

**ECE 3317**  
**Applied Electromagnetic Waves**

**Exam 1**  
**Oct. 19, 2021**

**Name** \_\_\_\_\_

**General Information:**

The exam is open-book and open-notes. You are not allowed to use any device that has communication functionality (laptop, cell phone, ipad, etc.).

**Remember, you are bound by the UH Academic Honesty Policy during the exam!**

**Instructions:**

- Show all of your work. No credit will be given if the work required to obtain the solutions is not shown.
- Write neatly. You will not be given credit for work that is not easily legible.
- Leave answers in terms of the parameters given in the problem.
- Show units in all of your final answers.
- Circle your final answers.
- Double-check your answers. For simpler problems, partial credit may not be given.
- If you have any questions, ask the instructor. You will not be given credit for work that is based on a wrong assumption.
- Make sure you sign the academic honesty statement below.

## **Academic Honesty Statement**

By taking this exam, you agree to abide by the UH Academic Honesty Policy during this exam. You understand and agree that the punishment for violating this policy will be most severe, including getting an F in the class and getting expelled from the University.

Signature: \_\_\_\_\_

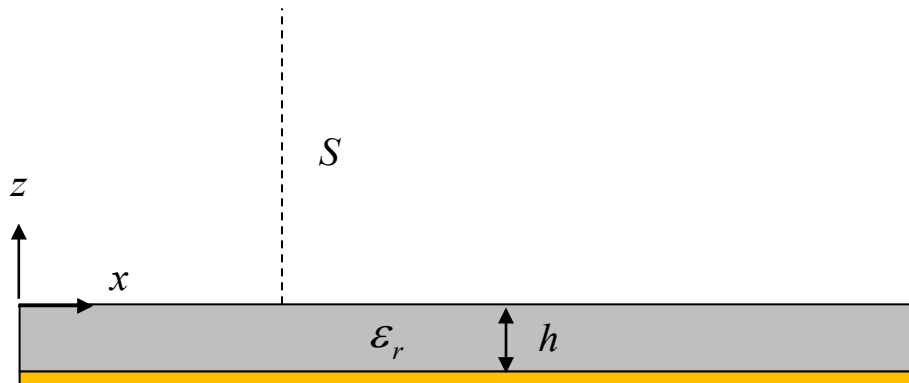
## Problem 1 (30 pts)

An electromagnetic surface wave propagates on a grounded dielectric slab as shown below. (The structure is infinite in the  $y$  direction.) In the air region above the slab ( $z > 0$ ), the electric field in the phasor domain has the following form:

$$\underline{E}(x, z) = \underline{\hat{y}} e^{-jk_x x} e^{-\alpha_z z} \quad [\text{V/m}],$$

where  $k_x$  and  $\alpha_z$  are both positive real numbers. Note that there is no  $y$  variation of the fields of this surface wave.

- Find the magnetic field vector  $\underline{H}$  in the air region, in the phasor domain.
- Find the complex Poynting vector in the air region.
- Find the time average power in watts going (from left to right) through a surface  $S$ , which extends from the top of the slab ( $z = 0$ ) to infinity in the vertical  $z$  direction, and is one meter wide in the  $y$  direction.



