

Family Name:	Given name:
Student number	Signature

Faculty of Applied Science and Engineering

ECE357 Electromagnetic Fields

First Test, February 4, 2005

Examiners – M. Mojahedi

Only Calculators approved by Registrar allowed

Answer the questions in the spaces provided or on the facing page

A complete paper consists of answers to all questions

For numerical answers specify units

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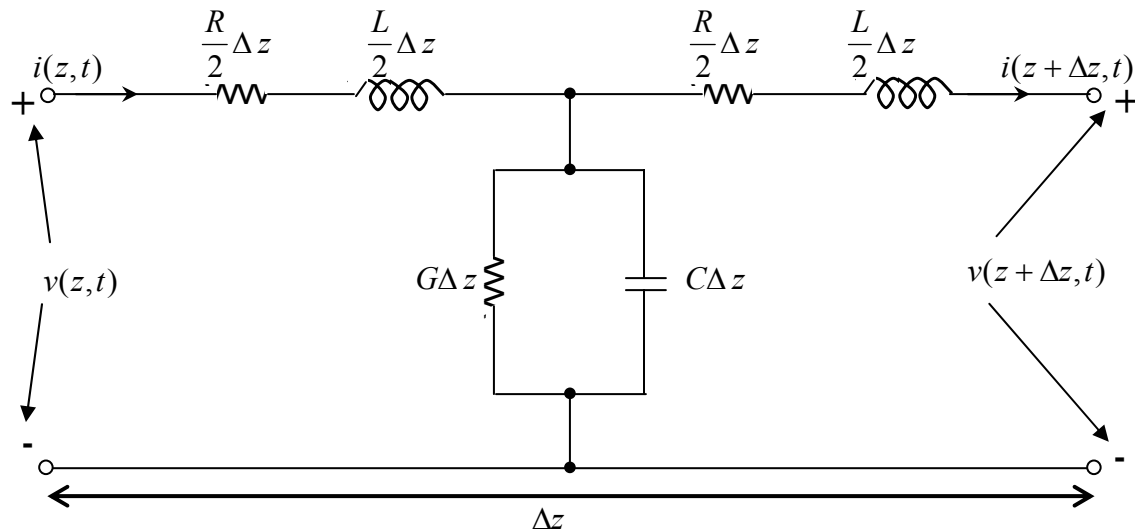
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1	2	3	TOTAL

$$\epsilon_0 = 8.854 \times 10^{-12} [F / m], \quad \mu_0 = 4\pi \times 10^{-7} [H / m], \quad c = 3 \times 10^8 [m / s]$$

Problem 1) A voltage source with series internal impedance of $R_g = 10 \, \Omega$ generates a voltage wave form given by $v_g(t) = 10 \sin(\omega t + 30^\circ)$. The source frequency is 1.05 GHz and it is connected to a load, $Z_L = (100 + j50) \, \Omega$ through a $50 \, \Omega$ lossless line. The line is 67 cm long and the phase velocity on the line is $0.7 c$, where c is the speed of light in vacuum. What is the instantaneous voltage, $v(z, t)$, along the line? **(Total points: 33)**

Problem 2) A transmission line is modeled by an equivalent circuit shown below. For this transmission line find the general transmission line equations (the so-called telegrapher's equations) as functions of time (t) and space (z). Show all your work.
(Total points: 33)



Problem 3) The diagram below shows a load connected to a generator by a transmission line. *In contrast to your notes and text, this coordinate system locates the load at $z = 0$ and the source at $z = -l$.*

a) For this configuration, define the reflection coefficient at the load (Γ_L) in terms of the positive and negative traveling voltages V_0^+ , and V_0^- .

b) Show that for a properly defined reflection coefficient in part (a), the expression for Γ_L in terms of Z_L and Z_0 is the same that we found in class.

(Total Point 34)

