Tema 1

28/40

Compromiso de Honor

Reconozco que el presente deber está diseñada para ser resuelto de manera individual, y no se permite la ayuda de fuentes no autorizadas ni copiar. Firmo al pie del presente Compromiso, como constancia de haber leído y aceptado la declaración anterior.

Alexandra Barreto A.

Firma de Compromiso del Estudiante.

Datos:

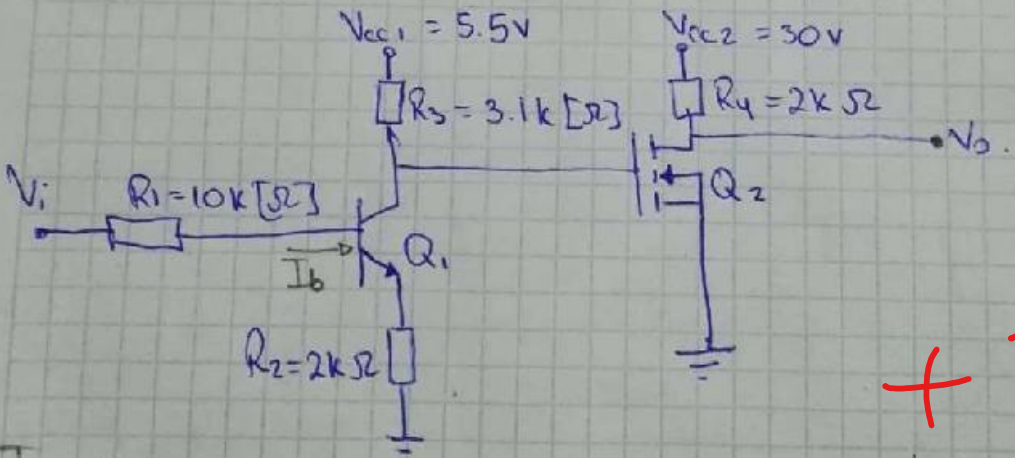
Q_1 : Si, $\beta = 50$, $V_{CE(sat)} = 0.4v$

Q_2 : $V_t = 2[v]$, $K = 1\left[mA/V^2\right]$.

a) V_o ; $V_i = 0.3\,v$

b) V_o ; $V_i = 3v$.

c) V_i ; $V_o = 17.5\,v$



+3P

$$I_b = \frac{V_i - V_{BE}}{R_1 + R_2}$$

$$I_b = \frac{V_i - 0.7v}{(10k + 2k)}$$

$$I_c = (\beta) I_b$$

$$I_c = 50\left(\frac{V_i - 0.7}{12k}\right)$$

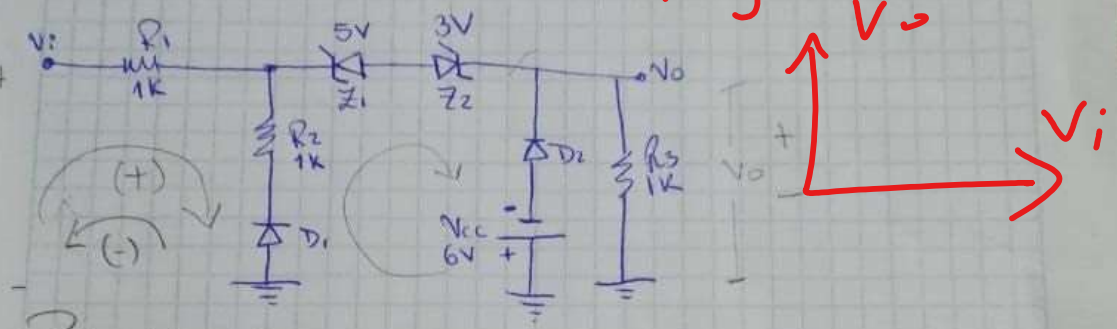
$$I_e = I_c + I_b.$$

// Tema 4

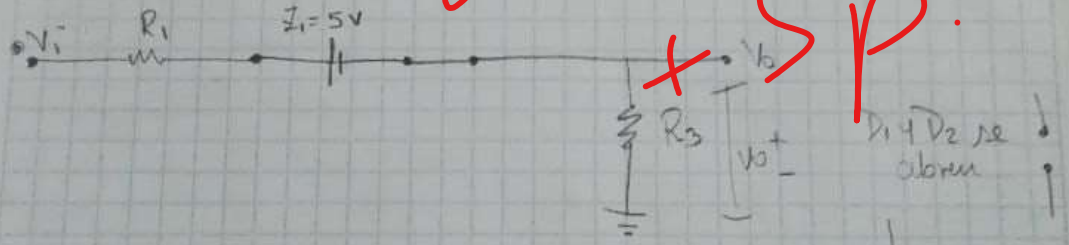
Tema 3

Graficar V_o vs V_i en el intervalo $0 < V_i < +15V$.

