ENGR-4300
Fall 2008
Test 1

Name _____

Section: 1(MR 8:00) 2(TF 2:00)
(circle one)

Question I (20 points) _____

Question II (20 points) _____

Question III (20 points) _____

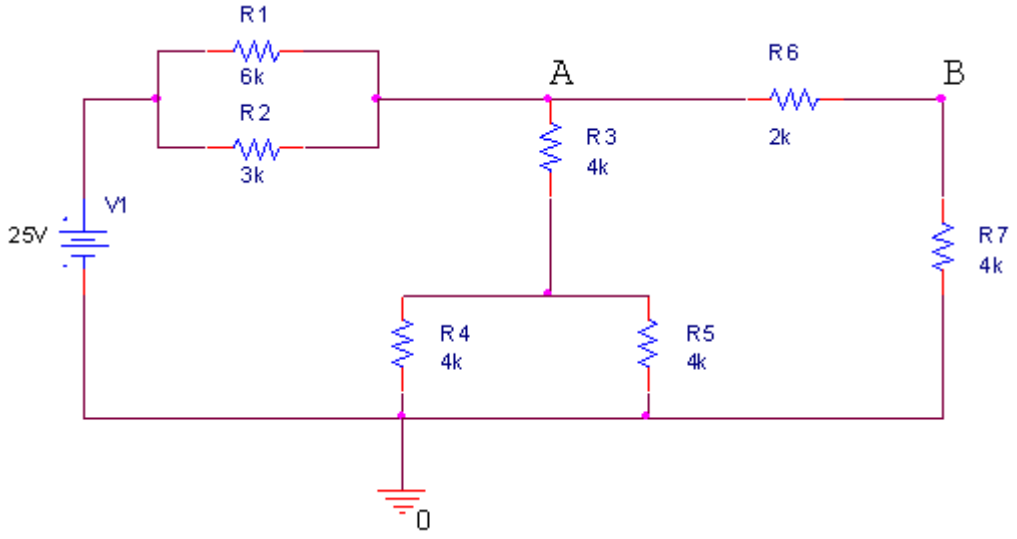
Question IV (20 points) _____

Question V (20 points) _____

Total (100 points) _____

On all questions: SHOW ALL WORK. BEGIN WITH FORMULAS, THEN SUBSTITUTE VALUES AND UNITS. No credit will be given for numbers that appear without justification.

Question I – Circuit Analysis (20 points)



1) Find the ***equation*** for total resistance. (6 pts)

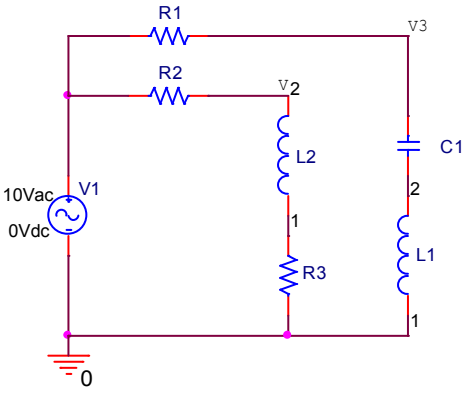
2) Find the total resistance ***and*** total current. (4 pts)

3) Find voltage at points A and B using the voltage divider equation. (5 pts)

4) Find the current through R4 ***and*** R6. (5 pts)

Question II – Filters (20 points)

You are given the following circuit. The input at V1 is a 10V AC signal. Leave all answers for 1) – 5) in terms of R1, R2, R3, C1, L1, L2 and the value of V1. V2 and V3 are measured with respect to ground.



