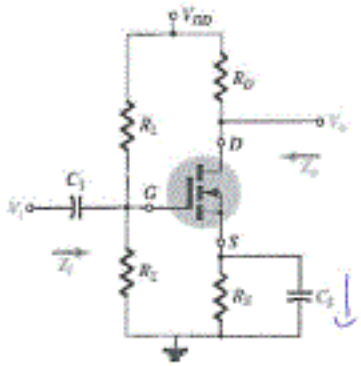
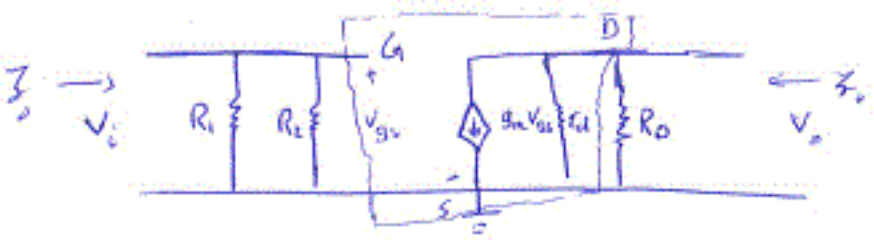
Question 6 (10 points)

a) Draw the small signal model of E-MOSFET

b) Derive the relationship for Input/output Impedance and Voltage gain.





$Z_i = R_1 \| R_2$ $\quad Z_o = R_D \| r_d$

$A_v = \dfrac{V_o}{V_i} = \dfrac{-g_m V_{gs}(R_D \| r_d)}{V_{gs}} = -g_m (R_D \| r_d)$

10

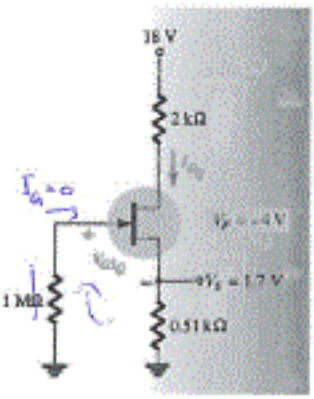
Question 5 (10 points)

(a) For the given JFET the Vs is 1.7V, Find

I_{DQ}

V_{GSQ}

I_{DSS}



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

$$I_D = \frac{V_S}{R_S} = \frac{1.7}{510} = 3.33\,mA = I_S$$ ✓

$$V_{GS} = V_G - V_S \Rightarrow V_{GS} = -V_S \Rightarrow V_{GS} = -1.7V$$ ✓

$$I_{DSS} = \frac{I_D}{\left(1 - \frac{V_{GS}}{V_P}\right)^2} = \frac{3.33m}{\left(1 - \frac{-1.7}{-4}\right)^2} = 10.07\,mA$$

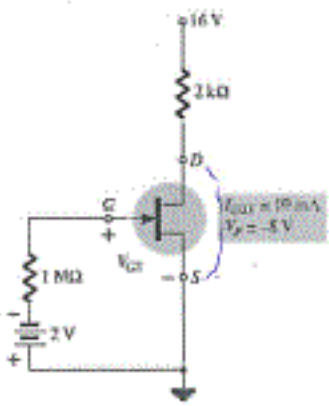
6

b) For the fixed biased configuration Determine

V_{GSQ}

I_{DQ}

V_{DS}



$$V_{GS} = -V_{GG} = -2V$$ ✓

$$I_D = I_{DSS}\left(1 - \frac{V_{GG}}{V_P}\right)^2 = (10m)\left(1 - \frac{-2}{-8}\right)^2$$ ✓

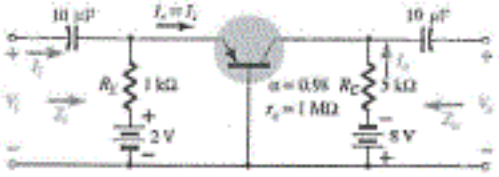
$$= 5.625\,mA$$

$V_{DS} = V_{DD} - I_D R_D$ no resistor in source terminal

$V_{DS} = 16 - (5.625m)(2K) = 4.75\,V$

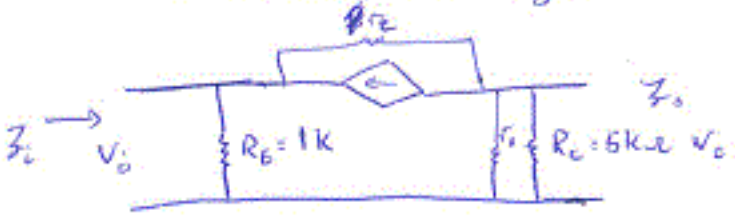
Question 4 (10 points)

Find and compare the value of Input/Output Impedence and voltage gain of the given Common base and Common Emitter configuration