V_i nunca es negativo



Para $V_i > 0$



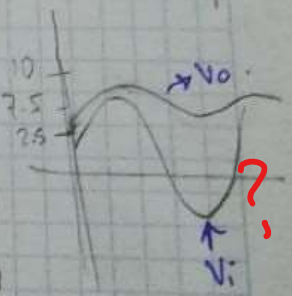
+ SP.

D_1 y D_2 se abren

$$\frac{V_o - V_i - 5}{R_1} + \frac{V_o}{R_3} = 0 \Rightarrow V_o - V_i - 5 + V_o = 0$$

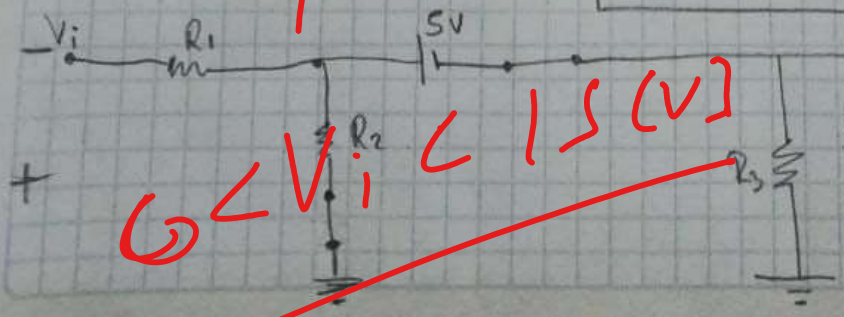
$$2V_o - V_i - 5 = 0$$

$$\boxed{V_o = \frac{V_i + 5}{2}}$$



?

Para $V_i < 0$ X



$0 < V_i < 15$ [V]

$$\frac{V_o + V_i}{R_1} + \frac{V_o}{R_2} + \frac{V_o}{R_3} = 0$$

$$V_o + V_i + V_o + V_o = 0$$

$$3V_o + V_i = 0$$

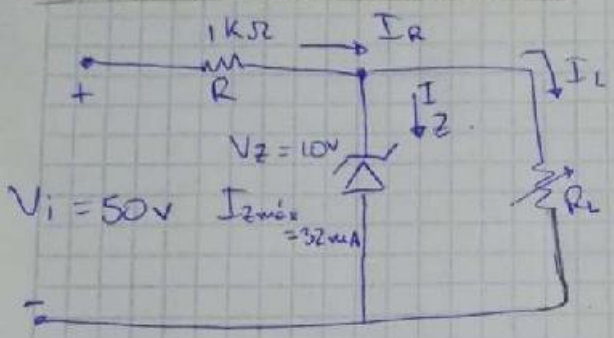
$$\boxed{V_o = -\frac{V_i}{3}}$$

Tema 4.

a) $R_{L_{min}}$; Z conduzca

b) $R_{L\ max}$; Z no se queme.

c) Potencia máx q' puede disipar el diodo zener.



Para que el zener conduzca debe $V_o > V_Z$

$\therefore$

$V_{R_L} \geq V_Z$

$V_Z = V_{R_L} = I_L R_L$

$10 = I_L R_L$

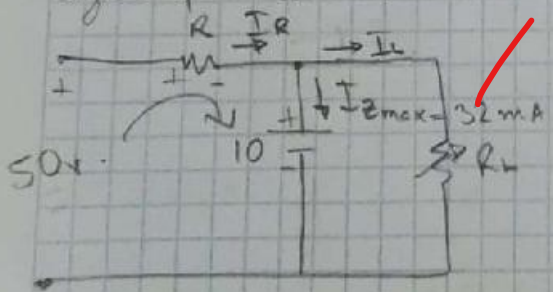
$R_{L_{max}} = \frac{10}{I_L} = \frac{10}{8mA} = 1250\Omega$

b) $R_{L\ max} = 1250\Omega$ ✓ top

$I_R = I_Z + I_L$

$I_R = \frac{V_i}{R} = \frac{50}{1K} = 0.05A$

Apenas q conduce



$I_R = I_{Z max} + I_L$

$I_L = I_R - I_{Z máx}$

$I_L = 8mA$.