1) Redraw the circuit for $\omega \rightarrow 0$ with appropriate simplifications for the impedances and find V2 and V3. (5 pts)

2) Redraw the circuit for $\omega \rightarrow \infty$ (high frequencies) with appropriate simplifications for the impedances and find V2 and V3. (5 pts)

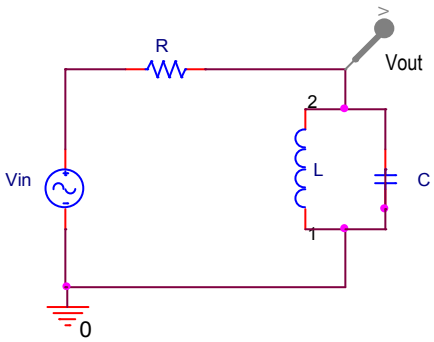
3) At what value of ω (greater than 0 and less than ∞) would you expect to find V3 minimized? (3 pts)

4) What special name is given to the ω value in 3)? (2 pts)

5) If Vac is set to 0V and Vdc is set to 5V on V1, what are the values of V2 and V3? (3 pts)

6) What type of filter is the circuit at V3, Low Pass, High Pass, Band Pass, or Band Reject? (2 pts)

Question III – Transfer Functions (20 points)



1) What is the transfer function H(jω) for the circuit above in terms of R, L, and C? You must reduce it to a simple ratio of polynomials in ω. (6 pts)

2) Substitute the values R = 2, C = 4, and L = 1 into H(jω) in 1) and simplify. (4 pts)

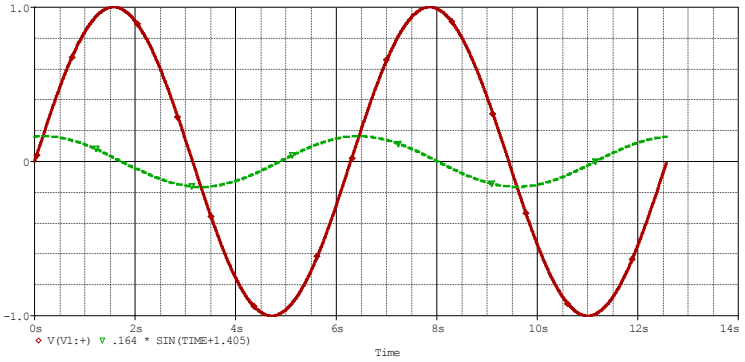
3) Find the simplified transfer function for low frequencies and high frequencies (4 pts)

4) For $\omega = 1$ radian/s, determine the magnitude of $H(j\omega)$. (2 pts)

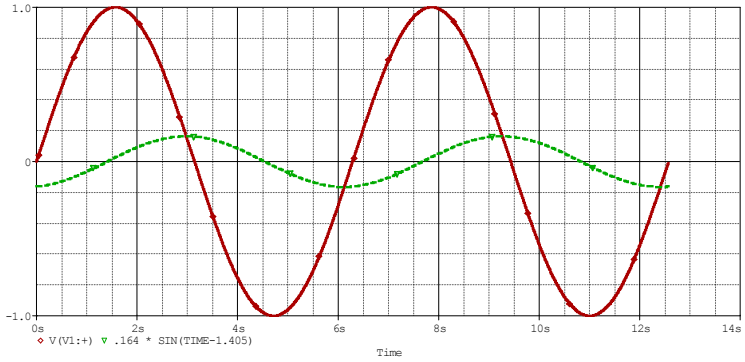
5) For $\omega = 1$ radian/s, determine the phase of $H(j\omega)$. (2 pts)

6) Which plot correctly displays the relationship between Vin (solid trace) and Vout (dashed trace) at ω = 1 radian/s? (2 pts)

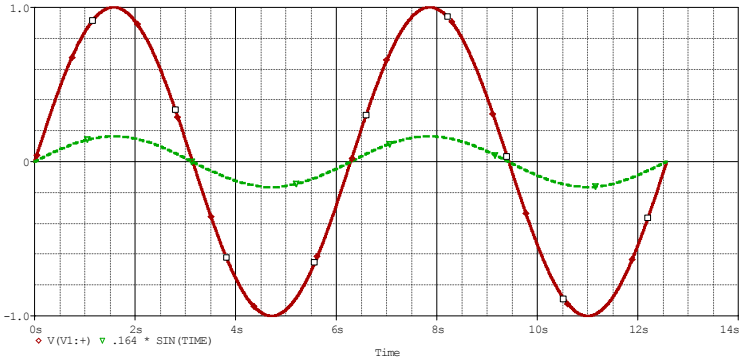
a.



