University of Portland
School of Engineering

EE 301-Electromagnetic Fields-3 cr. hrs.
Spring 2006

Midterm Exam # 2
Sinusoidal Steady-State Waves on Transmission Lines

(Prepared by Professor A. S. Inan)

(Friday, April 21, 2006)
(Closed Book Exam; 2 Formula Sheets Allowed)
(Total Time: 55 mins.)

Name:_____ ☺

Signature:_____ ☺

"Honesty is the best policy."
Aesop (~ 620B.C. –?)

"An honest mind possesses a kingdom."
Lucius Annaeus Seneca (4B.C.–65A.D.)

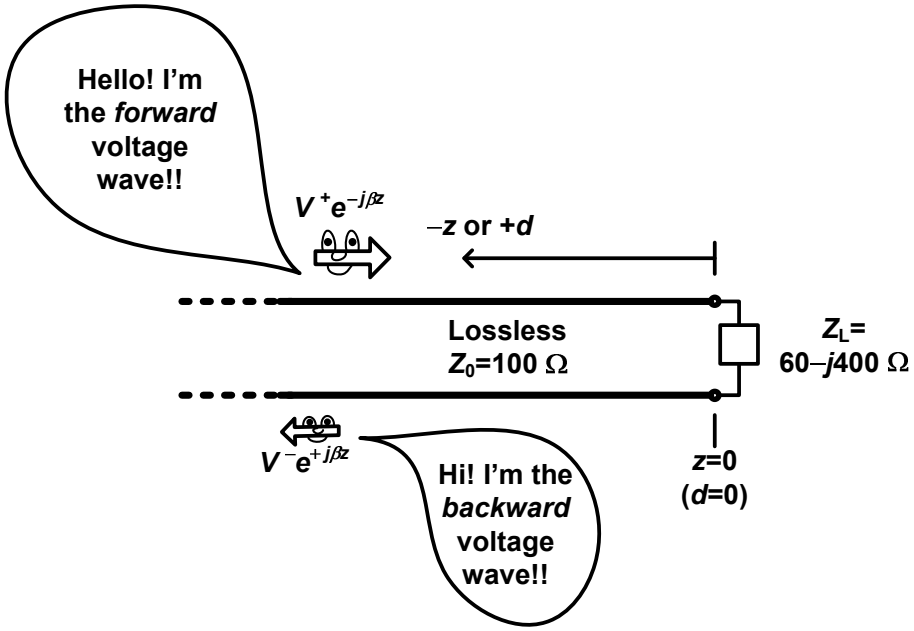
"Honest people are the true winners of the universe."
Anonymous

"Honesty is not for sale."
A. Inan

This table will be used by Inan for grading!

Problem #	Points gained
#1	
#2	
#3	
Total	

(1) (*15 mins.*, *Total: 40 points*) **A lossless transmission line terminated with a complex impedance.** A $100\,\Omega$ transmission line is terminated with an inductive load impedance given by $Z_L = 60 - j400\,\Omega$, as shown.



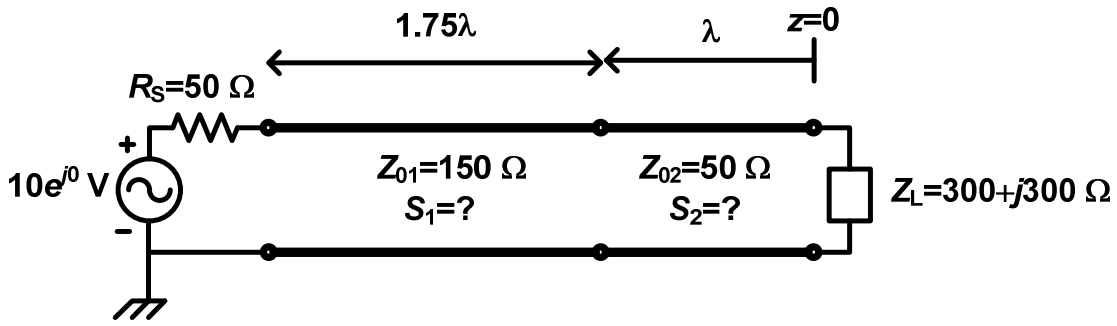
(a) (*10 points*) Find the load reflection coefficient, Γ_L. (Provide your answer in polar form.) Show your work!

(b) (*10 points*) What is the value of the standing wave ratio, *S*, on the line? (Show your work!)

(c) (*10 points*) Calculate the percentage time-average incident power that reflects back from the load.

(d) (*10 points*) Find the V_{max} and V_{min} positions nearest to the load. Provide your answers as electrical lengths.

(2) (*15 mins.*, *Total: 30 points*) **Two cascaded transmission lines.** Consider the transmission line circuit as shown. Assume lossless lines.

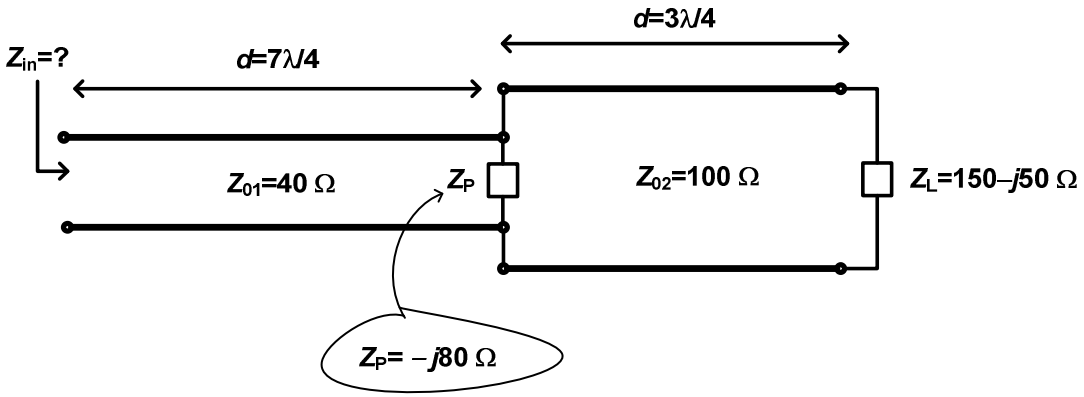


(a) (*15 points*) Find the standing wave ratio on each line. Show your work!

(b) (*15 points*) Find the time-average power delivered to the load impedance.

(3) (*15 mins.*, *Total: 30 points*) **Input impedance.** Consider the transmission line circuit as shown where Z_P impedance represents a parallel lumped element.

(a) (*20 points*) Find the input impedance Z_{in}. Show your work step by step.



(b) (*10 points*) Assume that the physical length of each transmission line stays the same, however, the wavelength reduces by a factor of 2. What will be the new value of the input impedance Z_{in}? Why? (Assume the values of Z_L, Z_P, Z_{01} and Z_{02} to stay the same.)