*University of Technology*
*Department of Laser& Optoelectronics Engineering*
*Final Examination 2011/2012*

*Subject: Electronic I* *Class: Second year*
*Division: Laser & Optoelectronics* *Time:3 hours*
*Examiner: Assist. Lec. Ahmed Chyad* *Date:3/6/2012*

***Answer only Five Questions***

**Q1:(A)** Determine $I_D$, $V_{D2}$, and $V_o$ for the circuit of Fig. 1.

**(B)** *(a)*For the Zener diode network of Fig. 2, determine $V_L$, $V_R$, $I_Z$, and $P_Z$.

*(b)* Repeat part (a) with $R_L = 3\ k\Omega$.

**Q2:** A full-wave bridge rectifier with a 120V rms sinusoidal input has a load resistor of 1 kΩ.

(a) If silicon diodes are employed, what is the dc voltage available at the load?

(b) Determine the required PIV rating of each diode.

(c) Find the maximum current through each diode during conduction.

(d) What is the required power rating of each diode?

**Q3:(A)** Sketch $v_o$ for each network of Fig. 3. for the input shown.

**(B)** Determine $v_o$ and the required PIV rating of each diode for the configuration of Fig. 4.

**Q4:** For the emitter bias network of Fig. 5, determine: $I_B$, $I_C$, $V_{CE}$, $V_C$, $V_E$, *and* $V_B$.

**Q5:** For the network of Fig.6. determine: $V_{GSQ}$, $I_{DQ}$, $V_{DS}$, $V_S$, $V_G$ *and* $V_D$.

**Q6**: For the network of Fig. 7, determine: $r_e$, $Z_i$, $Z_o$, $A_i$, and $A_v$.

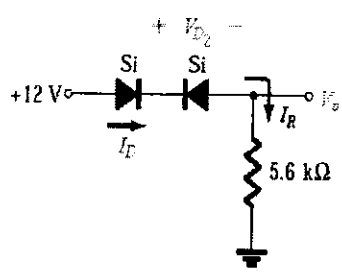



Fig. 1.

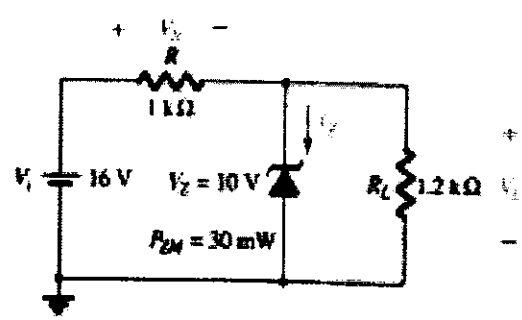



Fig. 2.

اقلب الصفحة ←

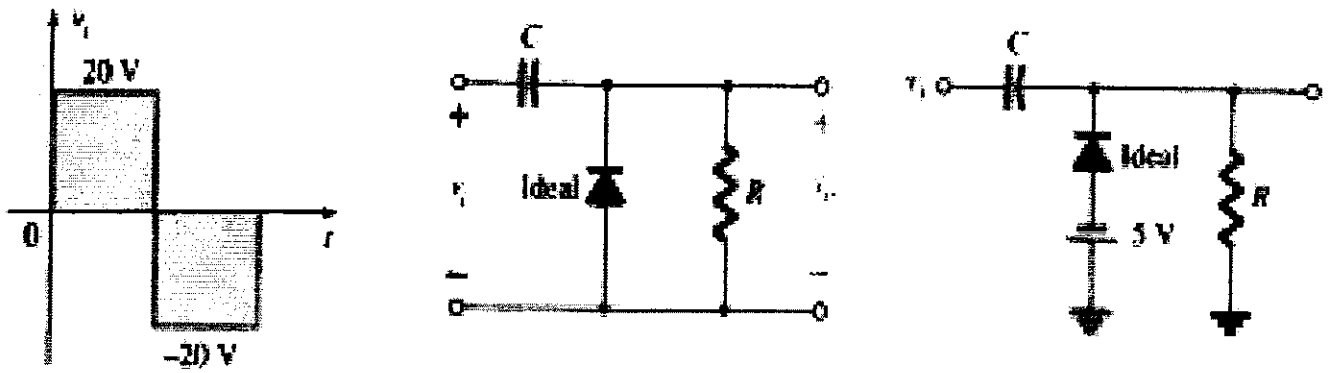



Fig. 3.