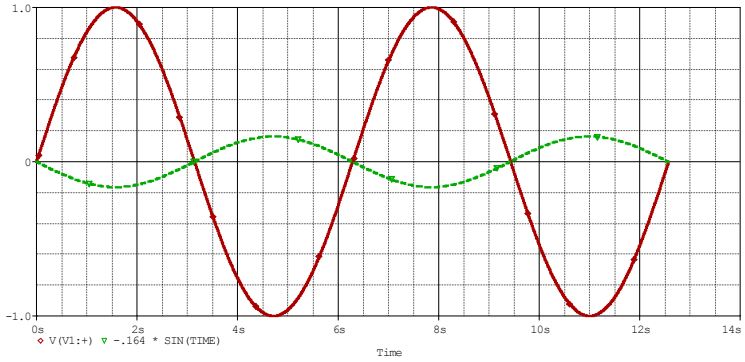
b.



c.

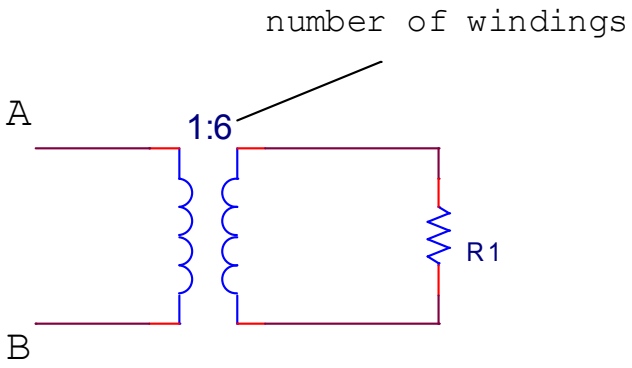


d.



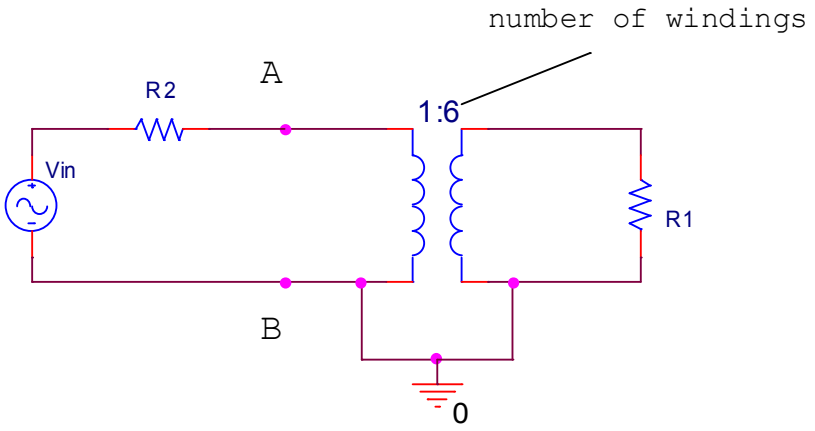
e. None of these.

Question IV: Transformers and Inductors (20 points)



1) In the circuit above, the transformer is ideal. If R1= 6KΩ, find the equivalent impedance, Z_{AB}, seen from points A and B. (5 pts)

We have connected the above circuit to an AC source with a resistor R2.

