ENEE 381 Problem Set #4

10/17/02- due 10/24/02

(1) (RWD 5.10g)A 50 ohm transmission line is terminated with a load of Z_L=20+j30. A *double-stub* tuner consiting of a pair of shorted 50 ohm transmission lines connected in shunt to the main line at points separated by 0.25λ is located with one stub at 0.2λ from the load. Find the lengths of the stubs to match the line for $-z < 0.45\lambda$.

(2) (RWD 5.10b) The standing wave ratio on an ideal 70 ohm line is measured as 3.4, and a voltage miniumum is observed 0.23 wavelengths in front of the load. Find the load impedance using the Smith chart.

(3) (RWD 5.10e)A 70 ohm line is terminated in an impedance of 50+j10 ohm. Find the position and value of a reactance that might be added in series with the line at some point to match the line. Use the Smith chart.

(4) A length of loss-less transmission line is first short-circuited at one end and then open-circuited. The impedance measured at the other end in the first case is Z_1 and Z_2 in the second. Prove that $Z_1 Z_2 = Z_0^2$. This is a convenient way for measuring the characteristic impedance of an unknown line.

(5) A microstrip line has parallel gold conductors 50μ wide spaced by 20μm. The dielectric between the conductors has $\epsilon_r = \epsilon' - j\epsilon''$, with ϵ'=4, ϵ'' =0.01. Calculate

(a) The characteristic impedance of the line.

(b) The attenutation of the line caused by surface resistance.

(c) The attenuation of the line caused by the lossy dielectric.

The line is being operated at 1GHz. The resistivity of gold is 2.3×10^{-8} ohm m.