1. A pulse transmitter as shown in Fig. 1(a) is implemented using an open-circuited transmission line, two switches, matching network and an antenna. The switches are differentially controlled by a carrier source, and the frequency of the source is 10 MHz. The duty cycle and amplitude of the output pulse are 1% and 100 V, respectively. The input impedance of the antenna is 300 Ω.
   (a) (10%) Determine the length l of the transmission line and the dc supply voltage V_{DC}. Assume the transmission line is lossless and air-dielectric with characteristic impedance (R_0) of 50 Ω.
   (b) (5%) If the matching network is designed using the quarter-wave transformer, determine the required characteristic impedance of the quarter-wave line and the standing-wave ratio on the matching line.
   (c) (10%) If the matching network is designed using the single-stub network as shown in Fig. 1(b). Use the Smith chart to find the position d_1 and length l_1 of the short-circuit stub required to match the transmitter.
   (d) (5%) Is it possible to use the doubly short-stub tuner spaced an eighth of a wavelength apart for the matching network? Why?

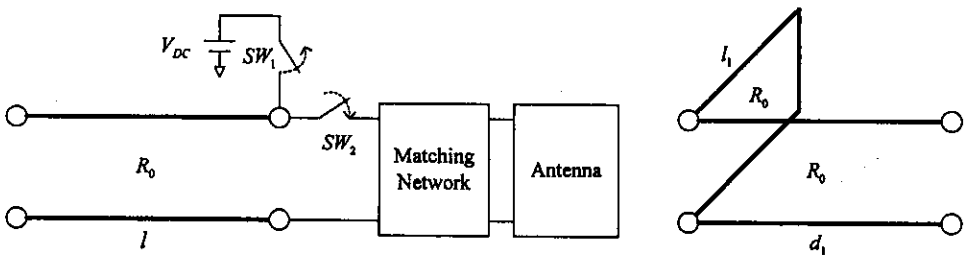
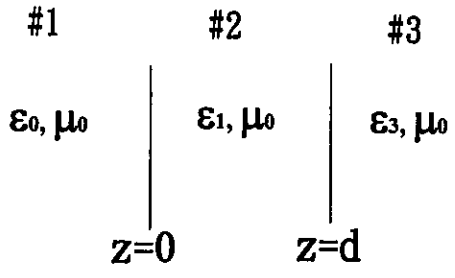


Fig. 1. (a) Pulse transmitter and (b) single-stub network

2. An air-filled $a \times b$ rectangular waveguide with brass walls is utilized for a microwave cavity resonator, and the length of the waveguide is d. Assume the $d > a > b$ and the brass conductivity is σ.
   (a) (5%) Determine the dominant mode and the resonant frequency of the resonator.
   (b) (12%) Find the quality factor of the resonator.
   (c) (2%) What is the dominant mode of the rectangular waveguide? What is the dominant mode of a parallel-plate waveguide?
   (d) (1%) Why the TEM waves cannot exist in the rectangular waveguide?

3. Assume there is a coaxial cable, with a thin hollow inner conductor. The radii of inner and outer conductors (perfect electric conductor) are y1 and y2, respectively. The constants of interest for the insulating material are ε, μ, and σ.
   (A). (6%) Determine the inductance per unit length of the line.
   (B). (6%) Determine the capacitance per unit length of the line.
   (C). (6%) Determine the leakage resistance per unit length of the line.
   (D). (6%) Assume there is such a cable of very short length △z. Draw its R-L-C equivalent circuit.
   (E). (6%) If y1 is 1 mm, and insulating material is air, with dielectric strength $3\times10^{6}\ V/m$. Determine the value of y2 so that the cable is to work safely at a voltage rating of 2.5 kV. In order to avoid breakdown due to voltage surges caused by lightning and other abnormal external conditions, the maximum electric field intensity in the insulating material is not to exceed 25% of its dielectric strength.

4. Consider a multi-layered structure as shown in the figure below. A plane wave is incident normally to layer #2 and #3 from layer #1.
   (a) (10%) Find the expression for the reflection coefficient at z = 0.
   (b) (10%) If layer #3 is replaced by perfect electric conductor (PEC), determine d such that the phase of the reflection coefficient at z = 0 is 0 degree.



