بسم الله الرحمن الرحيم

Ministry of Higher Education
King Fahd University of Petroleum & Minerals
Electrical Engineering Department

وزارة التعليم العالي
جامعة الملك فهد للبترول و المعادن
قسم الهندسة الكهربائية

EE 203: Electronics I

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Examination: First Major Exam

Date : March 2, 2013

Time: 6:15-7:45 PM

Student Name:	
Student Number:	
Section Number:	

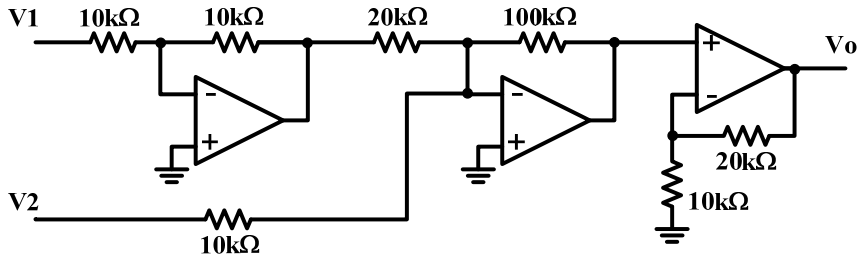
Problem 1	20	
Problem 2	15	
Problem 3	15	
Problem 4	10	
Total	60	

Answer All Questions

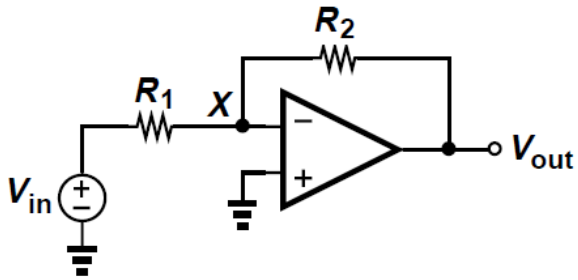
Problem (1) [20 points]

A. For the op amp circuit shown below, write an expression for V_o in terms of the two inputs V_1 and V_2.

Assume ideal op amp



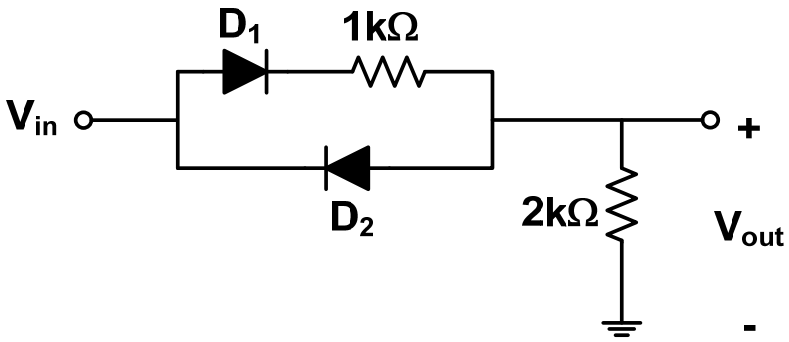
B. The op amp circuit, shown below, uses an op amp **with finite gain A.** Find $\frac{v_{out}}{v_{in}}$.



Problem (2) [15 points]

Consider the circuit in the figure below where both diodes have a constant voltage drop model with $V_D = 0.7\ V$.

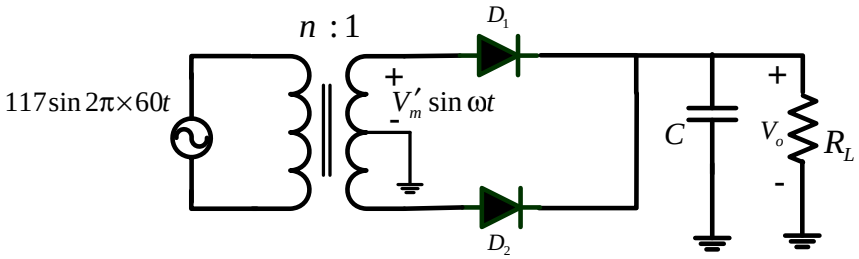
1. Find the output voltage for $V_{in} = +3\ V$. **(verify your assumptions about the diodes operating mode)**
2. Find the output voltage for $V_{in} = -3\ V$. **(verify your assumptions about the diodes operating mode)**
3. Find the expressions of the output voltage (V_{out}) when the input voltage V_{in} varies from $+3\ V$ to $-3\ V$. Draw the voltage transfer characteristics of the circuit. **(clearly show all key values)**
4. If V_{in} is a sinusoidal voltage with a maximum value of $+3\ V$, draw the voltage V_{out} versus time over two periods of V_{in}. **(Clearly show all key values)**



Problem (3) [15 points]

The power supply shown below is required to deliver a 12 V DC to a load of $R_L = 1\,k\Omega$ with a ripple voltage of $\pm 0.3\,V$. C is a smoothing capacitor used in parallel with the load resistance. In addition each diode used can be a constant voltage drop model with $V_D = 0.7$ V. The center tap-transformer has turns ration *n*:1 find:

a- The peak voltage across each secondary side of the transformer (V_m').
b- The value of *n*
c- The value of *C*
d- Different than increasing C, how can the ripple be reduced? Draw the complete circuit.



Problem (4) [10 points]

The Zener in the circuit shown below has a fixed voltage drop of 18 volt across it as long as i_Z is maintained between 20 mA and 200 mA.

a- Find R so that V_L remains at 18 volt while V_S is free to vary from 24V to 28V.

b- Using R of part a, find the maximum Zener current.