
 - (a). (5%) Find the phasor representation of its retarded vector potential when the dipole is placed at the origin of the coordinate system.
 - (b). (10%) Assume there is a ground plane on x-y plane. The dipole is placed at position $(0,0,d)$ above the ground plane and is oriented in the direction $\hat{a} = \frac{1}{\sqrt{2}}\hat{x} + \frac{1}{\sqrt{2}}\hat{z}$. Find the electric field in the far zone.
 - (c). (5%) The dipole is placed at the center of the cross section of a rectangular waveguide with inner dimensions $a=2.286\text{cm}$ and $b=1.016\text{cm}$. The dipole is operating at 10 GHz with \hat{a} parallel to the broad side and cross section of the waveguide. What is the propagating mode in the waveguide?
2. Given a lossless 50Ω transmission line terminated in a $Z_L \Omega$ load. Describe
 - (a). (10%) How to use the Smith Chart to locate the positions of the maxima and minima of the voltage.
 - (b). (10%) How to read the standing wave ratio from the Smith Chart? And why?
3. (10%) Prove that a linearly polarized plane wave can be resolved into a right-hand circularly polarized wave and a left-hand circularly polarized wave of equal amplitude.
4. (20%) There are two conducting wires, each of radius a and separated by distance D in a dielectric medium (ϵ, μ, σ) . Also the conductivity of the wire is denoted as σ_c . Derive the R, L, G, and C of this two-wire transmission line. Detailed derivation is necessary.
5. (15%) Derive the boundary conditions.
6. (15%) For a scalar function f and a vector function \mathbf{G} , prove
 - (a). $\nabla \times (f\mathbf{G}) = f(\nabla \times \mathbf{G}) + (\nabla f) \times \mathbf{G}$
 - (b). $\nabla \cdot (f\mathbf{G}) = f\nabla \cdot \mathbf{G} + \mathbf{G} \cdot \nabla f$