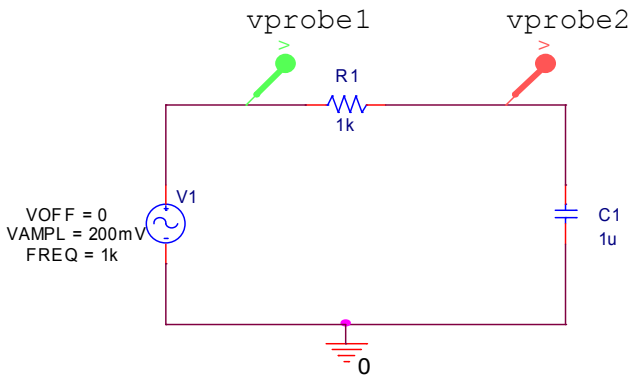


2) If the input voltage has an amplitude of 10V, and the voltage at point A is 526mV, what is the value of R2? (8 pts)

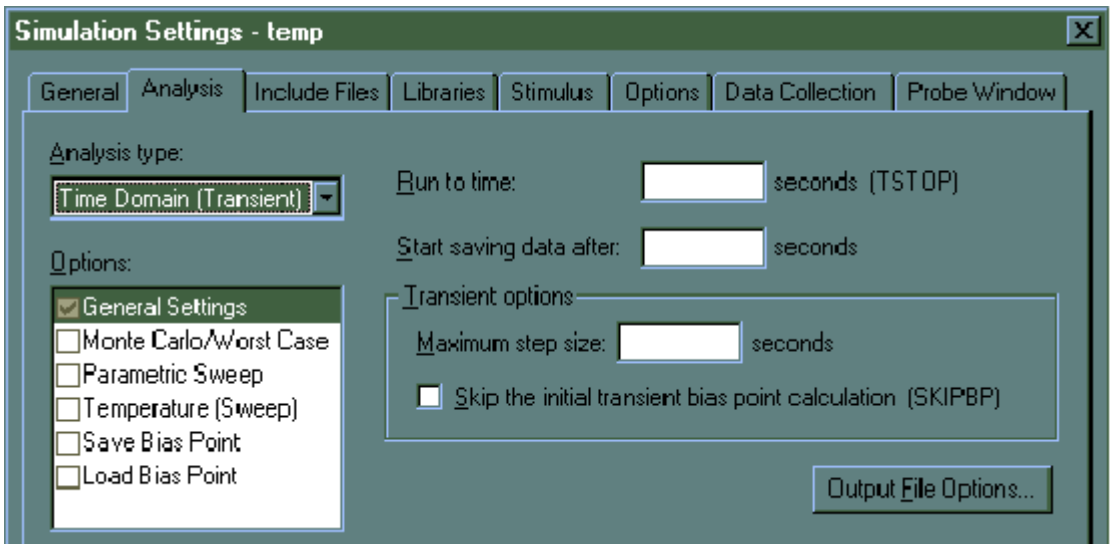
3) What is the value of the voltage across R1? (7 pts)

Question V: PSpice (20 points)

