The University of Jordan
Faculty of Engineering and Technology
Electrical Engineering Department
Electronics 1 First Examination
Thurs. 7th March 2013 3-4 pm

Total 20 marks or 20 %

إسم الطالـــب : .....
الرقم الجامعي : .....
رقم التسلسل : .....
الشـــــعبة : .....

ملاحظات :

1) الفترة الإمتحانية ساعة واحدة
2) لا يسمح بإدخال الهواتف الجوالة
3) لا يسمح باستعمال الحاسبات المبرمجة
4) لا يسمح باستعمال القلم الرصاص بالإجابة باستثناء الرسومات
5) لا يسمح باستخدام قصاصات ورقية للمسودات بل يتم ذلك في الدفتر الإمتحاني

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(4) Q1) A piece of Silicon has $n_o = 5\times10^{15}\ cm^{-3}$ at 300K.

(a) Determine the hole concentration.

$n_o = 5\times10^{15}\ cm^{-3}$

2 $p_o = \frac{n_i^2}{n_o} = \frac{(1.5\times10^{10})^2}{5\times10^{15}} \Rightarrow p_o = 4.5\times10^{4}\ cm^{-3}$

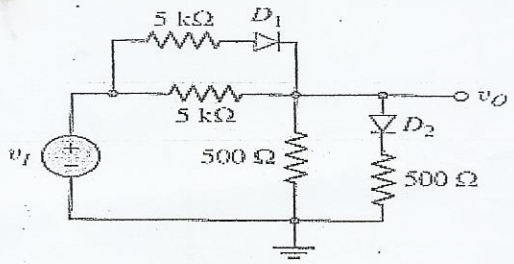
(b) Is the material n-type or p-type? And why?

1 $n_o \gg p_o \Rightarrow$ n-type

(c) Calculate the impurity doping concentration.

1 $n_o \cong N_d = 5\times10^{15}\ cm^{-3}$

(4) Q2) For the circuit shown, perform the following: (take $V_\gamma = 0.6$ V)



(a) For v_i small, both diodes are _____ OFF 1

Therefore v_o = - - - - - v_i $v_o = (0.5/5.5)\, v_i = 0.0909 v_i$ 1

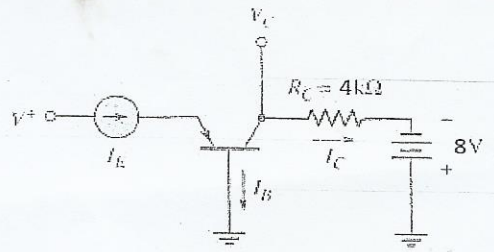
(b) When D_1 just turns on and D_2 is off find v_o .

In this case $v_i - v_o = 0.6$ V, $v_i - 0.0909 v_i = 0.6$, $v_i = 0.66$, $v_o = 0.06$ V

2

(3)

Q3) For the BJT circuit shown $\beta = 50$ and $I_E = 0.8$ mA



Determine I_B, I_C and V_C.

$I_B = I_E/(\beta+1) = 0.8/51 \times 1000 = 15.686\ \mu A$
$I_C = I_E\ (\beta/(\beta+1)) = 0.8x50/51 = 0.784$ mA
$V_C = 8-0.784x4 = 4.864V$

(5) Q4) For the circuit shown below $V\gamma = 0$ and $r_f = 0$. Plot v_o versus v_i for $0 \le v_i \le 30$ V

$v_I = 0$, D_1 off, D_2 on

$$I = \frac{10 - 2.5}{15} = 0.5 \text{ mA}$$

$v_0 = 10 - (0.5)(5) \Rightarrow \underline{v_0 = 7.5 \text{ V for } 0 \le v_I \le 7.5}$

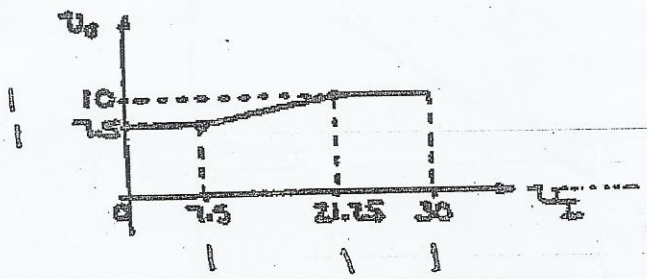
For $v_I = 30$ V, D_2 off, $v_0 = 10$ V

Determine v_I when $V_x = 10$

$$I = \frac{v_I - 2.5}{25}$$

$V_x = 10 = I(10) + 2.5 \Rightarrow I = 0.75$ mA

$v_I = (0.75)(25) + 2.5 = 21.25$



(4) Q5) The transistor in the circuit shown below has $\beta = 120$. Determine I_c and V_{EC}. Plot the load line and the Q point.

5.21

$$I_B = \frac{5 - 0.7}{250} \Rightarrow 17.2\ \mu A$$

$$I_C = (120)(0.0172) = 2.064\ \text{mA}$$

$$V_C = (2.064)(1.5) - 5 = -1.90\ \text{V}$$

$$V_{EC} = 5 - (-1.90) \Rightarrow \underline{V_{EC} = 6.90\ \text{V}}$$