

國立中央大學九十學年度碩士班研究生入學試題卷

所別: 電機工程學系 丁組 科目: 電磁學 共 / 頁 第 / 頁

1. (20%) A high-frequency (f) electromagnetic wave is attenuated very rapidly as it propagates in a good conductor (The constitutive parameters of a conductor are ϵ, μ, σ). The distance through which the amplitude of a traveling plane wave decreases by a factor of e^{-1} or 0.368 is called the *skin depth* or the *depth of penetration* of a conductor. Determine the *skin depth*.
2. (20%) By using stored magnetic energy, determine the inductance per unit length of an air coaxial transmission line that has a solid inner conductor of radius a and a very thin outer conductor of inner radius b .
3. (10%) An electric dipole consisting of equal and opposite point charges $+q$ and $-q$ separated by a small distance d . Determine the potential V at an arbitrary point P at a distance $R \gg d$ from the dipole.
4. (15%) A coaxial cable, having a characteristic impedance Z_0 , is terminated in a load impedance, $Z_L = R_L + jX_L$. What must be the relationship between R_L and X_L in order that the standing-wave ratio on the line be 2?
5. For a rectangular waveguide with perfect conductor walls,
 - (A). (15%) Explain why cannot TEM waves exist in this waveguide.
 - (B). (10%) Plot the surface currents on guide walls for TE_{10} mode.
 - (C). (10%) If you are asked to cut slots on the waveguide wall with least effect on the current distribution, how will you do it? State the slot positions and your reasons.