

國立中央大學 106 學年度碩士班考試入學試題

所別： 電機工程學系 碩士班 電波組(一般生)

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科目： 電磁學

本科考試禁用計算器 如有計算題請列出計算過程

*請在答案卷 內作答

參考用

Problem 1 (20%)

There is a sphere of charge of radius b . Its volume charge density $\rho_v(R) = \rho_0(1-R/b)$, where R is the distance from the observation point to the center of the sphere. Find

- a) (10%) the electric potential when $R < b$.
- b) (10%) the energy required to assemble the sphere of charge.

Problem 2 (20%)

A long, round wire of radius b and conductivity σ is coated with a material of conductivity 0.2σ .

- a) (10%) What must be the thickness of the coating so that the resistance per unit length of the uncoated wire is reduced by 30%?
- b) (10%) Find the equivalent circuit of the coated wire in terms of the resistances of the uncoated wire and the coating.

Problem 3 (10%)

Show that Gauss's law is consistent with Ampère-Maxwell equation and the equation of continuity.

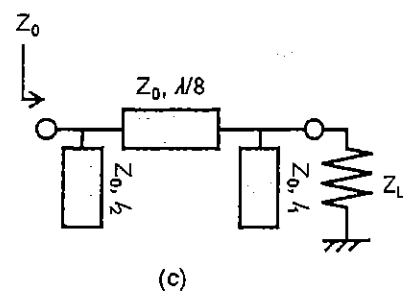
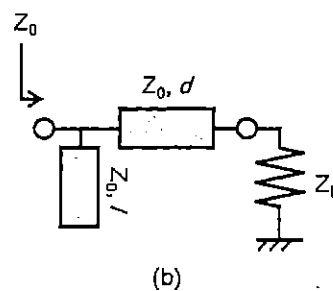
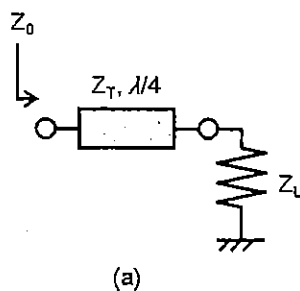
Problem 4 (20%)

- a) (10%) For a plane wave propagating in an unbounded medium, describe how one determines whether the wave is linearly polarized, circularly polarized, or elliptically polarized.
- b) (10%) For a plane wave impinging upon a plane boundary between two media, describe the definitions of parallel polarization and perpendicular polarization.

Problem 5 (30%)

Consider a load impedance $Z_L = 25 \Omega$ to be matched to the system impedance, Z_0 , which is equal to 100Ω . As shown in the figures below, three different types of matching networks can be used to match Z_L to Z_0 . For each matching network, find the unknown parameter(s).

- a) (10%) Quarter-wave transmission line: find the characteristic impedance of the line, Z_T .
- b) (10%) Single-stub matching: using the attached Smith Chart, find the length of the cascaded line, d , and the length of the open stub, l , in terms of wavelength λ . Show only the solution with shortest lengths.
- c) (10%) Double-stub matching: using the attached Smith Chart, find the lengths of the two open stubs, l_1 and l_2 , in terms of wavelength λ . Show only the solution with shortest lengths.



注意:背面有試題

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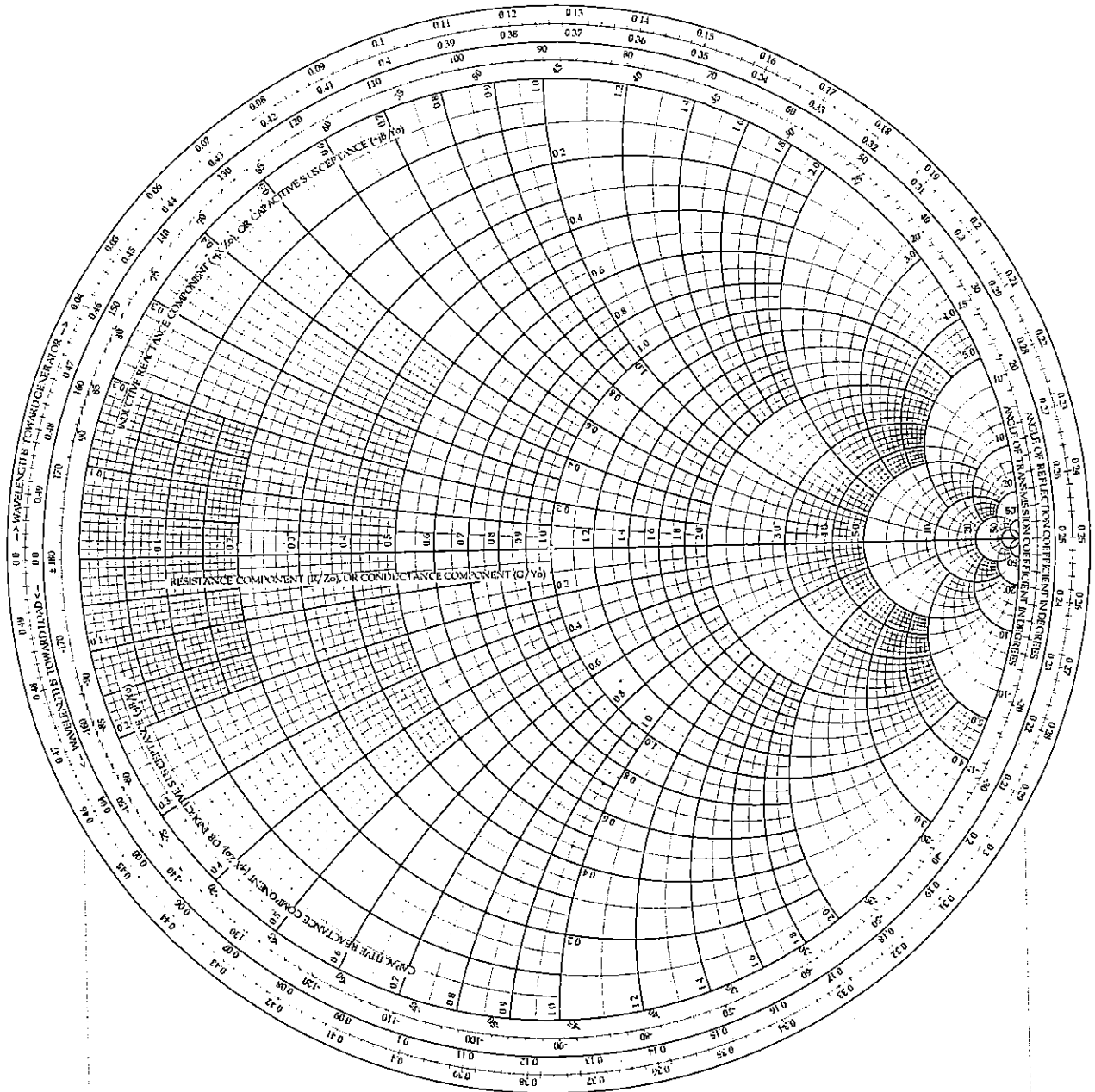
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內作答

The Smith Chart



RADIALLY SCALED PARAMETERS

