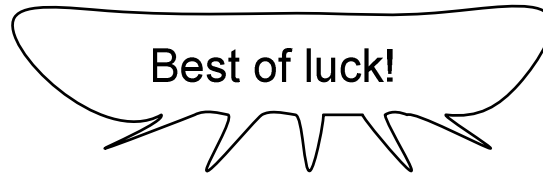


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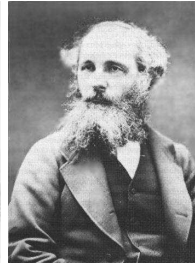
Ampere (1775-1855)



Gauss (1777-1855)



Faraday (1791-1867)



Maxwell (1831-1879)



Hertz (1857-1894)

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

Final Examination

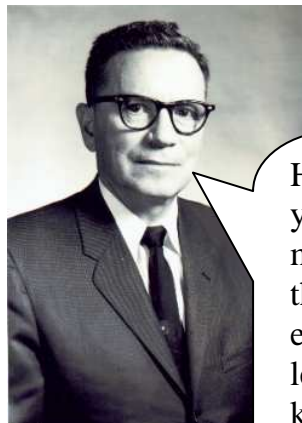
(Prepared by Professor A. S. Inan)

(Tuesday, April 30, 2013, 8:00-10:00a.m.)

(Closed Book Exam; Formula Sheets Allowed)

Name: _____ 😊

Signature: _____ 😊



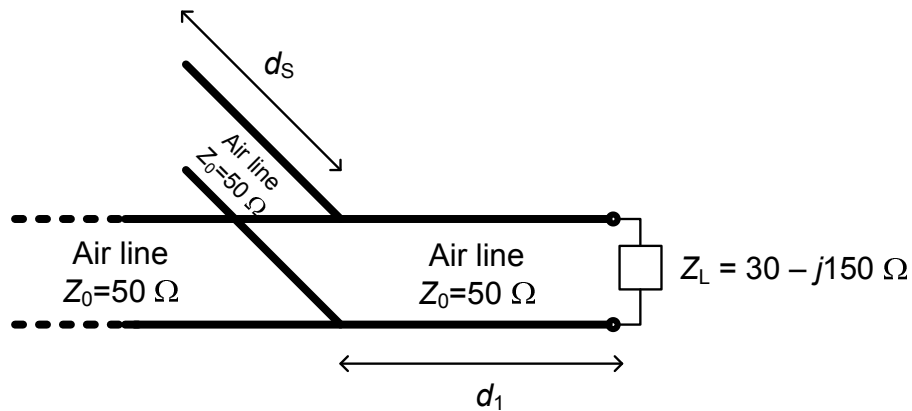
Hi EE 301 Students: FYI, yesterday, April 29, 2013 was my 108th birthday. I wish you the best luck in Inan's final exam and in case he doesn't let you use my chart, let me know right away!
PHS!

Points gained on each problem:

#1	_____
#2	_____
#3	_____
#4	_____
Total	_____

Note: The above table belongs to Inan, so, do not even dare to touch it!! ☺

- (1) (25 points) **A single, shunt, open-circuited stub matching network.** Use the Smith chart to design a single, shunt, open-circuited stub to match a load impedance of $Z_L = 30 - j150 \Omega$ to a 50Ω air transmission line at a frequency of 750 MHz. Assume air lines. Provide your design values in actual lengths.



(2) (*Total: 25 points*) **A purely reactive load.** A $100\ \Omega$ air transmission line is terminated with a load impedance of $Z_L = -j50\ \Omega$ at 1 GHz.

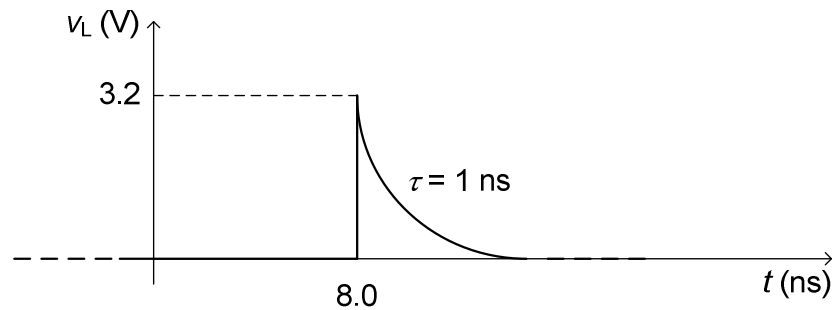
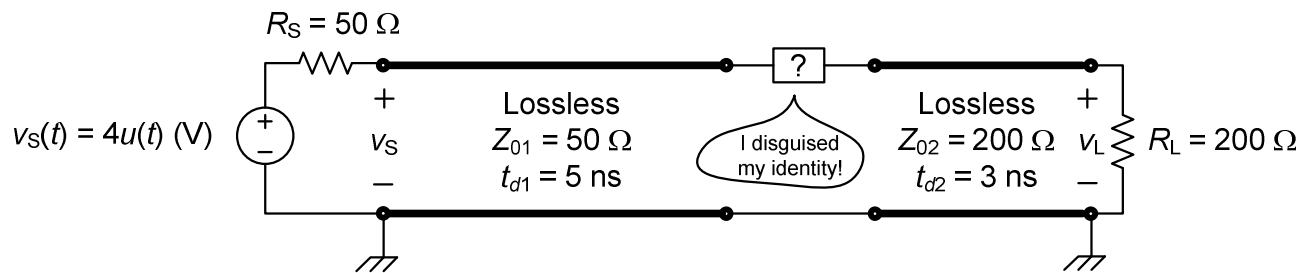
(a) (10 points) Determine the nearest position (in cm) on the line with respect to the load position where $|Z_{in}|$ is minimum.

(b) (10 points) Determine the nearest position (in cm) on the line with respect to the load position where $|Z_{in}|$ is maximum.

(c) (5 points) Determine the nearest position (in cm) on the line with respect to the load position where Z_{in} equals $j50\ \Omega$.

(3) (Total: 25 points) **Unknown lumped element.** The load-end voltage waveform $v_L(t)$ observed at the end of the two transmission-line electric circuit due to a step excitation is as shown.

(a) (12.5 points) Determine the type and the value of the single lumped element connected at the junction of the transmission lines. Provide justification for your solution.



(b)(12.5 points) Find the complete mathematical expression for the source-end voltage $v_s(t)$ and sketch it. Include all the pertinent values on your sketch.

- (4) (20 points) **Quarter-wave matching transformer design.** A quarter-wave matching transformer section is designed to match a load impedance Z_L to a $50\ \Omega$ air transmission line, as shown. Determine the load impedance Z_L .

