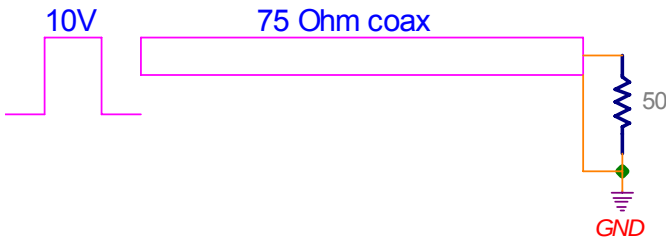
PHYS 483/683 Final Exam 12/10/07 Name:_____

1) You want to shield a circuit from a nearby transmitter by putting the circuit in an aluminum enclosure. The transmitter is transmitting at 10.89 MHz and the skin depth of Aluminum (in inches) is $3.3/\sqrt{f}$.

a) (5 pts) How thick would the enclosure have to be to attenuate the 10.89 MHz signal by 40db (i.e. a factor of 100)?

b) (5 pts) How big of a hole can there be in the enclosure and still have 40db attenuation at 10.89 MHz?

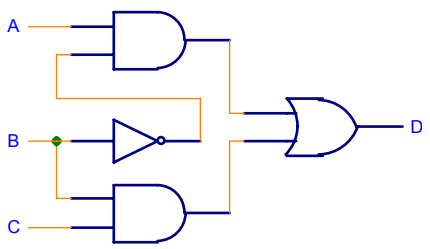
2). A 10V pulse is traveling down a 75Ω coax cable that is terminated with a 50Ω resistor.



a) (5 pts) What is the voltage across the terminator when the pulse reaches the end of the cable?

b) (5 pts) If the 50Ω resistor is replaced with a 100Ω resistor what is the voltage across the terminator when the pulse reaches the end of the cable?

3) (5 pts) Fill out the truth table for this logic circuit.

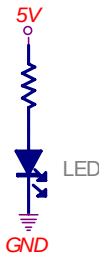


A	B	C	D
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

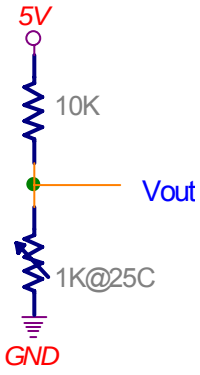
4) (7 pts) **Simplify** and implement this truth table with logic gates.

A	B	C	D
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	1

5) (3 pts) What value should the resistor be to put 10mA through the LED? Note: the LED has a forward voltage drop of 2V@10mA.



6) (15 pts) a) Design an amplifier to amplify the output of the thermistor temperature sensor shown below by a factor of 10. The gain should roll off for frequencies above 10Hz (Note: the gain **doesn't** have to go all the way to zero at high frequency).



b) (5 pts) Which of these op-amps would be best for the above design and why?

op-amp	Input Offset Voltage	Gain Bandwidth Product
LTC6081	70µV	3MHz
LT1210	15mv	35MHz

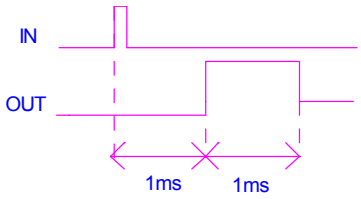
7) Design a photodiode amplifier using the photodiode specified below and an op-amp (you can assume the op-amp is ideal). The amplifier should have an output of **+1V** when 1uW of light hits the photodiode (i.e. 1V/1uW). The light is passed through a beam chopper before hitting the photodiode. The light is chopped 1000 times a second so the amplifier should be able to respond to a 1KHz input.

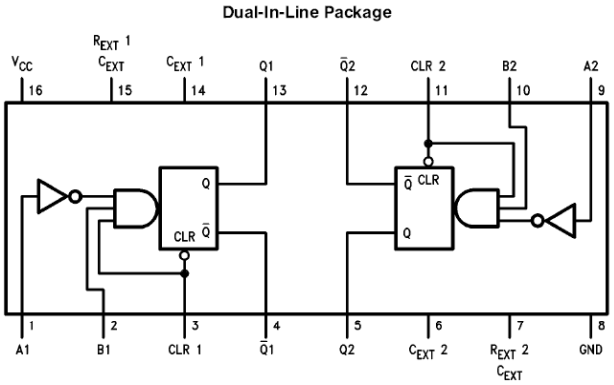
a) (15 pts) Draw the complete schematic. Include power connections and decoupling caps (use any power supply you need).

Photodiode Specs:
I_{dark} = 1nA
Sensitivity = 1uA/uW
Junction Capacitance = 2nf@0V reverse bias
Junction Capacitance = 100pf@15V reverse bias

b) (5 pts) What is the output voltage of your amplifier when no light is hitting the photodiode?

8) (15 pts) Design a circuit using the 74HC123 that will trigger on the rising edge of an input pulse, wait 1ms, then provide a 1ms output pulse. Tie all unused inputs high or low. Label the input and output. You can assume the pulse width is equal to the RC time constant of the external R & C.





9) (10 pts) Fill out the timing diagram for B & C. Note: B & C are initially low. The 74HC74 clocks in data on the rising edge of the clock. You can assume A is clean 1Hz square wave and the AND gate has schmitt trigger inputs.