

**American University of Beirut**  
**Department of Electrical and Computer Engineering**

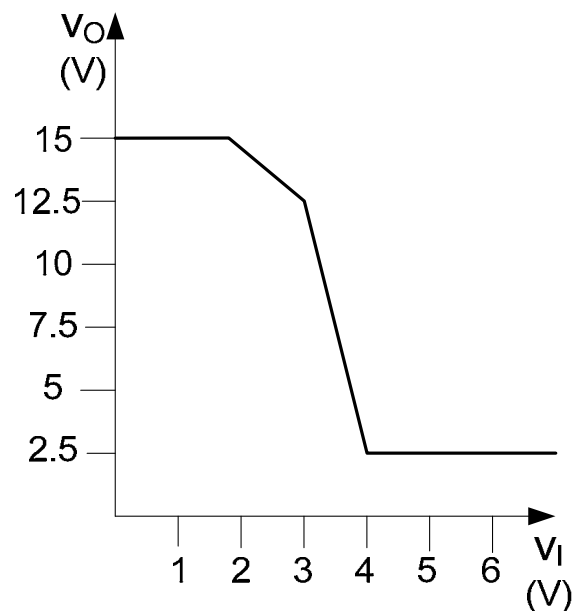
EECE 310 – Electronics  
Quiz 1 – November 2, 2007  
Closed Book – No Programmable Calculators  
90 minutes  
Penalty is 5 to 1

Name: \_\_\_\_\_ ID number: \_\_\_\_\_

Assume in the following that  $V_T = 25$  mV.

\_\_\_\_\_

Consider an amplifier with the following characteristics. The amplifier is biased to give a DC output voltage of 7.5 V.



1- Find  $L^-$  in V.

- a) 3      b) 1      c) 1.5      d) 2      e) **2.5**

2- Find  $L^+$  in V.

- a) 18      b) 9      c) 12      d) **15**      e) 6

3- Find the DC bias voltage at the input, in V.

- a) **3.5**      b) 2      c) 3      d) 4      e) 5

4- Find the small-signal voltage gain at the bias point.

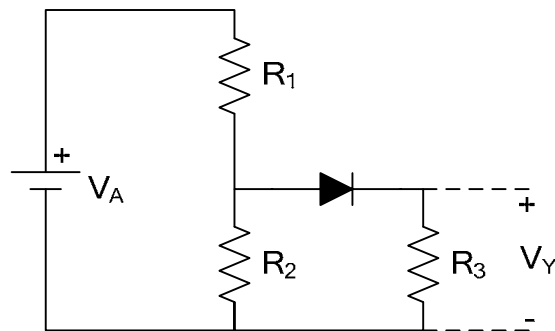
- a) -8      b) **-10**      c) -12      d) -4      e) -6

- 5- What is the largest undistorted sinusoidal output signal, in V, that can be produced (around the bias point)?
- a)  $2 \sin(\omega t)$       b)  $3 \sin(\omega t)$       c)  $4 \sin(\omega t)$   
 d)  $5 \sin(\omega t)$       e)  $6 \sin(\omega t)$
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An amplifier uses +12 V and -12 V power supplies. The average current in each of the two supplies is 10 mA. The amplifier provides a 3.0 V RMS sine wave to a 50  $\Omega$  load when the input is a 0.5 V RMS sine wave, from which a 5 mA RMS sine wave current is drawn.

- 6- Find the voltage gain of the amplifier in dB.
- a) 13.6      b) 14.6      c) **15.6**      d) 16.4      e) 12.5
- 7- Find the power gain of the amplifier in dB.
- a) 19.4      b) 15.5      c) 16.6      d) 17.7      e) **18.6**
- 8- Find the efficiency of the amplifier (in %).
- a) 90      b) **75**      c) 60.5      d) 36.5      e) 48
- 9- What is the power dissipated in the amplifier (in mW)?
- a) 152      b) 125      c) 95      d) **61**      e) 23
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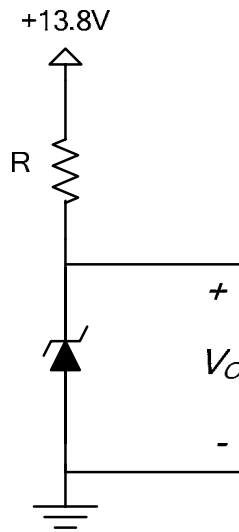
Consider the circuit shown below.



Assume  $R_1 = 10 \Omega$ ;  $R_2 = 12 \Omega$ ;  $R_3 = 30 \Omega$ . The diode is a PN junction diode with  $n = 1.5$ . The diode current is 1 mA at the original value of  $V_A$ . The source  $V_A$  now increases by a small amount  $v_a = 10$  mV.