ROOM FOR WORK

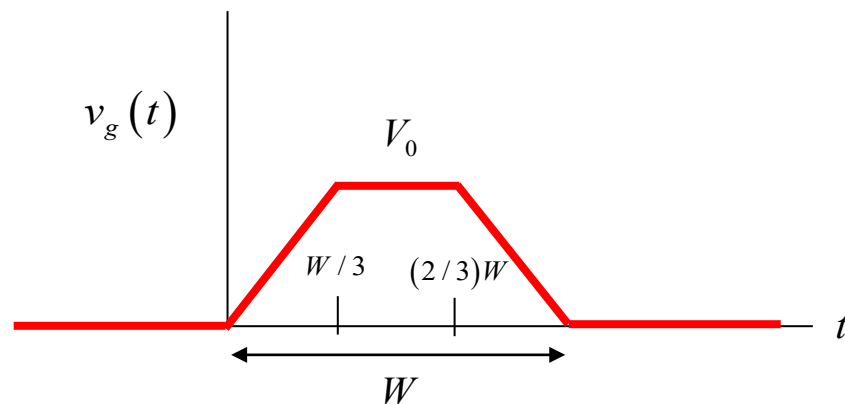
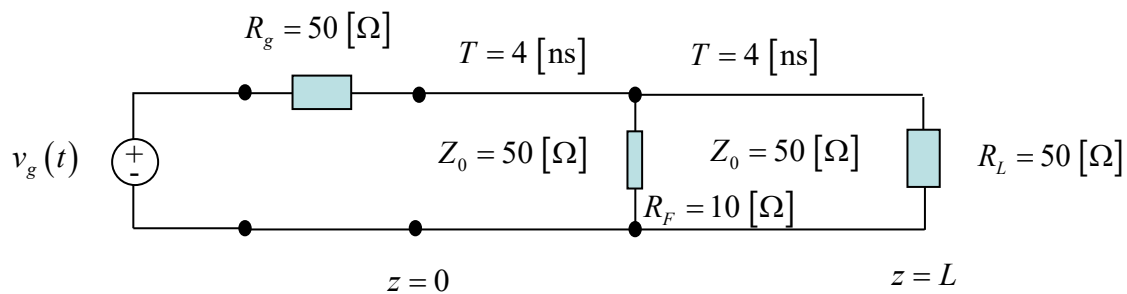
ROOM FOR WORK

## Problem 2 (35 pts)

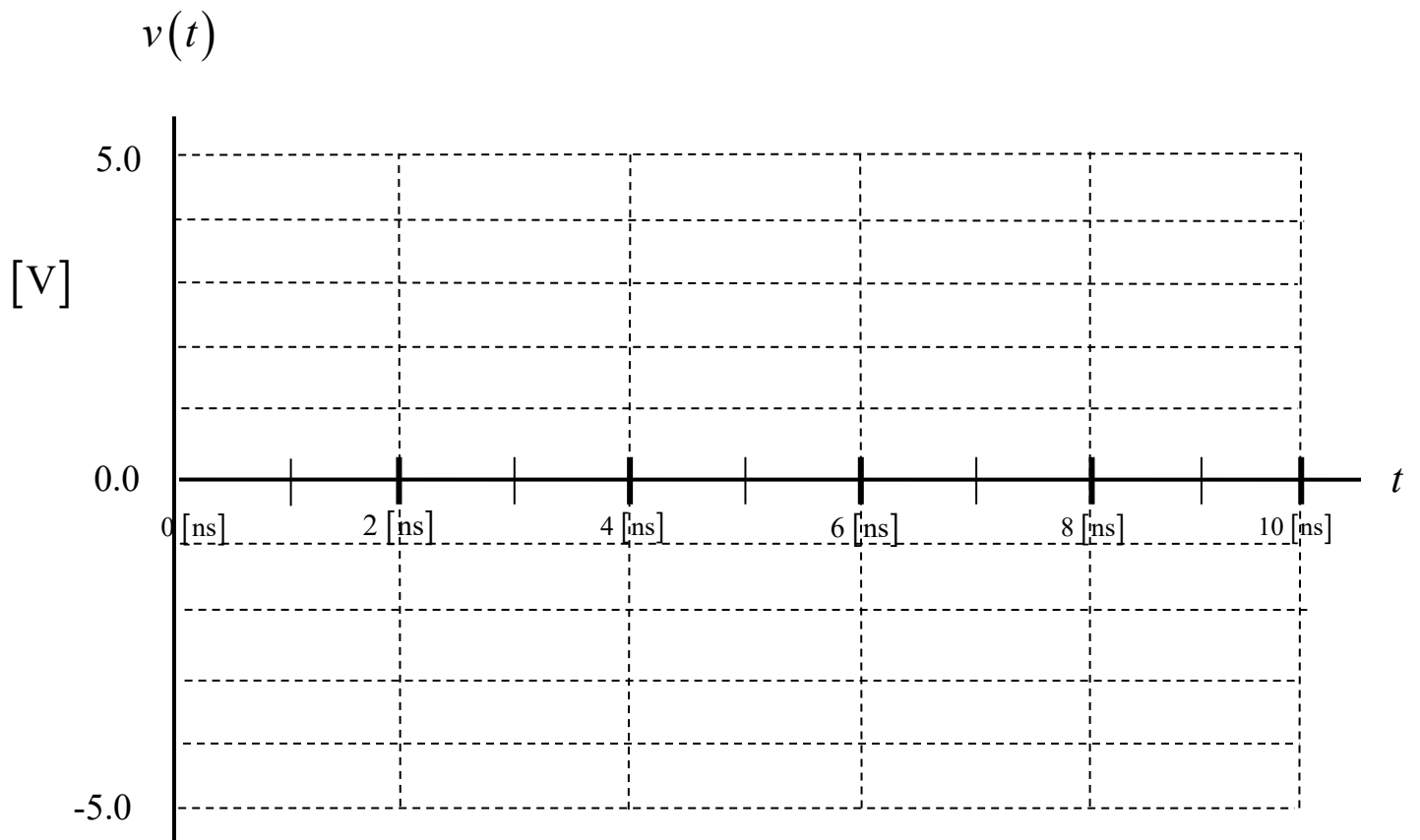
A voltage source is applied at the left end of a transmission line as shown below. The transmission line meets a second transmission line, which is then terminated by a load. At the junction between the two transmission lines a fault occurs, which is modeled by a parallel (shunt) resistor  $R_F$ .