$I_{min} = 0A$

$I_R = I_{L_{min}} = 40mA$

$I_R = \frac{V}{R} = \frac{50-10}{1K} = \frac{40}{1K} = 40mA$

$R_{L_{min}} = \frac{10}{I_{L_{max}}} = \frac{10}{40mA} = 250\Omega$ ✓ top

a) $R_{L\ min} = 250\Omega$ ✓

c) $P = VI$

$P_{max} = I_{max}^2 R_{max}$

$= (32mA)^2 (1250\Omega)$

$P_{max} = 1.28W$ ✗

Nombre: Luis Camacho Coello

Compromiso de Honor

Reconozco

29/100

$I_{10k\Omega} = \frac{0,3-0,7}{10k\Omega+2k} = -0,04mA$ +1P

$I_B = I_{10k\Omega}$

$I_B = -0,04mA$

$I_{C=0}$ $V_q = 5,5V$

$I = K(V_a - V_T) =$

$I = \frac{1}{V^2}(5,5-2)$

$I_D = 12,25mA$

$V_0 = 30 - 12,25(2k) =$

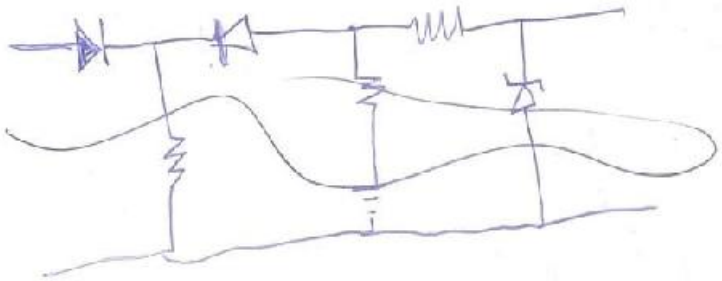
$V_0 = 5,5V$ ✓ +4P

$V_0 = V_{DS} = 5,5V$

$Q(5,5V; 12,25mA; 5,5V)$

$V_e = 3V$

$V_{BE} = 0,7V$



$V_{BE} = 0,7V$

$V_B - V_E = 0,7$

$V_B = 0,7$

$i_{10K} = \frac{3-0,7}{10K} = 0,23mA$ +2P

+1P

$I_{10K} = I_B$

$I_B = 0,23mA$

$I_C = \beta I_B$

$I_C = 11,6mA$

$V_C = 5,5 - 3,1(11,5)$

$V_C = -30,1S$

$I_C = 0$ y $V_Q = 5,5$

$V_Q = 5,5 \quad V_E = 2V$

c) $i \quad \frac{24-17,5}{1K} = 6,25mA$ ✓

+1P

$I_D = k(V_{GS} - V_{Th})^2$

$6,25 = \frac{1}{2}(V_{GS} - 2)^2$

$V_{GS} = 4,5$