- 10- Find the change  $v_y$  (in mV) in the value of  $V_Y$ .
- a) 1.03      b) 1.73      c) **2.24**      d) 2.63      e) 3.18
- 11- Find the change in diode current (in  $\mu A$ ).
- a) 53.0      b) 103      c) 86.6      d) **74.8**      e) 65.7
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The Zener regulator shown below uses a diode with the following parameters:  $V_{Z0} = 8.5 \text{ V}$ ,  $r_Z = 15 \Omega$ ,  $I_{ZK} = 5 \text{ mA}$ , and  $I_{Z\text{max}} = 300 \text{ mA}$ . The output voltage with no-load is  $9 \text{ V}$ .



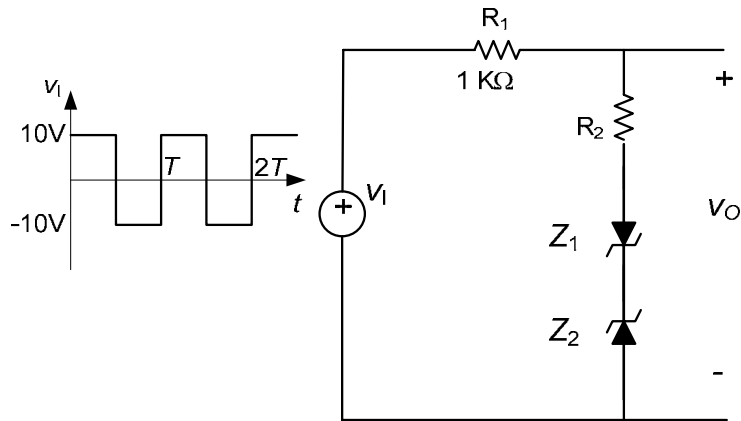
12- Find the value of the resistor  $R$  (in  $\Omega$ ) in the circuit.  
 a) 95                  b) 190                  c) 80                  d) 144                  e) 720

13- Assume that  $R = 100 \Omega$ . A load that draws a current  $I_L$  is connected from the output node to ground. Find the output voltage  $V_O$  (in V) when  $I_L$  is  $25 \text{ mA}$ .  
 a) 8.5                  b) 8.9                  c) 9.2                  d) 9.6                  e) 9.9

The input  $v_1$  to the circuit shown below is a  $\pm 10 \text{ V}$  symmetrical square wave. The Zener diodes drop  $0.6 \text{ V}$  in the forward direction,  $V_{Z1} = 4.7 \text{ V}$ , and  $V_{Z2} = 8.2 \text{ V}$ . Assume  $R_2 = 200 \Omega$ .

14- Find the current (in mA) in the resistor  $R_2$  when  $v_1$  is  $10 \text{ V}$ .  
 a) 0.4                  b) 0.545                  c) 1                  d) 0.8                  e) 0.667

15- Find the average value of the output voltage (in V).  
 a) 0.972                  b) 0.795                  c) 0.583                  d) 1.46                  e) 1.17



A certain PN junction diode conducts 0.3 mA at 0.61 V and 3 mA at 0.71 V.

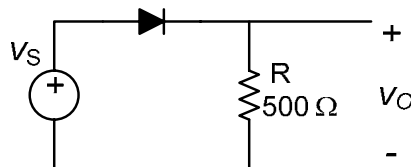
16- Find the value of  $I_S$  for this diode. ( $n$  is  $10^{-9}$ ,  $p$  is  $10^{-12}$ ,  $f$  is  $10^{-15}$ )

- a) 7.1 pA    b) 0.24 nA    c) 0.85 nA    d) 20.4 fA    e) 0.58 pA

17- Find  $i_D$  (in mA) when  $v_D$  is 0.7 V.

- a) 1.97    b) 9.49    c) 5.79    d) 4.0    e) 2.38

In the circuit shown below, the diode drops 0.8 V when conducting. The source is  $v_S = 8 \sin(2\pi \times 100t)$  V.



18- Find the maximum value of the diode current, in mA.

- a) 14.4    b) 16.4    c) 8.4    d) 10.4    e) 12.4

19- Find the first time instant (in ms) at which the diode starts to conduct (after  $t = 0$ ).