A plot of the generator voltage  $v_g(t)$  is shown below. The pulse peak is  $V_0 = 8 \text{ [V]}$  and the width of the pulse is  $W = 3 \text{ [ns]}$ .

Plot the voltage  $v(t)$  measured by an oscilloscope that is connected to the first (left) line at a point halfway down the first line (halfway between the generator and the fault). Plot to a time of 10 [ns]. Use the graph on the next page to make your plot. Label all voltage values on your plot.



Make your plot here:



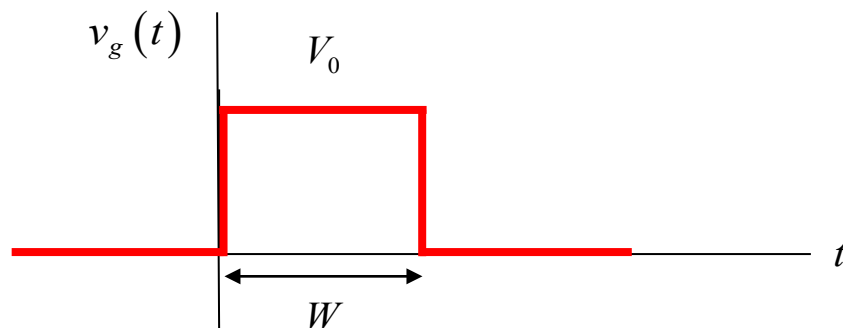
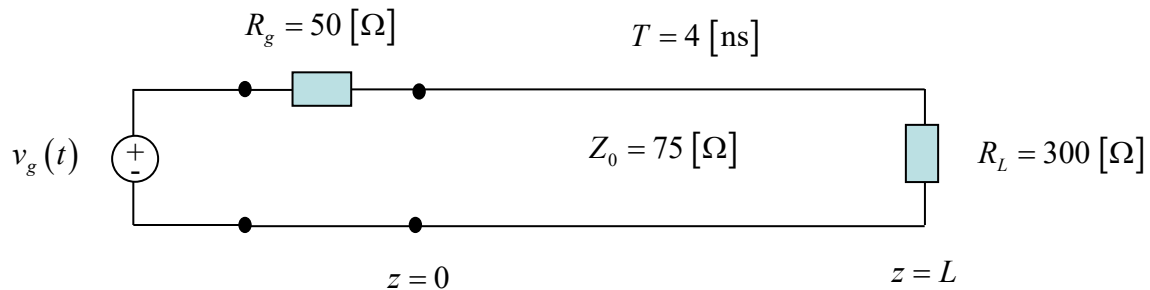
ROOM FOR WORK



