EE3140 Hour Exam 2, Fall 2014

There are 4 problems and not all problems have the same number of points. All units are mks. Show your work for full credit.

1. A wave propagates between two parallel conducting plates of infinite extent which are \( a = 20 \text{ cm} \) apart and perpendicular to the x-axis. The electric field of the wave is:

\[
\vec{E} = \hat{y}E_0 \cos(20\pi x)e^{-jk_z z}
\]

What mode, including number, is propagating? (for example, \( TM_1 \)) (6 points)

\[\text{mode} = \underline{\text{______}}\]

2. A load is measured to be \( Z_L = 50 - j50\Omega \) using 50\( \Omega \) cable. What is the reflection coefficient, \( \Gamma \)? (6 points)

\[\Gamma = \underline{\text{______}}\]
3. A pulse generator having an internal resistance of 100Ω produces a pulse of amplitude 30V and duration 1µs with no transmission line connected. A 50Ω line, 400m long and short-circuited at the far end, is connected to the generator. In the spaces below, sketch the voltage reflection diagram and the voltage at z=400m, assuming that z = 0 is at the load and the phase velocity is 200m/µs. All relevant voltage amplitudes must be labeled. (10 points).
4. A 25Ω load is connected to a 50Ω line. Assuming single-stub tuning in order to create a match, what is the minimum distance from the load that the stub should be placed, and what is the length of the shorted stub? Give your answers in wavelengths. If you use the attached Smith chart, show your work for full credit. (10 points)

distance from load to stub \( (l_1) = \)_______

length of shorted stub \( (l_2) = \)_______