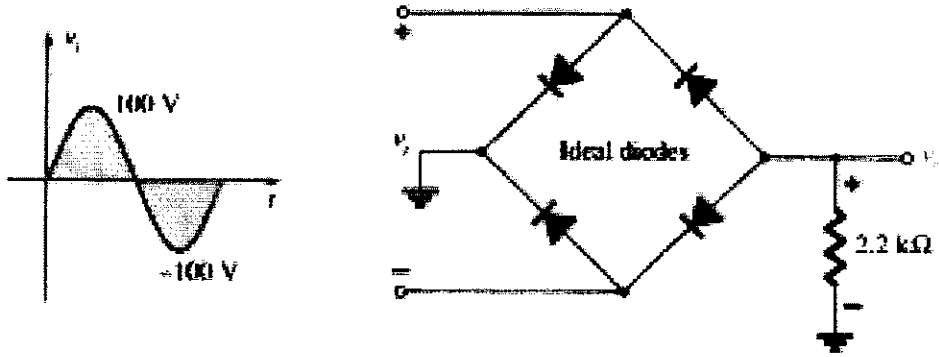



Fig. 4.

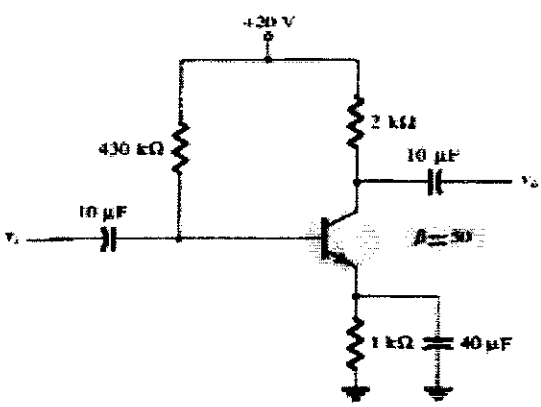



Fig.5

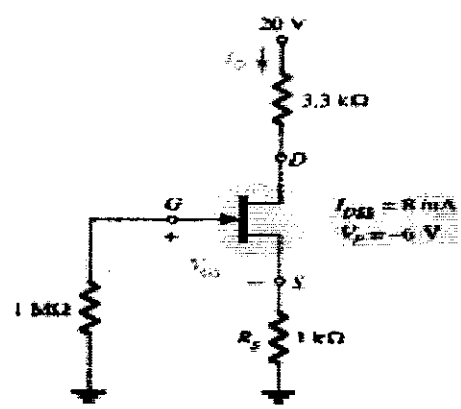



Fig.6

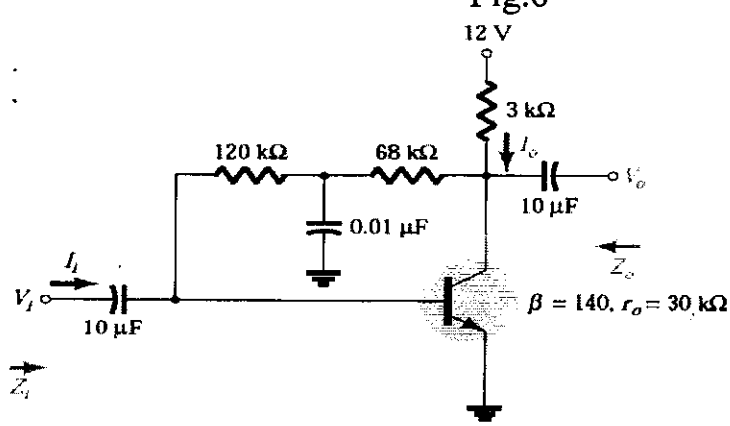



Fig. 7.