The following circuit is setup in PSpice

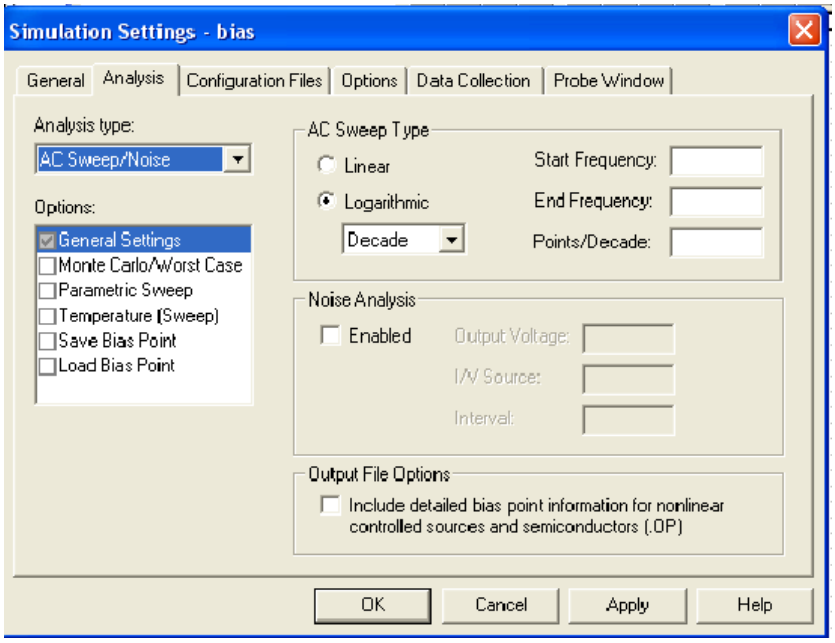


1) Setup a transient analysis in the simulation settings window below that will show 4 cycles of the signal, (the "start saving data after:" box can be neglected) (3 pts)

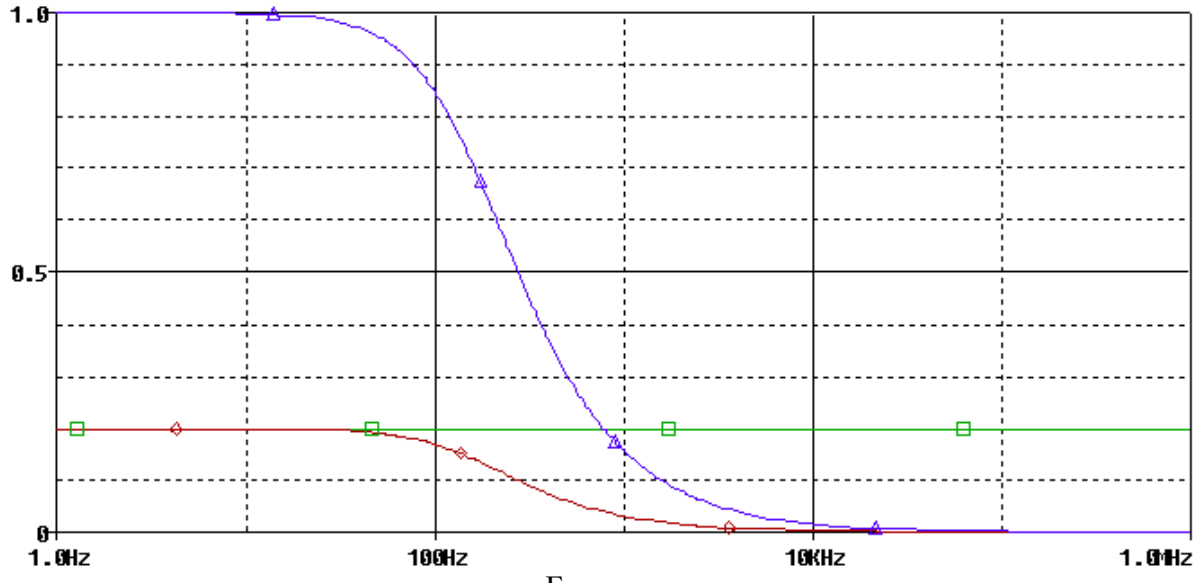


2) What steps should be included (to avoid errors) in creating an AC Sweep simulation over a range to 1 Megahertz for the circuit above? (circle all that apply) (6 pts)

a. Place ground in the circuit
b. Choose AC Sweep/Noise from the drop down box
c. Set parameter for VSIN called AC (double click AC source)
d. Set start frequency to 0 Hz
e. Set start frequency to 1 Hz
f. Set end frequency to 1MHz
g. Set end frequency to 1Meg
h. Set Points/Decade to 0
i. Set Points/Decade to 100



3) On the simulation output, label on the plot vprobe1 (Vin), vprobe2 (Vout), and the transfer function *(Vout/Vin)*. (3 pts)



4) What kind of filter is this? (3 pts)

5) How do you determine the corner frequency from the simulation output? How do you calculate the corner frequency from the circuit component values? ***Compare the two results.*** (5 pts)