EEE 451/551

HW # 6

(1) Consider the lossless transmission line shown in Fig. 1. The transmission line has the following parameters: $Z_0 = 100\Omega$, $v_p = 2\times10^8$ m/sec, $l = 4$m, and terminated in a short circuit. Draw the voltage and current waveforms along the line $V(z,t)$ & $I(z,t)$ at $t = 10$ns, $t = 20$ns, $t = 30$ns, $t = 40$ns. Determine ϵ_r, if $\mu_r = 1$.

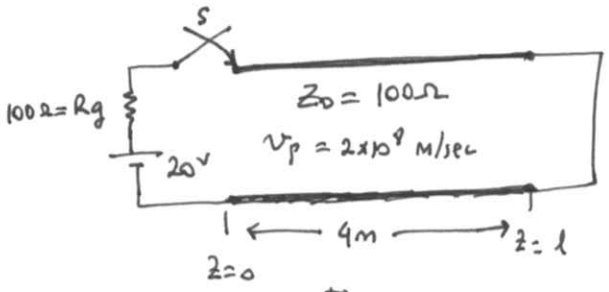

Fig.1

(2) A DC voltage V_0 is applied at $t=0$ to the input terminal of an open-circuited air-filled line of a length l through a series resistance equal to $R_0/2$, where R_0 is the characteristic resistance of the line as shown in Fig. 2.

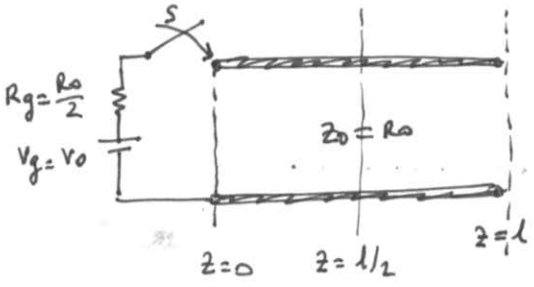

Fig.2

Considering that T is the required time for the wave to reach the end of the line (one-way trip from $z=0$ to $z=l$), sketch the followings:

(a) Voltage and current reflection diagrams (i.e. bounce diagrams, space-time diagrams, etc.) up to 5T.

(b) The voltage and current waveforms versus time at the source plane ($z=0$) up to 5T.

(c) The voltage and current waveforms versus time at the middle of the line ($z=l/2$) up to 5T.

(3) Consider the transmission line circuit shown in Fig. 3, which is terminated in a resistor $R_L = 100\Omega$. The generator resistor is matched with the characteristic impedance of the line ($Z_g = Z_0 = 50\Omega$). The length of the line is 4m, and is filled with a dielectric medium $\epsilon_r = 2.25$. If a pulse as shown in Fig. 4 is excited (with $V_g = 18^V$ and duration 30nsec), determine the followings:

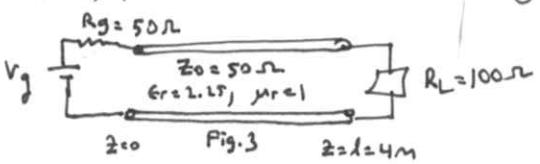

Fig.3

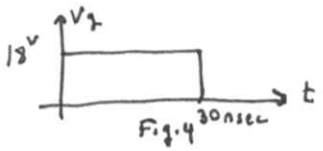

Fig.4

(a) Draw the voltage and current at the loaded end (i.e. $V(l,t)$ and $I(l,t)$).

(b) Draw the voltage and current at the middle of the line (i.e. $V(l/2,t)$ and $I(l/2,t)$).

* Clearly determine & mark all critical time instants.