حل أسئلة الكتاب

(D) 1 (A)

$I_D = 0$ , $V_{D_2} = 12 - 0.7 = 11.3\,V$

$V_o = 0$

(B) (a) $V_L = 16 \times \frac{1.2}{2.2} = 8.73$ Volt.

$P_{Z_m} = 30\,mW$

$\therefore V_L < V_Z$ ∴ appear as ~~short~~ open circuit.

$\therefore V_L = 8.73$ Volt., $V_R = V_L = 8.73$ Volt.

$I_Z = 0$ , $P_Z = I_Z \cdot V_Z = 0$

(b) $V_L = 16 \cdot \frac{3}{4} = 12$ Volt.

$\therefore V_L > V_Z$ The zener diode appears as voltage source.

$\therefore V_L = V_R = V_Z = 10\,V$

$I_R = \frac{10}{1.2} = 0.99\,mA$ , $I_i = \frac{16-10}{1} = 6\,mA$

$\therefore I_Z = I_i - I_R \approx 5\,mA$

$\therefore P_Z = V_Z I_Z = 10 * 5 = 50\,mW$

Q2

$V_{rms} = 120$ V Sin Wave

$R_L = 1k\Omega$

a) $V_{dc} = 0.318 * V_m \rightarrow V_m = \frac{120}{\sqrt{2}} = 100.7$ Volt.

or

$V_{dc} = 0.318(V_m - 2(0.7)) = 0.318(100.7 - 2(0.7))$

$\therefore V_{dc} = 5.4$ Volt.

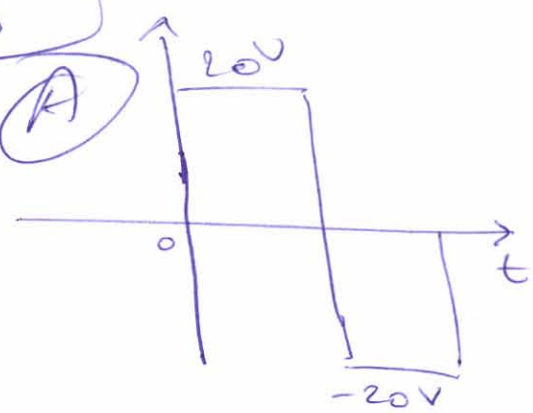
b) $PIV = V_m = 100.7$.

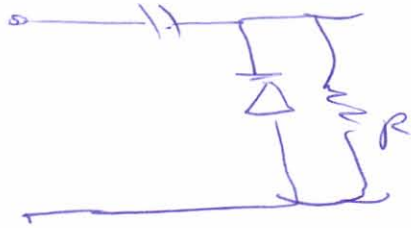
c) $I_m = \frac{V_m - 0.4}{1k\Omega} = \frac{100.7 - 1.4}{1k\Omega} = 99.7$ mA

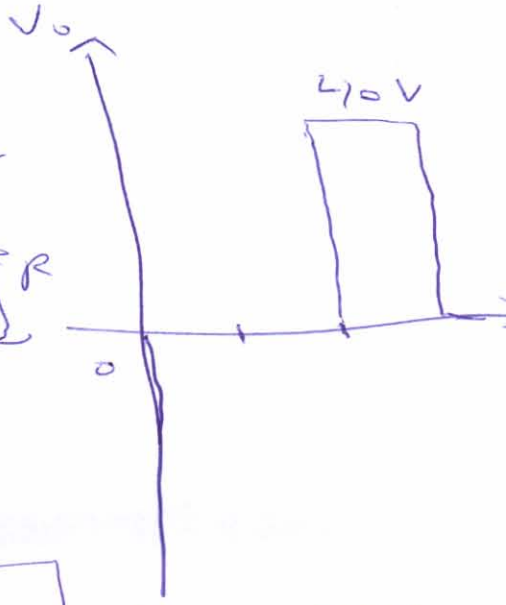
d) $P_D = V_D I_D = 0.7 * I_m = 88.7$ mW