$I_C = \frac{6 - 4,5}{2K} = 1,5/2K$

$I = 0,75mA$

$I_B = \frac{0,75}{\beta} = \frac{0,75}{25} = 0,03 mA$

$i_{10\Omega} = \frac{Ve - 0,7}{10K}$

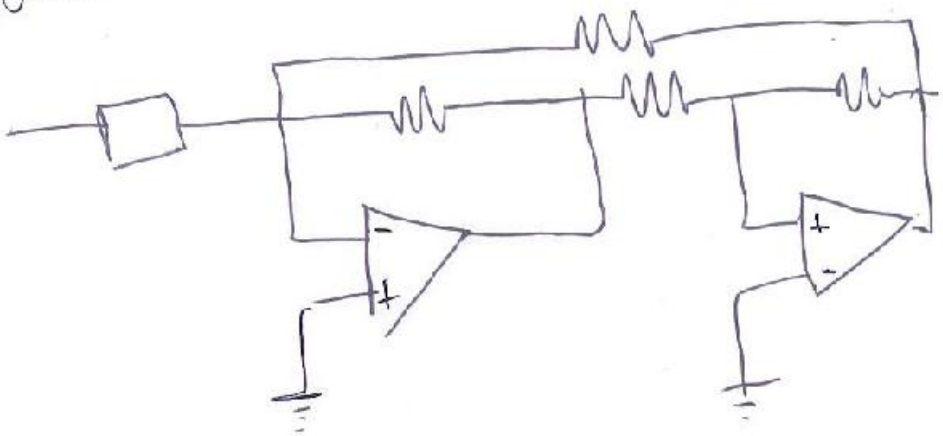
Lei

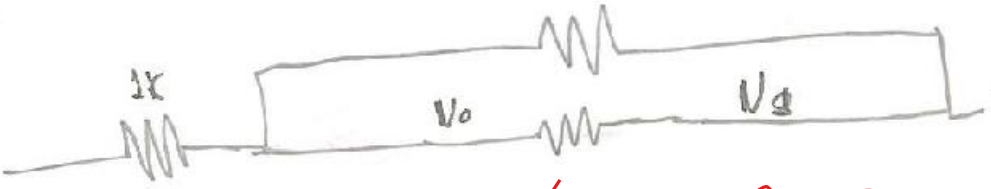
$I_B = I_{10K}$

$0,03A = \frac{Ve - 0,70}{10}$

$Ve = 1,13V$

Segundo Teno



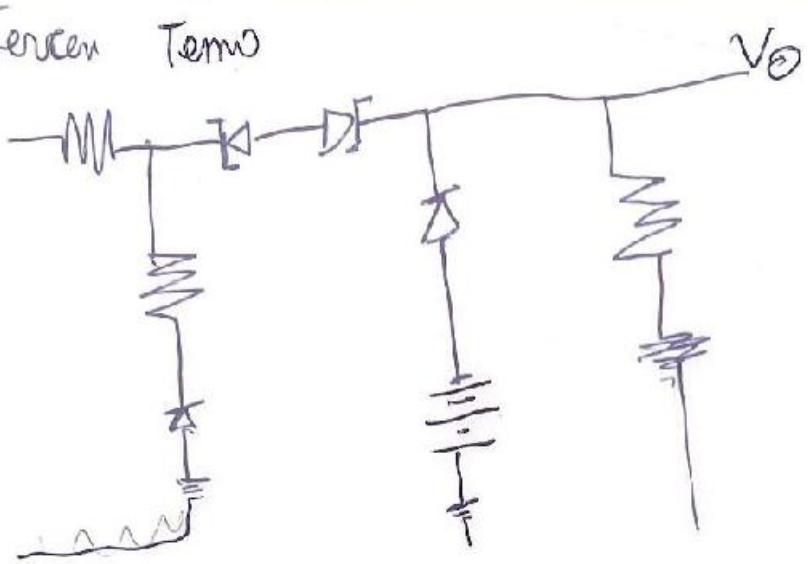


$$\frac{V_o}{V_s} = -\frac{R_f}{R_1}$$ ✓ +2p

$$V_o = 5\left(\frac{2}{1}\right)$$

$$V_o = -10\ \mathrm{sen}(\omega t)$$

Tercera Tarea

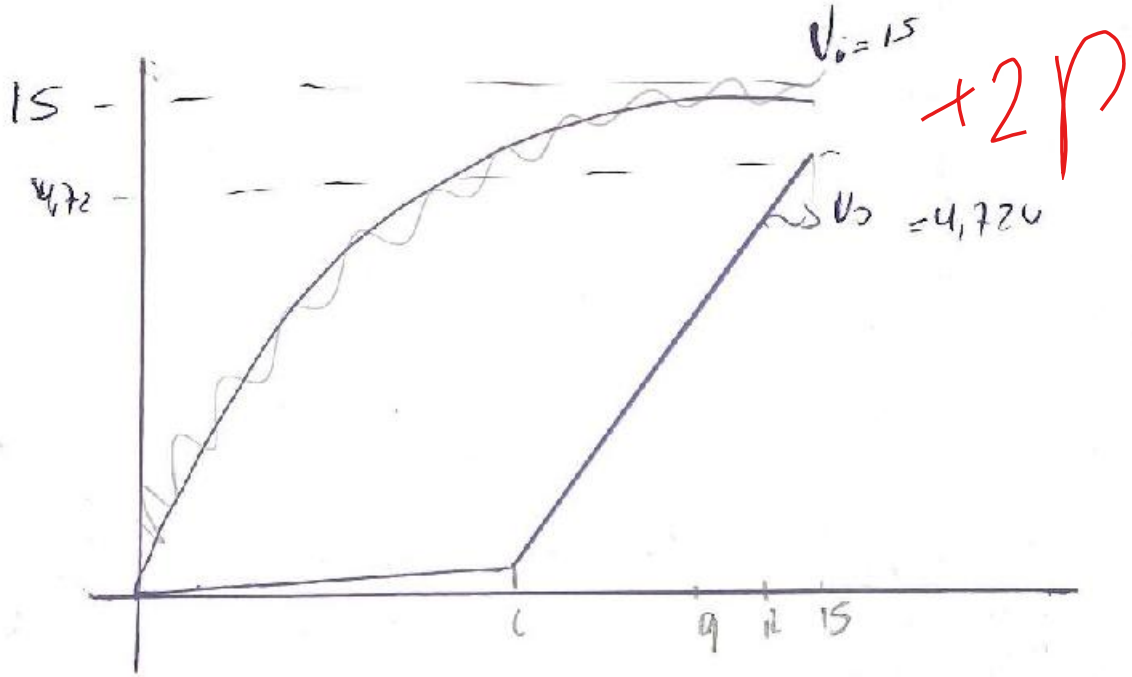


$V_i - V_{Z1} = I_3(R_3 + R_2) - I_2 R_2$

$V_{dc} = V_{Z2} = 6V + I_2 R_2 - I_3 R_3$

$V_{Z2} = I_2 R_2 + I R_3$

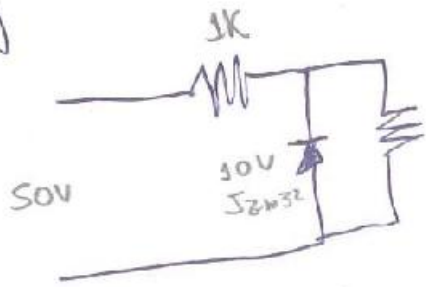
V_i	V_o
0	-6 ?
3	532,45 mV
6	289,14 mV
9	1,747 V
12	3,23 V
15	4,724



+2p

Cuarto tema

a)



a) $= V \Rightarrow \frac{R_L V_i}{R + R_L}$

$R_V + R_L V = R_L V_i$

$R_V = R_L (V_i - V)$

$\frac{R_V}{(V_i - V)} = R_L$

$\frac{10(1000)}{50-10}$

$250\,\Omega = R_L$ ✓ +10p

b) $V_L = V_Z$

$V_R = V_i - V_L = 50 - 10 = 40$

$I_L = \frac{V_L}{R_L} = \frac{10}{R_L}$

$0{,}032 = \frac{10}{R_L}$ +5p

$R_L = \frac{10}{0{,}032}$

$R_L = 312{,}5\,\Omega$

c) Potencia