### Problem 3 (35 pts)

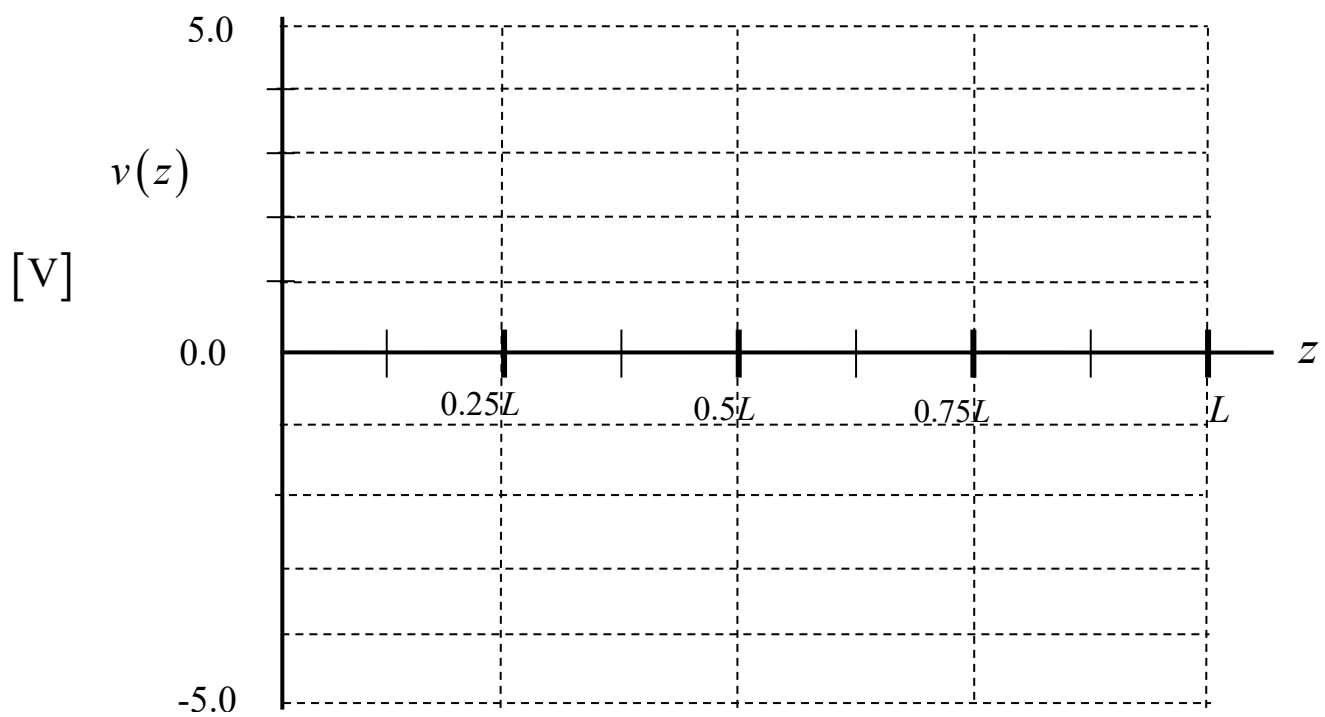
A voltage source is applied at the left end of a transmission line as shown below. A plot of the generator voltage is shown below. The pulse width is  $W = 6 \text{ [ns]}$  and the pulse voltage is  $V_0 = 5 \text{ [V]}$ .

- Construct a bounce diagram for this problem that extends to a time of 16 [ns]. (Make your bounce diagram on the next page.)
- Make an accurate “snapshot” plot of the voltage  $v(z)$  on the line at  $t = 7.0 \text{ [ns]}$ . Make your plot on the graph that is given below on the next page. Label all voltage values on your plot.



Make your bounce diagram here:

Make your plot here:



ROOM FOR WORK