ECE 3025: Electromagnetics

SOLUTIONS TO TEST 1 (Fall 2003)

(1) **Short Answer Section**

   (a) false – remember that we are studying *lossless* transmission lines.

   (b) nonlinear

   (c) dispersion

   (d) crosstalk

   (e) $\frac{1-N}{N+1}$, since parallel fanout load is $\frac{Z_0}{N}$

   (f) $\frac{N-1}{N+1}$, since series fanout load is NZ_0

   (g) 1, -1, 0 – Note: I didn't take off points for missing the short circuit since I called it a *closed* circuit on the test, which may have been ambiguous.

   (h) 1 second

   (i) $\frac{Z_0}{v_p}$

   (j) true

(2) **Descriptive Answer Section** (21 points)

   (a) There are two problems apparent from the graph: 1) the line is mismatched, which causes reflections and 2) the pulses are distorted by some reactance in the circuit – probably parasitic capacitance.

   (b)
   - Write the the forward-propagating voltage waveform: $60\cos(1000t - 5z)$

   - Write the the backward-propagating current waveform: $2\pi\mathrm{u}\left(2t + \frac{z}{100} + 12\right)$

   - The characteristic impedance for this line is 60 Ω.

   - The velocity of propagation for this line is 200 m/s.

   - What is the total voltage at $t = 0$ at the front of the line ($z = 0$)? $60 - 120\pi$ V

(3) **Reflection Sketches** (15 points)

   Explanation on the grading: If you sketched reflections using the wrong excitation (i.e. a DC voltage instead of a impulse), it was -3 points per graph. If you sketched reflections

using the wrong excitation and you did it incorrectly, it was -5 points per graph.
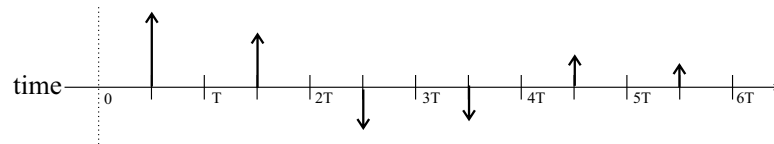
a. The voltage observed at the transmission line load:
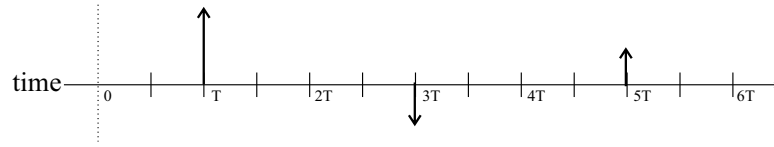
b. The voltage observed at the transmission line source:
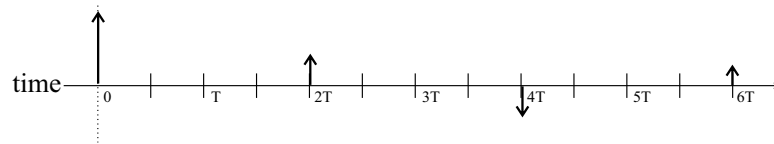
c. The voltage observed exactly halfway down the transmission line:

(4) **Switching Network** (40 points)

	V_A	V_B	V_L	V_X	V_Y
State 0	0	0	0	0	0
State 1	3	0	0	0	0
State 2	12	12	0	0	0
State 3	12	6	0	6	0
State 4	6	6	2	2	2