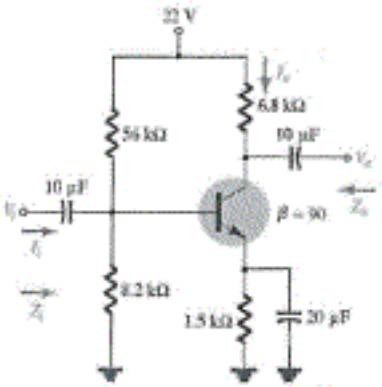


Solution

if we draw small signal



$r_e = \frac{26m}{I_E}$



$Z_i = R_E \| \beta r_e$

$I_E = \frac{2 - 0.7}{1k} = 2mA$

$r_e = \frac{26m}{2m} = 13$

$A_i = -\alpha = -0.98$

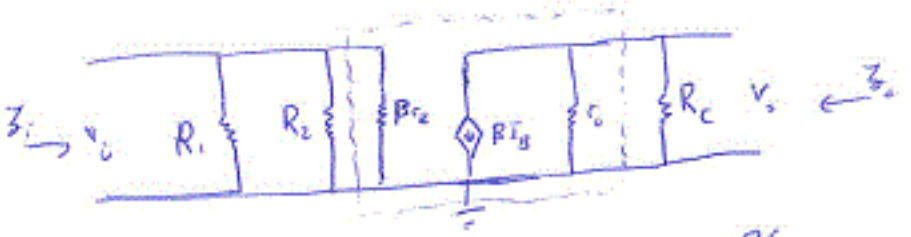
$Z_o = R_C = 5k\Omega$

because $r_o \gg R_C$

$Z_i = 12.83\Omega$

$A_V = \frac{V_o}{V_i} = \frac{R_C}{r_e} = \frac{5k}{13} = 384.61$ V

5



$Z_i = R_1 \| R_2 \| \beta r_e$

$V_{BE} = V_B - V_E$

$0.7 = 2.81 - V_E$

$V_E = 2.81 - 0.7 = 2.11$ V

$\therefore I_E = \frac{2.11}{1.5k} = 1.407mA$

$\therefore r_e = \frac{26m}{1.407m} = 18.48$

$r_e = \frac{26m}{I_B} = \frac{26m}{(\beta+1) I_B}$

$V_B = \frac{22 \times 8.2k}{8.2k + 56k} = 2.81$ V

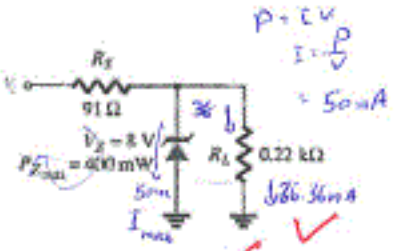
$\therefore Z_i = \frac{7152.65 \times 18.48 \times 90}{7152.65 + 18.48 \times 90} = 1349.42\Omega$

$Z_o = R_C = 6.8k\Omega$

$A_V = \frac{V_o}{V_i} = \frac{-R_C}{r_e} = -367.96$ V

Question 3 (10points)

(a) For the given circuit calculate maximum V_i that will maintain V_l (Vload) to 8V and not exceed the power rating of diode



$P = IV$, $I = \frac{P}{V}$, $= 50mA$

Solution

$$8 = \frac{V_{i\,min}(0.22k)}{(91)+(0.22k)}$$

$$V_{i\,min} = \frac{8(91+0.22k)}{0.22k} = \boxed{11.31\,V} \quad \text{this min } V_i$$

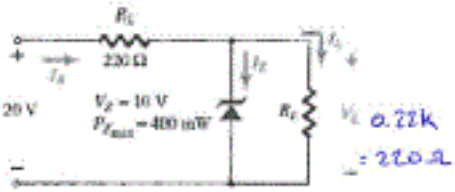
$$V_{i\,max} = V_z + IR_s$$

$$= 8 + (50)(91) = \boxed{12.55\,V}$$

$$(50+36.36)(91) = 15.86$$

4

b) Determine V_L, I_{RL}, I_Z, I_{Rs} for the given Zener diode circuit



$$V_L = \frac{20 \times 0.22k}{0.22k + 220} = \boxed{10\,V}$$

$$I_{R_L} = \frac{10}{0.22k} = \boxed{45.45mA}$$

$$I_z = \frac{P}{V} = \frac{400m}{10} = \boxed{40mA} \quad 45.45 - 40m = \boxed{5.45mA}$$

440
45.45 mA

$$I_R = I_z + I_{R_L} \quad 45.45m + 5.45m = \boxed{50.9\,mA}$$

Question 2 (10 points)

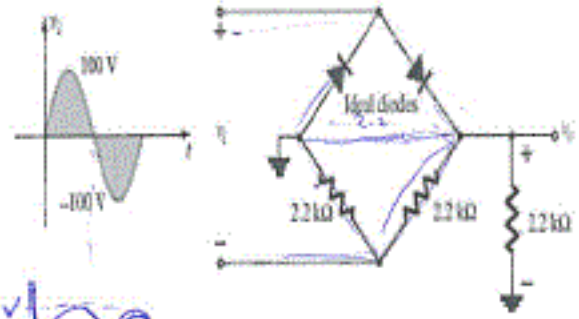
a)For the Diode rectifier circuit draw the output wave farm with correct voltage levels.

