

國立中央大學97學年度碩士班考試入學試題卷

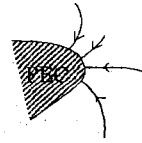
所別：電機工程學系碩士班 電波組 科目：電磁學 共 2 頁 第 1 頁

*請在試卷答案卷(卡)內作答

1. The magnetic field of a uniform plane wave propagating in a nonmagnetic material ($\mu = \mu_0$) medium is given by

$$\mathbf{H} = H_0 e^{-z} \cos(2\pi \times 10^6 t - \sqrt{3}z) \mathbf{a}_x \text{ A/m}$$

- (a) Is this wave in a perfect dielectric? Explain. (5%) (b) Find the frequency and propagation constant of the wave. (5%) (c) Write down the expression of the electric field of the wave. (5%) (d) Find the time-average power flow per unit area normal to the z -direction and (5%) (e) Find the time-average power dissipated in the volume bounded by the planes $x = 0, x = 1, y = 0, y = 1, z = 0$, and $z = 1$. (5%)
2. Below are plots of the electric and magnetic field lines of a perfect electric conductor (PEC). Are these plots correct? Explain. (If no, plot the correct field lines.) (25%)



Electric-field line plot

Magnetic-field line plot

參考用

3. An air-filled $a \times b$ rectangular waveguide, where $a = 2b$. (a) Determine the lower 8 waveguide modes and their cutoff frequencies. (8%) (b) What is meant by a cutoff frequency of a waveguide? (2%) (c) Assuming the dielectric strength of air is E_0 (V/m) and the operation frequency is f_0 , find the maximum time-average power that can be transmitted through the rectangular waveguide at the dominant mode without breakdown. (10%) (d) Find the wave impedance of the dominant mode (5%).
4. A signal generator is to feed equal power through a lossless air transmission line with a characteristic impedance 25Ω to two separate loads, $R_L = 50 \Omega$, and $Z_L = 15 + j47.5 \Omega$. As shown in Fig. 1, a quarter-wave transformer is used to match the resistive load R_L to the $25\text{-}\Omega$ line, and a double-stub tuner spacer a quarter wavelength apart is used to match the load Z_L to the line. (a) Determine the required characteristic impedance (R_{01}) of the quarter-wave transformer line. (5%) (b) Find the required lengths of the short-circuited stubs (l_1 , and l_2). (12%) (c) Find the standing-wave ratios on the matching line sections. (6%) (d) Is it possible to match a short circuit to a $25\text{-}\Omega$ system using lossless network? Why? (2%) (You can use the Smith Chart as shown in page 2, and draw all your results with Smith chart as the Fig. in your answer sheets, if necessary.)

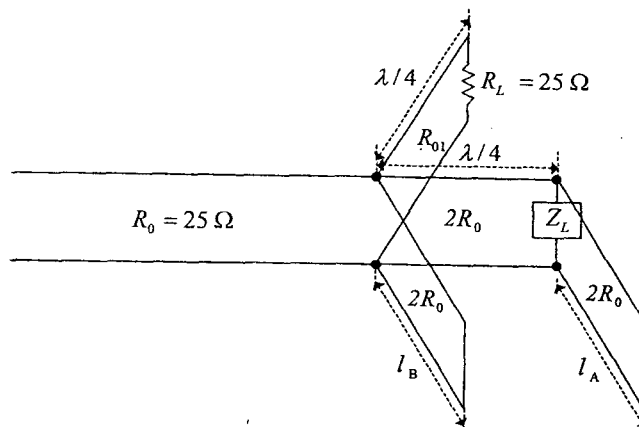


Fig. 1

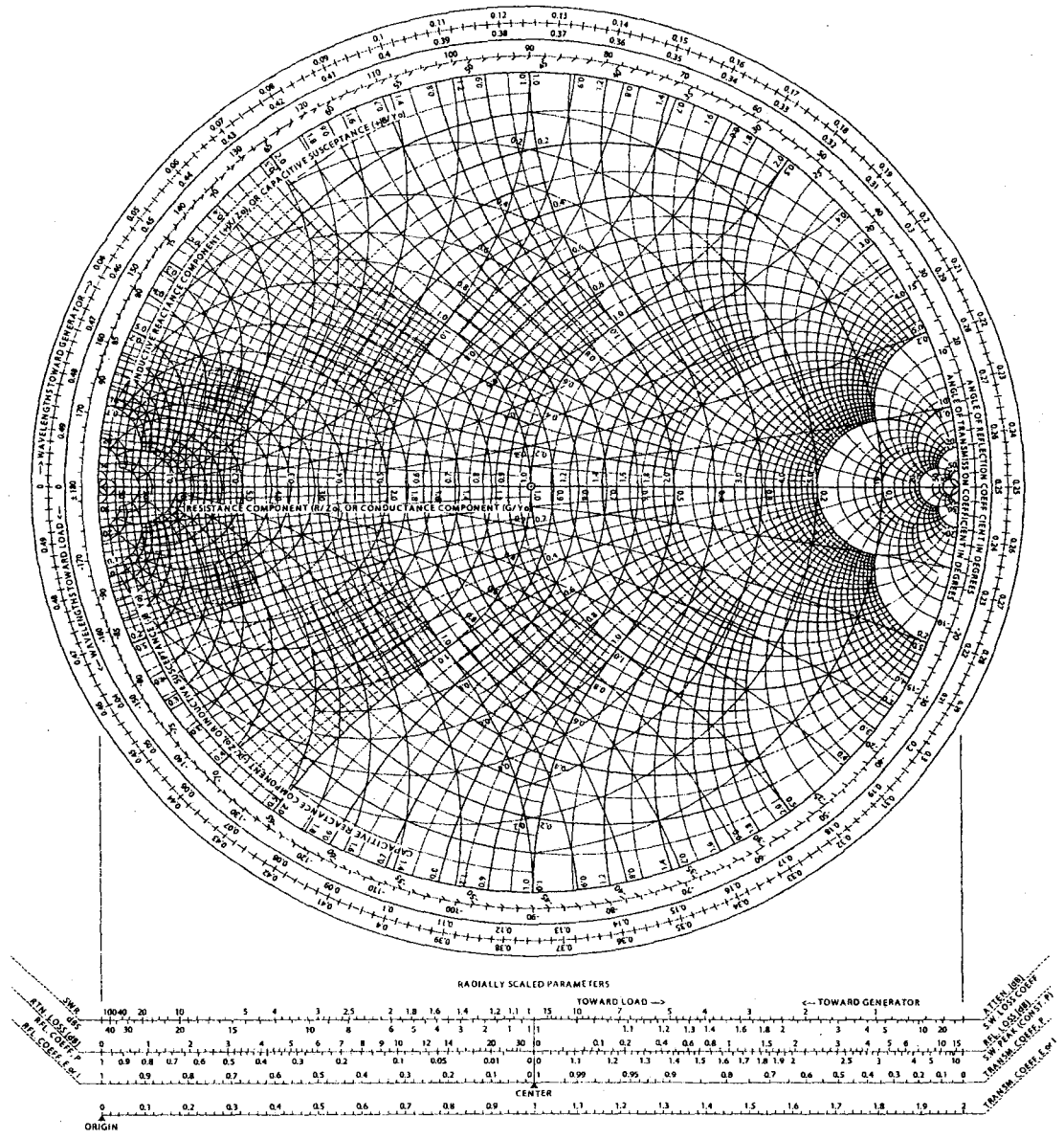
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