$P_Z = V_Z I_Z$

$P_Z = 10(0{,}032)$ +5p

$P_Z = 0{,}32\,W$ ✓

Cac. 2013-108 - Compromiso de honor etica de los estudiantes al momento de realizar un examen escrito de la ESPOL

20/20

Compromiso de Honor

Reconozco que el presente deber esta diseñado para ser resuelto de manera individual, y no se permite la ayuda de fuentes no autorizadas ni copiar. Firmo al pie del presente compromiso, como constancia de haber leido y aceptar. La declaracion anterior

JE Chavez
0942476777

Examen Electronica

Nombre: Edwin Chavez López 23 de Noviembre 2021

Primer tema

a) V_o para $V_i = 0.3$

$i_{10K\Omega} = \frac{0.3 - 0.}{10K} = -0.04\ mA$

$V_t = 2$

$V_{Q_2} = 5.5\ V$

$I_{r4} = K(V_{Q_2} - V_t)$

$i_{r4} = K(5.5 - 2)$

$= 1(3.2)^2\ mA$

$i_{r4} =$

$V_o = 30 - i_{r4}(2K)$

$= 30 - (3.2)^2(2)$

$V_o = 19.76\ V$ x

Q1 (3.5pts)

b) V_o para $V_i = 3\,V$

$V_o = 5.5$ $\quad i_{10K} = \frac{3 - 0.6}{10} = 0.36\,mA$

$V_t = 2$

$i_{r4} = 10 - 24$

c) Calcular V_i para $V_o = 17.5\,V$

Segundo tema:

Tercer tema:

Graficar: $0 < V_i < +15\,V$

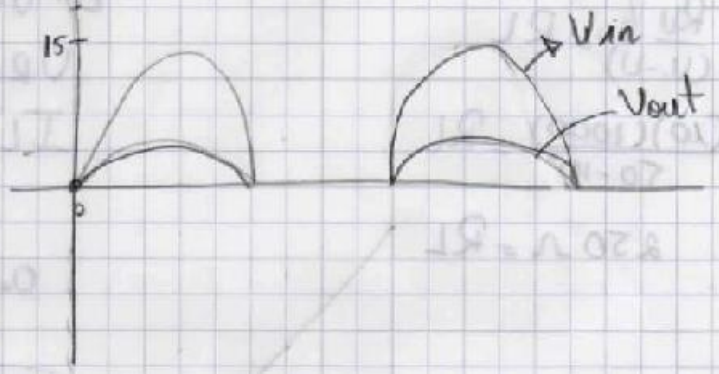
$M_1: V_i - V_{Z1} = I_1(R_1+R_2) - I_2(R_2)$