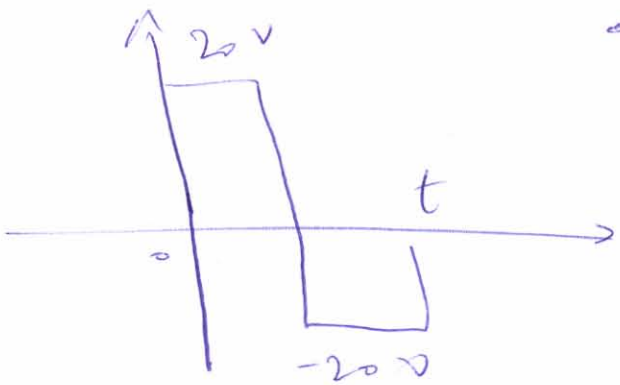
Q3

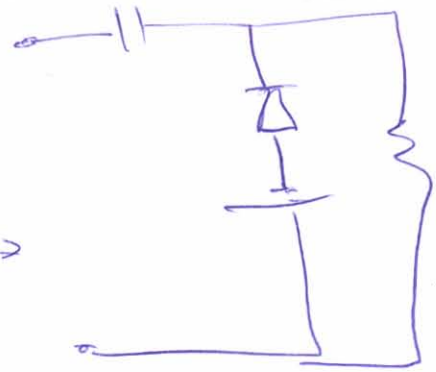
(A)

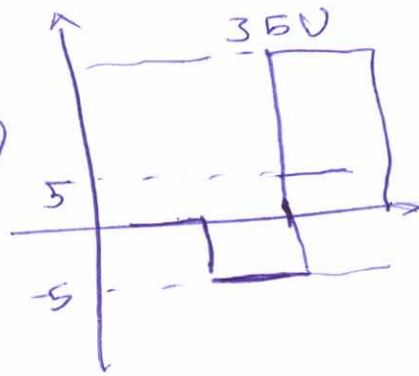


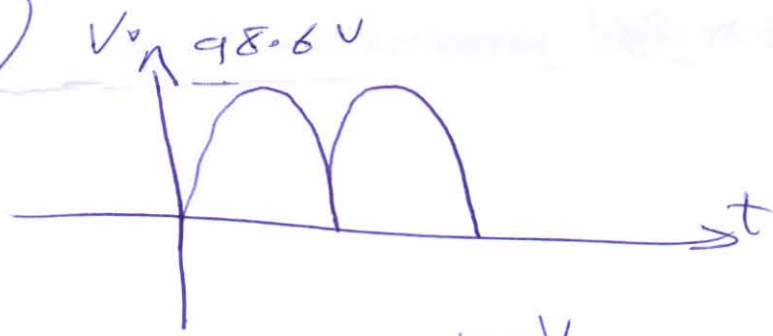



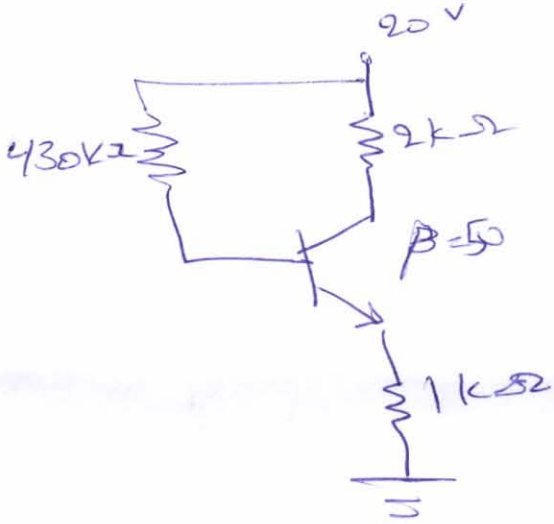



(B)




