ELEC351 Class Test

Name:_____

I.D. Number:_____

October 10, 2007

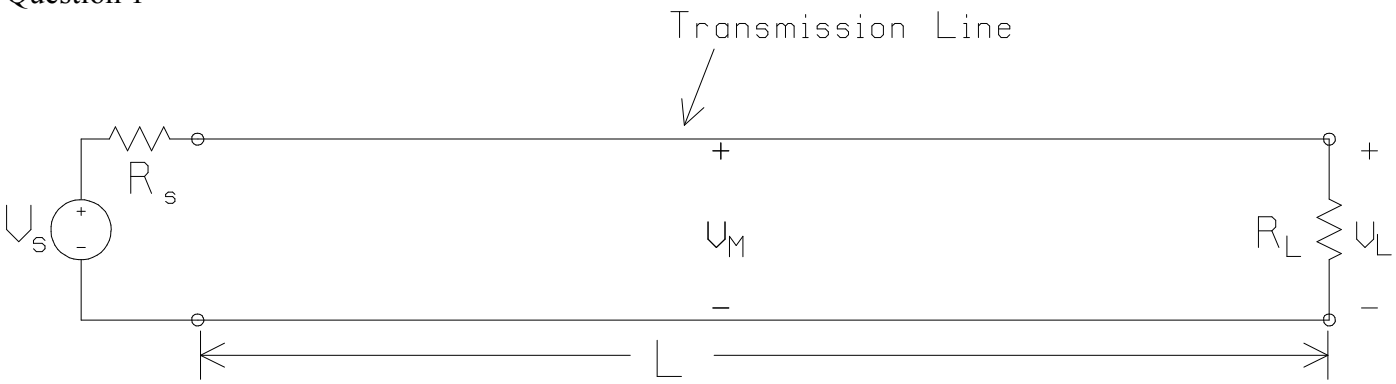
Closed book exam! No books or notes allowed!

Cell phones and other wireless devices are forbidden in examinations. You cannot have a cell phone in your possession during an examination.

Calculators: Only the Sharp EL531 or the Casio FX-300MS calculator is permitted.

Circle the correct answer directly on the examination paper. The exam booklet is for rough work only and will not be evaluated. If your answer is within 3% of one of the given answers, then choose that answer.

Question 1



A transmission line of length $L = 14$ cm has characteristic resistance $R_c = 300$ ohms and speed of travel $u = 19.5$ cm/ns. The source generates a pulse of amplitude $V_s = 10$ volts and length 0.5 ns, starting at $t = 0$. The source resistance is $R_s = 50$ ohms. The load is a resistor of value $R_L = 800$ ohms.

1.1What is the voltage V_M in the middle of the transmission line at $t = 0.5$ ns?

(a) 8.57 volts	(b) 1.30 volts	(c) 6.67 volts	(d)4.23 volts	(e) none of these

1.2What is the load voltage V_L at $t = 1.2$ ns?

(a) 6.23 volts	(b) 1.90 volts	(c) 9.70 volts	(d) 12.47 volts	(e) none of these

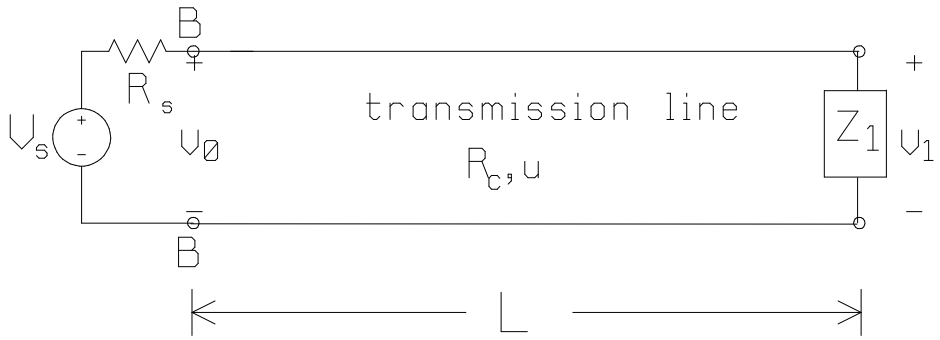
1.3What is the voltage V_M at $t = 2.0$ ns?

(a) -1.01 volts	(b) -2.78 volts	(c) 0.28 volts	(d) 0.44 volts	(e) none of these

1.4What is the load voltage V_L at $t = 2.5$ ns?

(a) -1.47 volts	(b) 0.64 volts	(c) -4.05 volts	(d) 0.40 volts	(e) none of these

Question 2



The transmission line circuit shown above operates in the sinusoidal steady state at 5.5 GHz. The generator has an open-circuit voltage of $V_s = 10\angle 0°$ volts RMS and an internal resistance of $R_s = 100\ \Omega$. The transmission line is $L = 4.33$ cm long, has characteristic resistance $R_c = 300\ \Omega$, and speed-of-propagation 19.5 cm/ns. The load is $Z_1 = 400\text{-}280\text{j}\ \Omega$.

2.1 Find the phase factor β.

a) 4.320 rad/cm	b) 1.772 rad/cm	c) 2.304 rad/cm	d) 1.280 rad/cm	e) none of these

2.2 Find the input impedance of the transmission line and load at terminals BB.

a) 487+270j ohms	b) 175-152j ohms	c) 137+ 59.7j ohms	d) 571-257j ohms	e) none of these

2.3 Find the RMS value of the voltage V_0 across terminals BB.

a) 4.27 volts RMS	b) 6.11 volts RMS	c) 8.62 volts RMS	d) 7.38 volts RMS	e) none of these

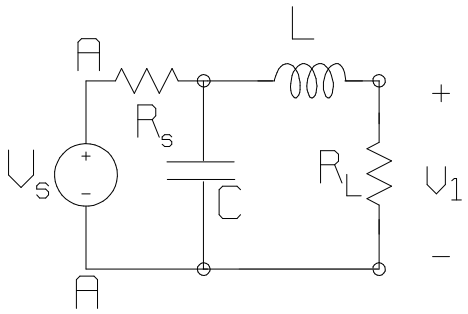
2.4 Find the reflection coefficient Γ_L at the load.

a) 0.714	b) 0.525-0.211j	c) 0.210+0.623j	d) 0.261-0.296j	e) none of these

2.5 Find RMS value of the voltage V_1 across the load.

a) 8.34 volts RMS	b) 11.7 volts RMS	c) 10.3 volts RMS	d) 17.7 volts RMS	e) none of these

Question 3



In the circuit above, the generator voltage is $V_s(t) = 24\sqrt{2}\cos(\omega t)$ at frequency $\omega = 2\pi f$ with $f = 2450$ MHz. The source resistance is R_s=50 ohms. The component values are $C = 1.2$ pF, $L = 2.0$ nH and $R_L = 80$ ohms.

3.1 What is the impedance of the inductance L?

a) j69.3 ohms	b) j30.8 ohms	c) 30.8 ohms	d) j117 ohms	e) none of these

3.2 What is the input impedance across the generator terminals A-A?

a) 35.8+2.39j Ω	b) 72.6-71.9j Ω	c) 83.8-44.3j Ω	d) 85.4-j60.8 Ω	e) none of these

3.3 What is the RMS value and phase angle of the voltage V_1 across the load?

a) $13.1\angle -46°$ v.	b) $5.32\angle 132°$ v.	c) $10.0\angle -83°$ v.	d) $12.2\angle -65°$ v.	e) none of these