The Edward S. Rogers Sr. Department
of Electrical & Computer Engineering
UNIVERSITY OF TORONTO

ECE320H1F: Fields and Waves
Laboratory 1: Waves On Transmission Lines

Marking Scheme

Show your calculations for *all* work, including theoretical diagrams and plots. **Measurement** graphs refer to intrumentation screen captures obtained in the laboratory. **Include the full name, student number and PRA session for all group members on the laboratory report.**

3.2 [3] Sketch of the waveform at point C when the line is terminated in Z_0.

[2] Z_0 found using the variable load.

3.3 [5] $Z_0 = \dfrac{v_1(t,0)}{i_1(t,0)}$ calculated using Ohm's law and measured voltages.

3.4 [5] **Measurement** v vs t graphs at C, D, E, and F for $R_\mathrm{L} = 50\,\Omega$.

[3] Recorded time delay Δt at points D, E, and F relative to the input signal.

3.5 [2] Calculated average velocity of propagation v_{avg} and relative permittivity ε_r.

[10] Theoretical bounce diagram (2 marks) and corresponding v vs t graphs at C, D, E, and F (2 marks each). Compare with Section 3.4 measurement results.

3.6 [1] Compare calculated and measured Γ_L.

[4] **Measurement** v vs t graphs at C and F for $R_\mathrm{L} = 100\,\Omega$.

[2] Discuss the relationship between the pulses at C and F.

[10] Theoretical v vs d graphs at $t = T/2$, T, $3T/2$, and $2T$ where T = pulsewidth.

[2] Discuss the pulse propagation along the line with a mismatch at the load.

3.7 [4] **Measurement** v vs t graphs at C and F for $R_\mathrm{source} = (50 + 100)\,\Omega$ and $R_\mathrm{L} = 20\,\Omega$ for pulse widths of T and $10\,T$.

[2] Calculated and measured Γ_S and Γ_L.

[20] Calculate the corresponding theoretical bounce diagram diagram for pulse widths of T and $10\,T$ (5 marks each) *and* plot the theoretical v vs t graphs for each case at C and F (2.5 marks each).

[3] Discuss how the measured results compare to the theoretically calculated ones.

3.8 [3] Find three v_1 *minumum* frequencies for the short circuit load.

[5] Explain why minimum voltages are obtained and discuss the effect on input current.

[3] Find three v_1 *minumum* frequencies for the capacitive load.

[6] Discuss how and why the results for the short circuit and the capacitor are different.

[5] Presentation and neatness.

[ ] Indicates the number of marks out of **100 total marks**