$M_2: V_{dc} - V_{Z2} = 6\,V + I_2(R_2) - I_3(R_3)$

$M_3: V_{Z2} = I_2(R_2) + I(R_3)$

+ 1P

V_i	V_o [nV]
0	-6.0092
3	532.45 uV
6	209.14 mV
9	1.747 V
12	3.23 V
15	4.724 V



Porque $V_o = -6$

V_o

V_i

Cuarto Tema:

a)

$$R_S = \frac{V_S - V_o}{I_L + I_Z}$$

$$V_i = \frac{R_L V}{R + R_L} \Rightarrow R V + R_i V = R_L V_i$$

$$R V = R_L (V_i - V)$$

$$\frac{R V}{(V_i - V)} = R_L$$

$$\frac{(10)(1000)}{50 - 10} = R_L$$

$$250\,\Omega = R_L$$

+1 VP

c) $I_{max} = \frac{P}{Volt}$

32 mA (Vd)

$P = 320$ mW

+ SP

b) $V_L = V_Z$

$V_R = V_i - V_L = 50 - 10$

$I_L = \frac{V_L}{R_L} = \frac{10}{R_L}$

$0,032 = \frac{10}{R_L}$

+ 3 P

$R_{L\,max} = 312,5\,\Omega$

Paralelo 2

Anthony Roger Chiquito Espinoza

23 de Noviembre del 2021

Compromiso de Honor

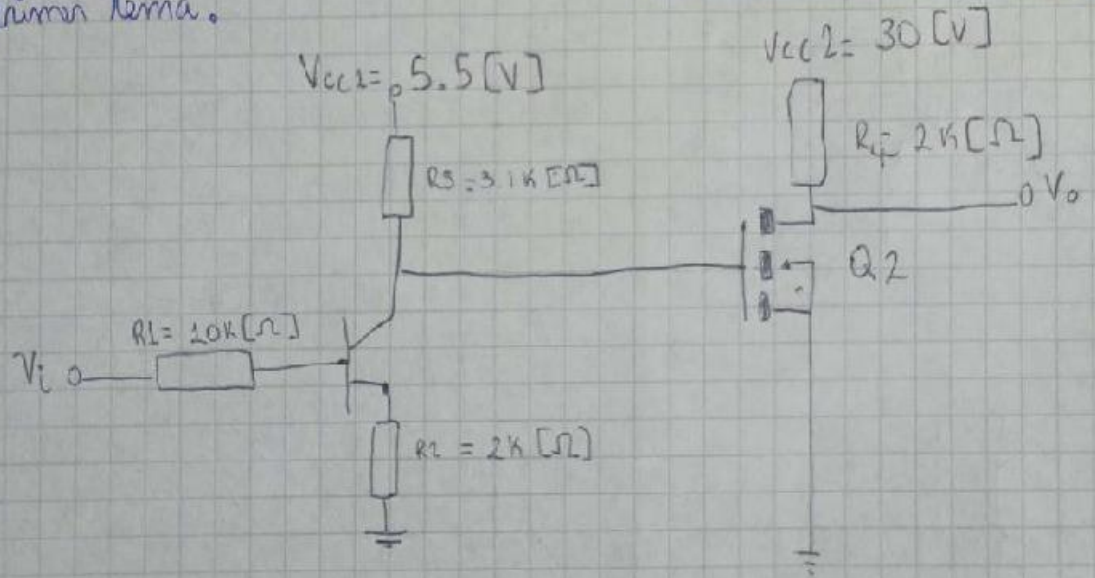
G1 pav

Reconozco que el presente deber está diseñado para ser resuelto de manera individual, y no se permite la ayuda de fuentes no autorizadas ni copiar. Firmo al pie del presente compromiso, como constancia de haber leído y aceptar la declaración anterior.

Anthony Chiquito

Firma de Compromiso del estudiante

primer tema.