$P_{IV} = V_M = 100V$

Q4) $I_B, I_C, V_{CE}, V_C, V_E, V_B$




$$V_{CC} - I_B R_B - V_{BE} - I_E R_E = 0$$

$$I_E = (1+\beta) I_B$$

$$\therefore I_B = \frac{V_{CC} - V_{BE}}{R_B + (1+\beta) R_E}$$

$$I_B = \frac{19.3}{430k + (51)\,1k} = \frac{19.3}{481k}$$

$\therefore I_B = 40\mu A \Rightarrow I_E = (1+\beta) I_B$

$\therefore I_E = 51 * 40\mu A = 2\,mA$

$I_C \simeq I_E = 2mA$

$V_E = I_E R_E = 2 * 1 = 2$ Volt.

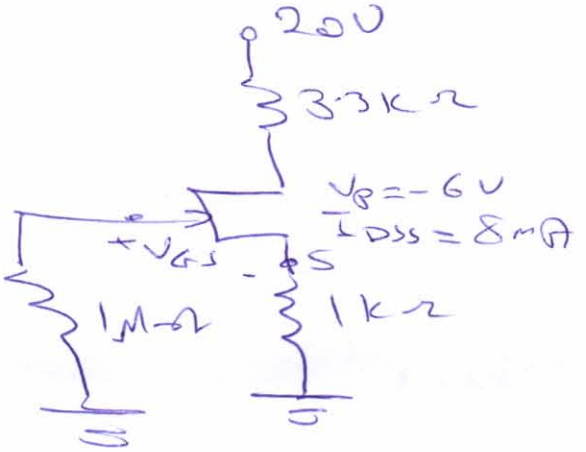
$V_B = V_{BE} + V_E = 0.7 + 2 = 2.7$ Volt.

$V_C = V_{CC} - I_C R_C = 20 - 4 = 16$ Volt.

$V_{CE} = V_{CC} - I_C R_C - I_E R_E$

$= 20 - 4 - 2 = 14$ Volt.

Q5) $V_{GSQ}$; $I_{DQ}$, $V_{DS}$, $V_S$, $V_G$, $V_D$




$I_G \approx 0$

$-V_G = I_G R_G = 0$

$V_{GS} = V_G - V_S$

$= 0 - I_D R_S$

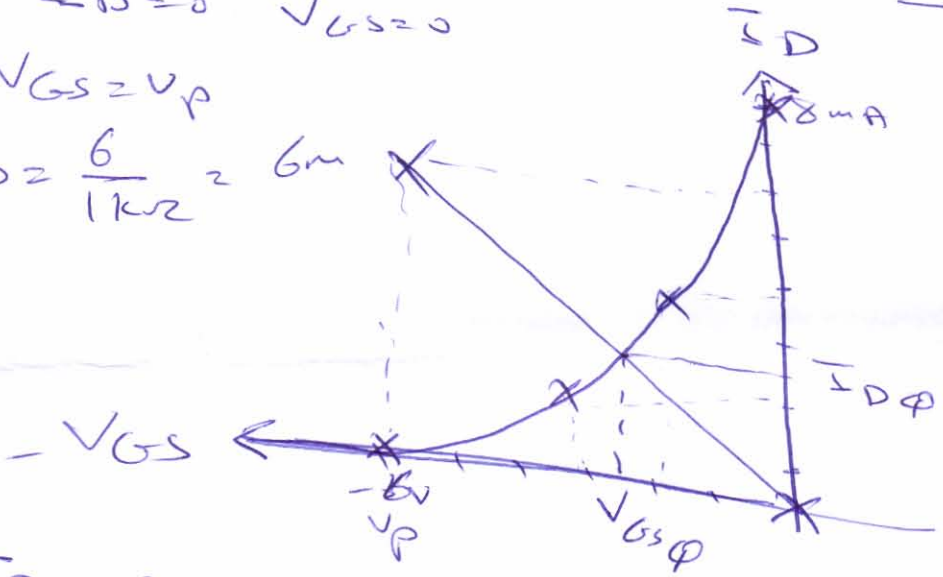
$I_D = I_{DSS}\left(1 - \frac{V_{GS}}{V_P}\right)^2$