- a) 0.142    b) 0.182    c) 0.159    d) 0.255    e) 0.213

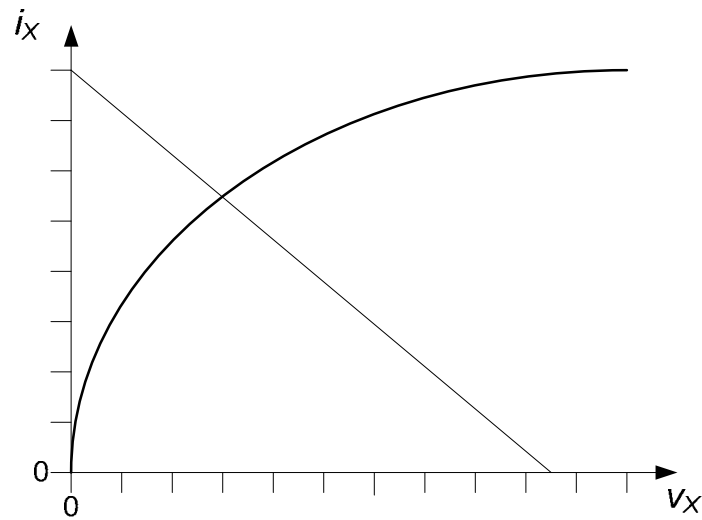
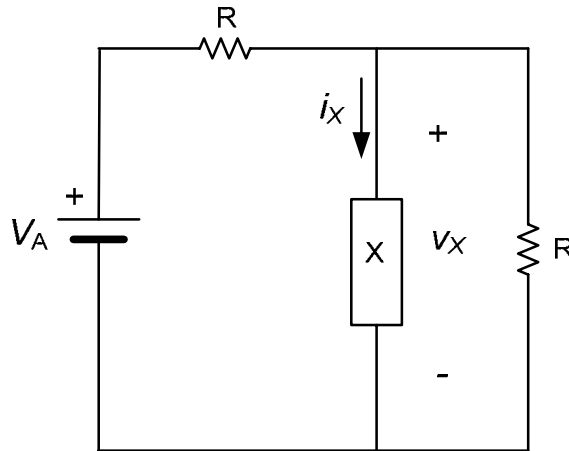
20- Find the PIV for the diode, in V.

- a) 5    b) 6    c) 7    d) 8    e) 9

21- A capacitor is connected in parallel with the resistor. Find the minimum capacitance needed (in mF) to have a ripple voltage in the output of at most 0.1 V.

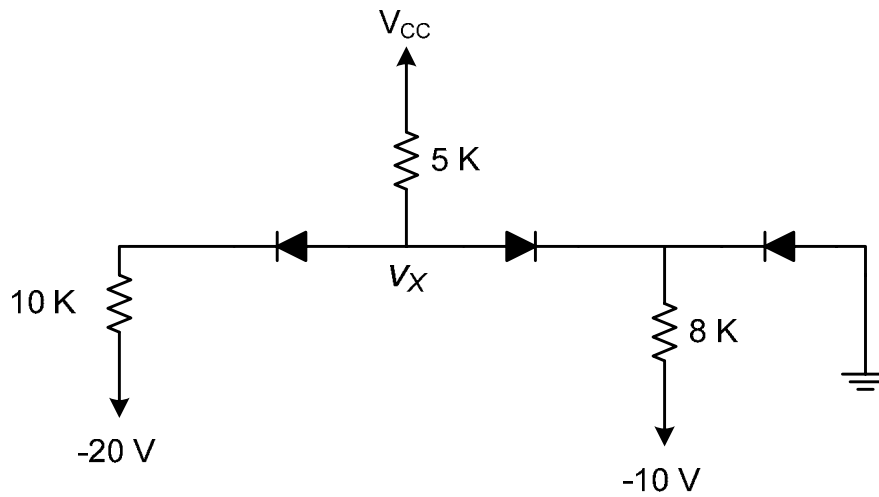
- a) 1.64    b) 1.44    c) 1.04    d) 1.24    e) 0.84

In the circuit shown below, device X has the characteristics shown in the  $i_x-v_x$  plot. The load line intercepts the  $i_x$  axis at 8 mA and the  $v_x$  axis at 19 V.



- 22- Find the value of  $V_A$  in V.  
a) 28.5      b) 38      c) 4.75      d) 9.5      e) 19
- 23- Find the value of  $R$  in  $K\Omega$ .  
a) 4.75      b) 3.56      c) 0.594      d) 1.19      e) 2.38
- 24- Find the bias point voltage  $V_X$  of the device, in V.  
a) 3      b) 4.5      c) 6      d) 1.5      e) 0.75

In the circuit shown below, the diodes are modeled as an open-circuit when OFF, and as a series combination of a battery  $V_{D0} = 0.65$  V and a resistor  $r_D = 40 \Omega$ , when conducting.



25- Find the voltage  $V_X$  (in V) when  $V_{CC} = 4$  V.

- a) -1.76      b) -4.43      c) -3.76      d) -3.09      e) -2.43