Paralelo

Anthony Roger Chiquito Espinoza — 23 de noviembre de 2021

$V_{be} = 0.5\ V$

$Q1\ \beta = 50$

$V_{ce\,sat} = 0.2\ V$

Q_2: $V_T = 2\ V$

$K = mA/V^2$

Q1:

$V_i = I_B R_1 + V_{BE} + I_E R_2$ $\quad V_{ce} = 5.3\, I_B (\beta R_3 + R_2(\beta+1))$

$I_B = \frac{V_i - V_{BE}}{R_1 + (\beta+1) R_2} = \frac{V_i - 0.5}{112}$ $\quad V_{ce} = 5.3 - 257\, I_B$

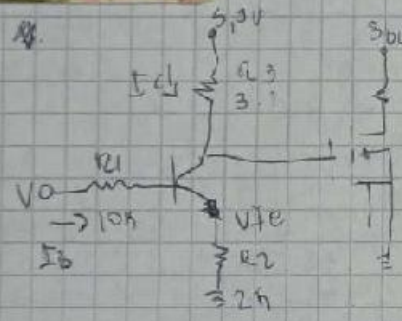
Q_2:

$5.3 = R_3 \beta I_D + V_{GS}$; $V_{GS} = 5.3 - R_3 \beta I_D$

$I_D = K(V_{GS} - V_T)^2$ $\quad V_{GS} = 5.3 - 155 I_D$

$I_D = (V_{GS} - 2)^2$

$V_{DS} = 30 - R_4 I_D = 30 - 2 I_D$



a) $V_i = 0,3$ $\quad V_{GS} = 3,3\ V$

$I_B = 0$ $\quad I_D = 12,23\ mA$

$V_{CE} = 5,3\ V$ $\quad V_D = 5,3\ V$

$V_D = V_{DS} = 5,3\ V$ ✓ +4p

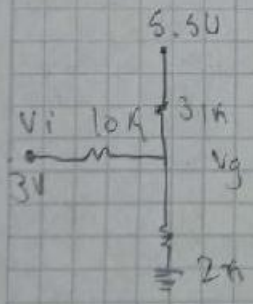
b) $V_i = 3V$

$I_B = 2,03 \times 10^{-2}\ mA$ $\quad V_{CE} = 0,2\ V$ → Q_1: 2.

