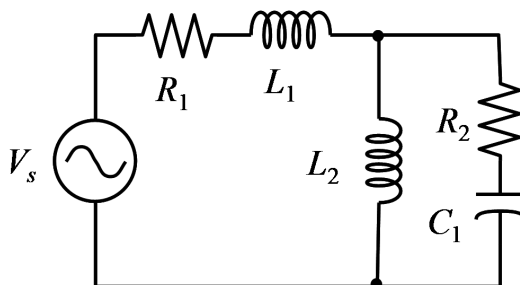
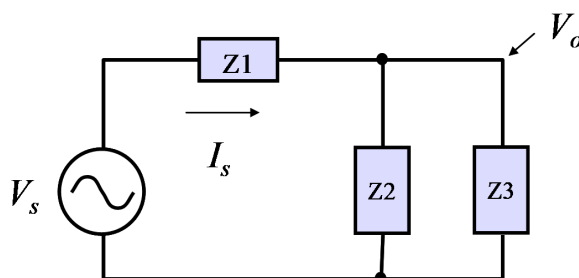


## Basic Electronic Circuits Fall 2007 Test 2

1. Given the circuit below, with  $R_1 = 1.5$  ohm,  $L_1 = 9.5$  mH,  $L_2 = 5$  mH,  $R_2 = 3$  ohm,  $C_1 = 250$   $\mu$ F, and  $V_s = 150 \cos(1000t)$  volts.

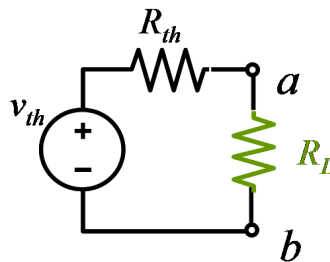


- (a) Find the impedances in the corresponding diagram below. (5 points)

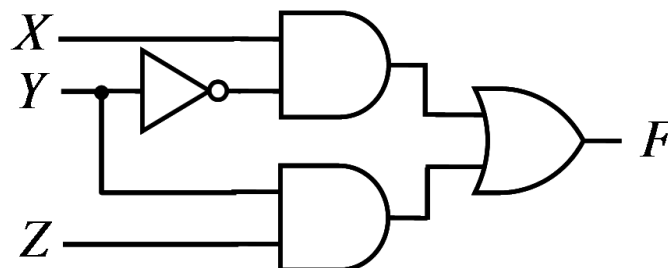


- (b) Find the effective impedance  $Z_p$  of  $Z_2$  and  $Z_3$ . (5 points)
- (c) Find the current  $I_s$ . (5 points)
- (d) Find the voltage  $V_o$  in complex form and phasor form. (5 points)
2. If  $CV$  has units of charge (Coulomb) and  $V/R$  has units of current (Ampere), then what are the units of  $RC$ ? (5 points)
3. A light bulb sees a 3-A current for 15 seconds. The light bulb generates 3 kJ of energy in the form of light and heat. What is the voltage drop across the light bulb? (5 points)

4. How much energy does a 75-W light bulb consume in six hours? (5 points)
  
5. Given an inductor of  $2j$  ohms and a capacitor of  $-3j$  ohms, find the total impedance if the elements are in series and if they are in parallel. (5 points)
  
6. How much energy is stored in a 5 mH inductor with a current of 2 amps flowing through it? (5 points)
  
7. If you leave an output of a TTL logic circuit unconnected, is the output high, low, or undefined? (5 points)
  
8. An  $RC$  circuit with a time constant  $\tau = 2$  msec has reached a steady state of 2 V at time  $t = 0$ . The circuit is then suddenly switched to a voltage source for which the final steady state will be 6 V. Write an equation representing the transient behavior of the voltage. (5 points)
  
9. In an exponential decaying signal, the time for the signal to drop to half its initial value is  $\tau \log(2)$  where  $\log(x)$  is the natural logarithm, and the time for it to drop from 0.9 to 0.1 of its initial value is  $\tau \log(9)$ . What is the time required to drop from  $2/3$  to  $1/3$  of its initial value? (5 points)
  
10. An inductance of 5 mH is combined in parallel with a capacitance of  $0.5 \mu\text{F}$ . What is the characteristic frequency (Hz) (not radian frequency) of the combination? (5 points)
  
11. Find the current flowing through the load resistor in the following Thévenin equivalent circuit with  $V_{th} = 5$  V,  $R_{th} = 30 \Omega$  and  $R_L = 70 \Omega$ . (5 points)



12. Is a TTL logic element better at sourcing current, sinking current, or the same for either sourcing or sinking current? (5 points)
13. If a logic value has a name like **DoorOpen**, would you expect the result to be high, low, or undefined if the door is open? (5 points)
14. Draw and identify the logic gates for AND, NOR, XOR, NAND, and NOT. (5 points)
15. Explain the operation of a 2-1 multiplexer with the aid of a logic diagram. What programming concept is represented by the multiplexer? (5 points)
16. The following logic diagram applies to this problem.



- (a) Write the logical expression for the variable  $F$ . (5 points)
- (b) Create the truth table for the logical variables in the circuit above. (5 points)