參考用

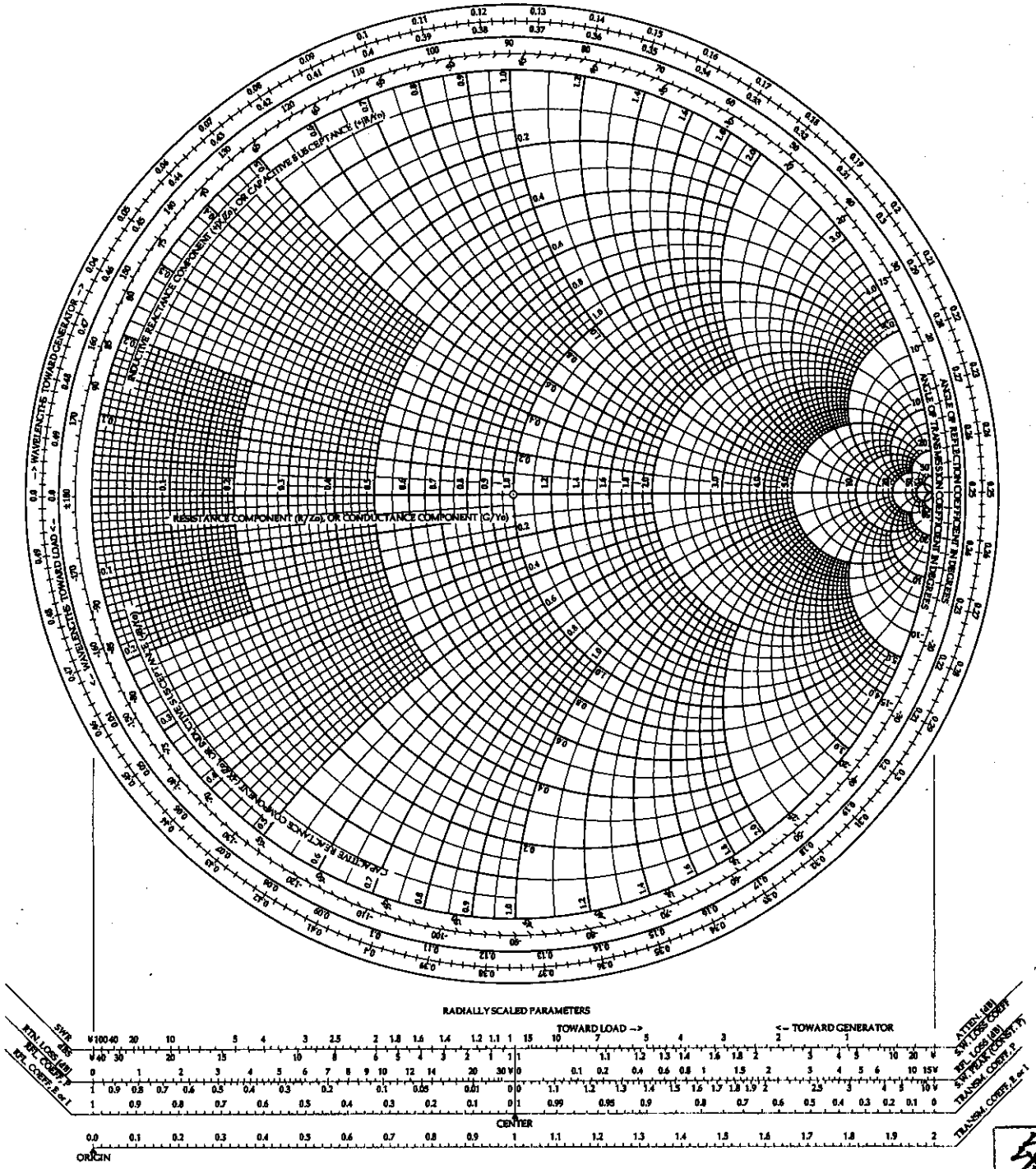
注意:背面有試題

國立中央大學99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(一般生)　科目：電磁學　共 7 頁 第 7 頁

本科考試禁用計算器　　＊請在試卷答案卷（卡）內作答

The Smith Chart



參考用