Electricity & Magnetism - ECE107

You are given a parallel plate transmission line made of perfect electrically conducting plates of width $w = 1cm$ with the distance between the plates of $d = 0.25cm$ (Fig. 1). The space between the plates is filled with vacuum. The transmission line is open-circuited at $z = 0$. It is excited by a source of frequency $f = 1.8\text{GHz}$. The current at $z_1 = -3cm$ is given as $\tilde{I}(z_1) = 2e^{j\pi/4}\,A$.

1) Find the characteristic impedance Z_0, wavenumber β, wavelength λ, and the phase velocity u_p of the transmission line.

2) Give general expressions describing the voltage and current in the transmission line in the form of phasors and in the time domain representation.

3) Give the current $\tilde{I}(0)$ at $z = 0$ and the reflection coefficient Γ at $z = 0$.

4) Find the reflection coefficient Γ at $z = z_1$.

5) Give the current $\tilde{I}(0)$ at $z = 0$, the voltage $\tilde{V}(0)$ at $z = 0$, and the voltage $\tilde{V}(z_1)$ at z_1.