if $I_D = 0$ $V_{GS} = 0$

if $V_{GS} = V_P$

$I_D = \frac{6}{1K\Omega} = 6m$

| $V_{GS}$ | $I_D$(mA) |
|---|---|
| 0 | $I_{DSS} = 8$ |
| -1.8 | 4 |
| -3 | 2 |
| -6 | 0 |




$I_{DQ} = 2.5mA$

$V_{GSQ} = 2.5$ Volt

$V_{DS} = V_D - V_S$

$V_D = I_D R_D = 2.5 * 3.3 = 8.25$ Volt

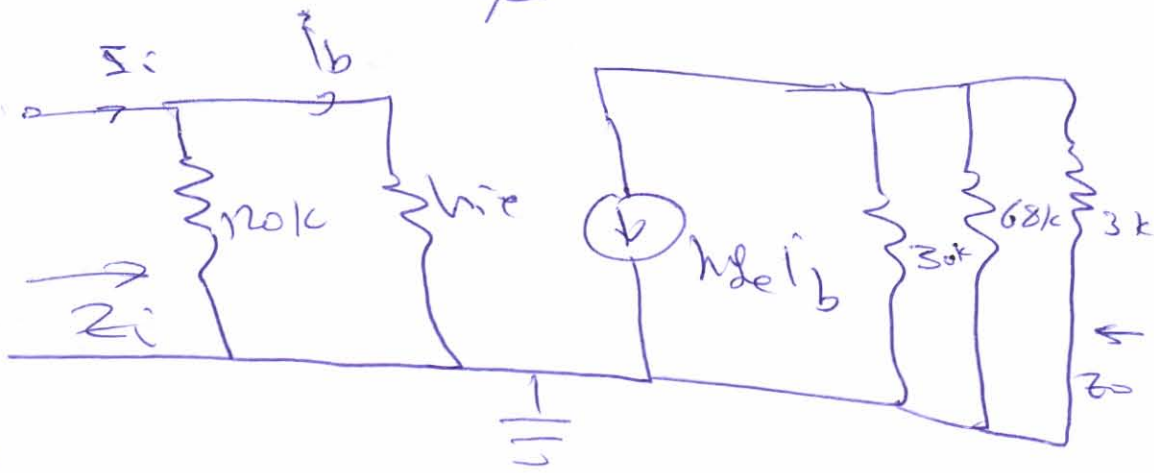
$V_S = 2.5 * 1 = 2.5$ Volt.

$V_{DS} = 20 - 8.25 - 2.5 = 20 - 10.75$

$\therefore V_{DS} = 9.25$ Volt

Q6)

$\beta = h_{fe} = 140$




$$r_e = \frac{26mV}{I_E} \Rightarrow I_E = (1+\beta) I_B$$

$$I_B = \frac{12 - 0.7}{188 + (141)*3} = \frac{11.3}{611\,k\Omega} = 10.4\,\mu A$$

$$I_E = 141 * 10.4 = 1mA.$$

$$\therefore r_e = \frac{26mV}{1mA} = 26\Omega$$

$$h_{ie} \approx \beta r_e = (141)\,26 = 9.7\,k\Omega$$

$$\therefore Z_i = h_{ie} \,//\, 120k = 0.974\,k\Omega$$

$$Z_o = 30k \,//\, 68k \,//\, 3k = 2.02\,k\Omega$$

$$A_v = -h_{fe}\frac{Z_o}{h_{ie}} = -140 \cdot \frac{2.02}{9.7} = -29.15$$

$$A_i = \frac{I_o}{I_c} \cdot \frac{I_e}{I_b} \cdot \frac{I_b}{I_i}$$