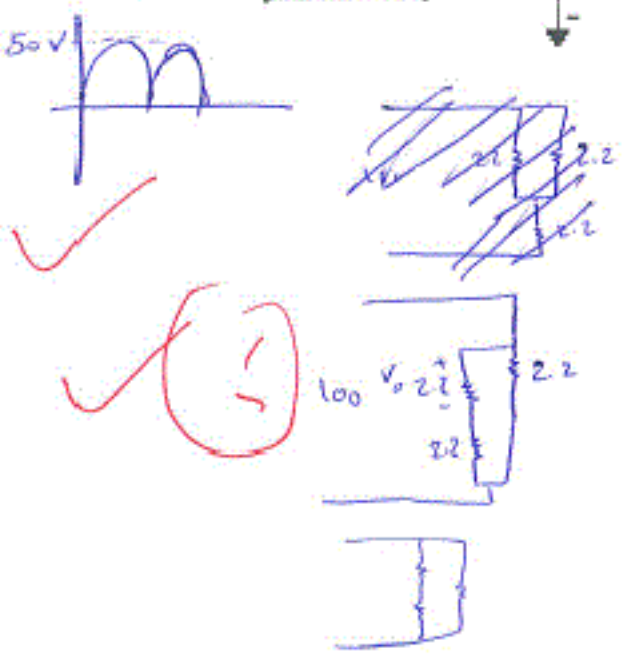
What is average DC value at the output? (5)

$V_{dc} = 0.636\, V_m$

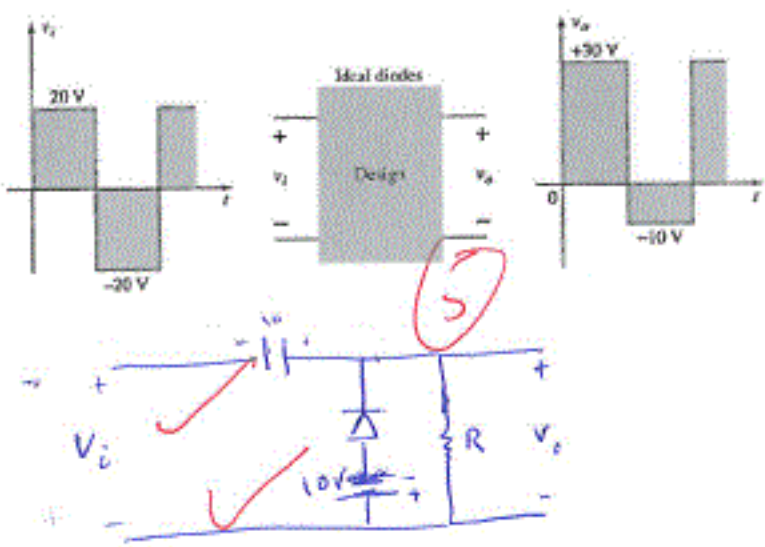
$= 0.636(50)$

$= 31.8\ V$





b) Design the diode circuit according to given specs (5)

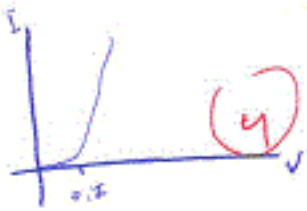


Question 1 (8 points)
(a) Explain semiconductor material. How n-type and P-type material are formed. (4)
(b) Explain semiconductor diode. Show characteristic curve for semiconductor diode. (4)
(c) Explain how LED works. (2)

Solution

a) Semiconductor material is between conductor and insolator material like silicon.
We can form n-type material by add Pentavalent elements so that the majorty is elections (carrier)
The P-type material can be formed by add trivalent elements and the majorty carrier is holes. (4)

b) semiconductor diode is formed by N-type and P-type materials, and called NP junction
it has a polarity so if you want to connect it you have to connect the ⊖ sicle of battery with N and ⊕ with P other wise thes depletion region will get bigger until it reach the breakdown voltage and then burn.



(4)

for silicon diode it will start conduct in 0.7V

c) LED is Light emitting diode and formed by Gallium arsenicle
when you connect it to voltage source the photons start moving. (1)

Islamic University Faculty of Engineering Department of Electrical Engineering		الجامعة الإسلامية كلية الهندسة قسم الهندسة الكهربائية

EE 212 - ELECTRONICS II

Fall Semester 2017-2018

Final Exam

Exam Date: December 31, 2017; Exam Duration: 120 minutes

Student's Full Name: [redacted]

Student ID #: [redacted] **Section #:** 1050 **Signature:** [redacted]

Instructions:

- **Write your student ID number on the top of each page**
- **Write the solution in the space provided under each question**
- **Show all the details of your analysis and calculations**

Good Work Keep it up.

Question No.	Points Assigned	Points Awarded
1. [CO_1, PI_1_45, SO_1]	10	9
2. [CO_3, PI_5_51, SO_5]	10	10
3. [CO_4, PI_1_74, SO_1]	10	9
4. [CO_6, PI_1_72, SO_1]	10	10
5. [CO_8, PI_5_52, SO_5]	10	10
6. [CO_9, PI_5_54, SO_5]	10	10
Total	60	58

Instructor's Full Name	Dr. Abdul Waheed Malik
Signature	