國立彰化師範大學 98 學年度碩士班招生考試試題

系所：電信工程學研究所　　科目：(甲)電磁學

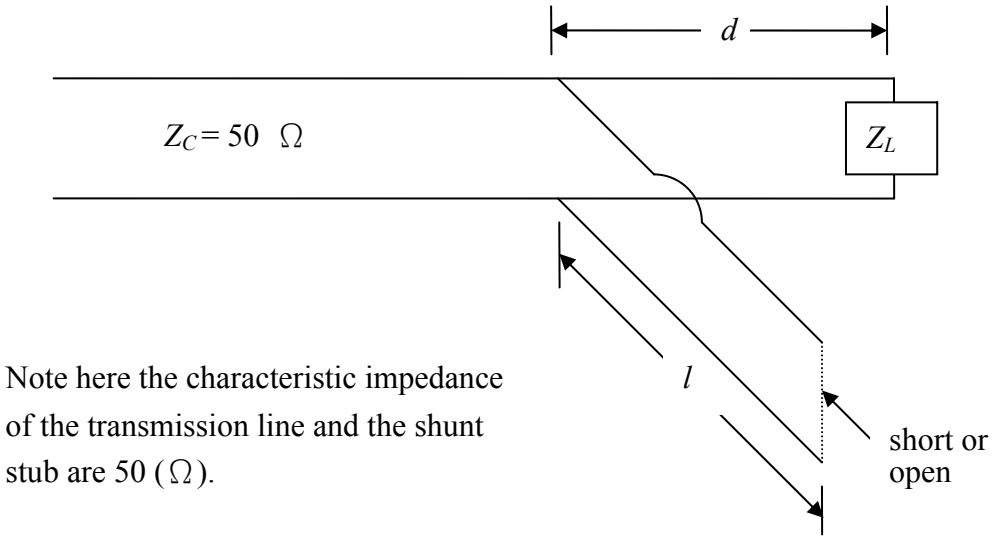
☆☆請在答案紙上作答☆☆

Problem weighting: 1 (20%), 2. (20%), 3 (25%), 4 (20%), 5 (15%)

1. It is known that the electric field intensity of a spherical wave in free space is (in spherical coordinate system) $\overline{E}(R,\theta;t) = \hat{a}_\theta \frac{10^{-3}}{R}\sin\theta\cos(2\pi 10^9 t - kR)$ (V/m), determine the magnetic field intensity $\overline{H}(R,\theta;t)$ and the value of k. (Please show all your work)

2. A uniform plane wave in air with $\overline{E}_i(x,t) = \hat{a}_y 50\sin(10^9 t - \beta x)$ (V/m) is incident normally on a lossless medium (with ε_r = 2.25 , μ_r = 1.0, and σ = 0) in the region $x \geq 0$. Find
   (a) $\overline{E}_r$ and $\overline{H}_r$ (reflected fields)
   (b) Γ (reflection coefficient), T (transmission coefficient), and S (standing wave ratio)
   (c) $\overline{E}_t$ and $\overline{H}_t$ (transmitted fields)

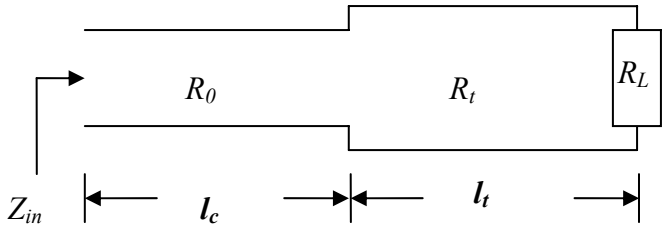
3 A 50 (Ω) transmission line is connected to a load impedance $Z_L = 40 - j25$ (Ω). Using the smith chart to find the position and length of a short-circuited (or open-circuited) stub required to match the line in term of wavelength. (turn in your smith chart as part of your answer)



Note here the characteristic impedance of the transmission line and the shunt stub are 50 (Ω).

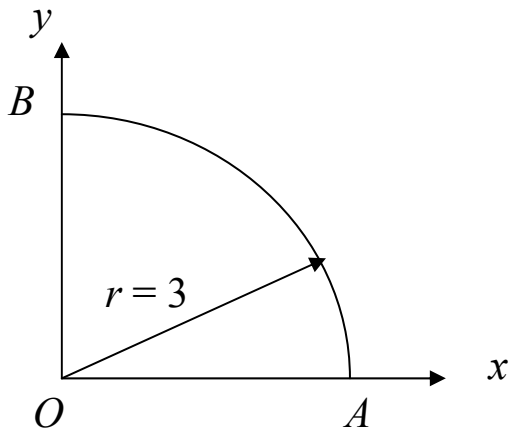
4. Find the expression of the input impedance, Z_{in}, for a cascaded transmission line shown in figure. If R_L is a pure real value and the λ is the guided wavelength of the wave propagated in all the

transmission lines, (a) find the values of R_t and l_t for the matching condition (no reflection), (b) find the expression of Z_{in} and if $R_L = \infty$ and $l_t = l_c$ find the value of l_t such that $Z_{in} = \infty$.



5. Find the integral in cylindrical coordinate along the close loop OABO

$$\oint (\hat{a}_x xy - \hat{a}_y 2x) \cdot d\bar{l}$$



The Complete Smith Chart

Black Magic Design