University ☺f P☺rtland
Sch☺☺l ☺f Engineering

EE 301-Electromagnetic Fields-3 cr. hrs.
Spring 2013

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

(Prepared by Professor A. S. Inan)

(Monday, April 8, 2013)
(Closed Book Exam; Formula Sheets Allowed)
(Total Time: 55 mins.)

Name:_____ _____ _____☺

***Signature:*_____ _____ _____☺**

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

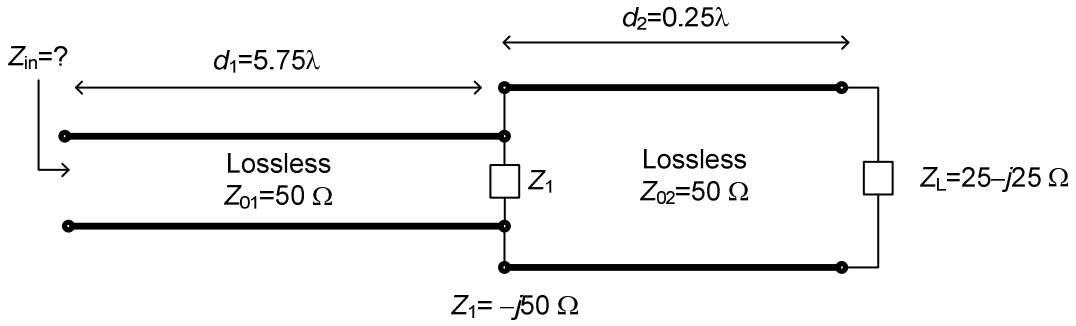
"An honest mind possesses a kingdom."
Lucius Annaeus Seneca (4B.C.–65A.D.)

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

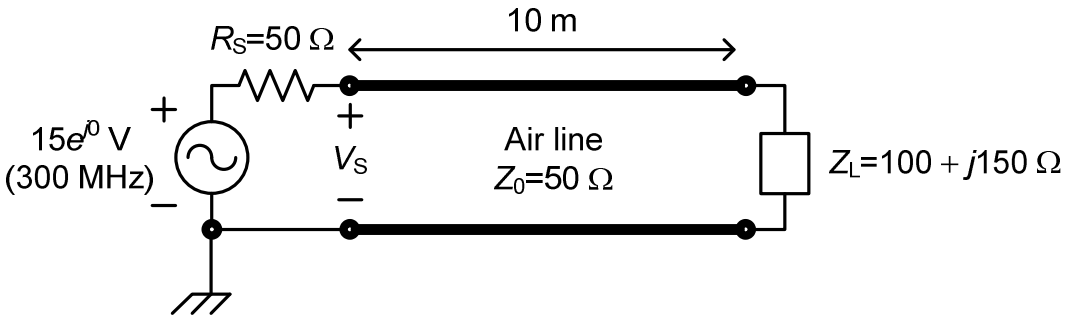
This table will be used by Inan for grading!

Problem #	Points gained
#1	
#2	
#3	
#4	
Total	

(1) (10 mins., 20 points) **Input impedance of a transmission-line circuit.** For the double transmission-line circuit shown, find the input impedance Z_{in}. Assume both impedances Z_1 and Z_L to be lumped elements.



(2) (15 mins., Total: 40 points) **A lossless transmission line terminated with a complex impedance.** A $50\,\Omega$ air transmission line is terminated with an inductive load impedance given by $Z_L = 100 + j150\,\Omega$ and excited by a sinusoidal voltage source as shown.



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

(b) (5 points) What is the value of the standing wave ratio *S* on the line?

(c) (15 points) Calculate the time-average power delivered to the load.

(d) (10 points) Find the first two V_{max} and the first two V_{min} positions nearest to the load on this transmission line. Provide your answers in units of distance.

(3) (10 mins., 20 points) **Unknown load.** The standing wave ratio on a 50 Ω transmission line feeding an unknown load antenna is measured to be 2.4 and one of the voltage maximums on the line is located at 0.65λ away from the load position. Determine the value of the antenna load impedance Z_L.

(4) (10 mins., 20 points) **Unknown load.** A 50 Ω air transmission line with a standing wave ratio of S = 3.4 has its first and second voltage minimums nearest to the load located at 0.1 m and 0.3 m respectively. Calculate (a) the operating frequency f; and (b) the load impedance Z_L.