$V_g = (5.3 - 0.3)\frac{1.64}{1.64 + 3.1} + 0.5$ $\quad$ +2p

$V_g = 2.22\ V$ $\quad Q_2$: Zilnod

$V_{GS} = 2.22\ V$



$I_S = 0.0574\ mA$

$V_{DS} = 29.86\ V$ ✓ +4p

$V_{DS} = 29.86\ V$

Parcial 2

Anthony Roger Chiquito Espinoza. 23 de Noviembre del 2021

c) $V_i = ?$ $V_o = 17.3\,V$

$V_{OS} = 17.3 \rightarrow I_D = \frac{3 - V_{OS}}{2} = 6.23\,mA$

$\rightarrow V_{GS} = 2 + \sqrt{I_D} = 4.3\,V$

$I_B = \frac{5.3 - V_{GS}}{1.53} = 6.43 \times 10^{-3}\,mA$

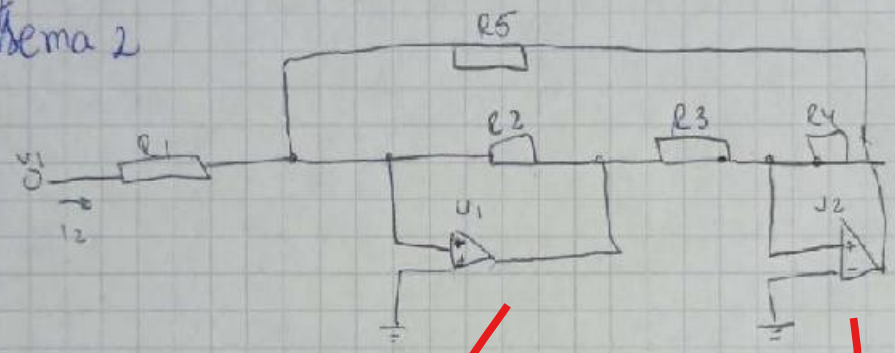
$V_i = 112\sqrt{6 + 0.7} = 1.40\,V$

Q1 y Q2 en zona activa

+5p

+5p

Tema 2



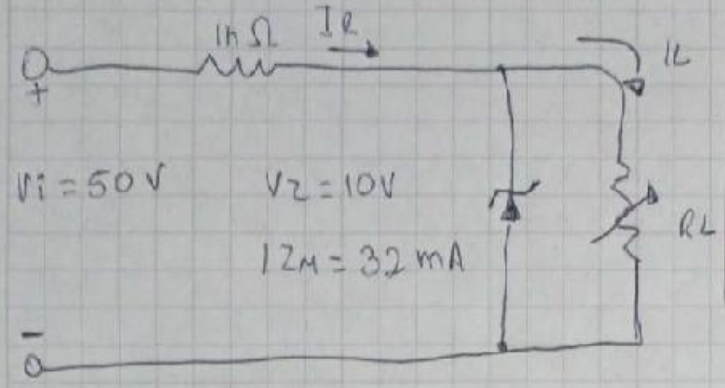
a) $I_2 = \frac{V_1 - \vec{V}}{R_1} = \frac{V_i}{R_1} = \frac{5\,sen\,\omega t}{1K} = 5\,sen(\omega t)\,[mA]$

+15p

Paralelo 2

Anthony Roger Chiquito Espinoza 23 de Noviembre del 2021

Tema 4.



$V_Z = 10V$

$I_{Z\,min} = 0mA$

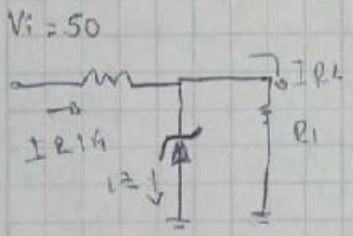
$I_{Z\,max} = 32\,mA$

$I_R = I_Z + I_{RL}$

$I_1 = I_R - I_Z$

$\frac{V_Z}{R_2} = 40 - I_Z$

$R_2 = \frac{10}{40 - I_Z}$



$R_{L\,max} = \frac{10}{40 - I_{Z\,max}} = \frac{10}{40 - 32} = 1.23\,K\Omega$

$R_{L\,min} = \frac{10}{40 - I_{Z\,min}} = \frac{10}{40 - 0} = 0,23\,K\Omega$

$I_L = \frac{V_Z}{R_L}$

$I_R = \frac{V_i - V_Z}{R} = \frac{40}{1\,K} = 40mA$

a) $R_{Z\,min} = 0.23\,K\Omega$

b) $R_{Z\,max} = 1.23\,K\Omega$

c) $P_{Z\,max} = 320\,mW$

$P_{Z\,max} = V_Z\, I_{Z\,max}$

$I_{Z\,max} = 32\,mA$

$P_{Z\,max} = 320\,mW$

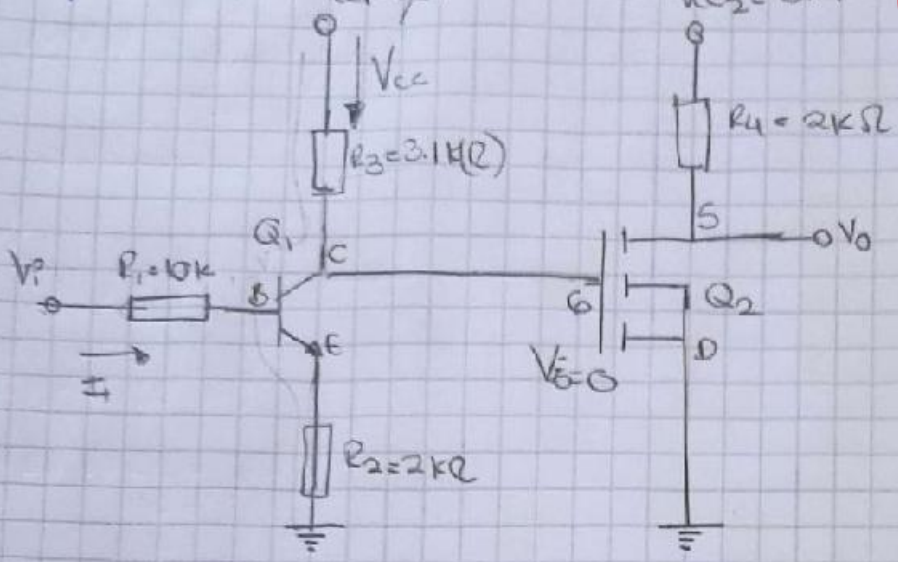
+1 p

+1 p

+3 p

28/100

Practica Toma $V_{cc_1} = 5.5V$ $V_{cc_2} = 30V$



Q_1 $\beta = 50$ $V_{CE_{sat}} = 0.4V$

Q_2 $V_t = 2V$ $k = 1\,[mA/V^2]$

a) Calcular V_o para $V_i = 0.3V$

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

$I_C = \beta I_B$

$I_E = (\beta+1) I_B$

$V = IR$

$V_i = 3V$

$$I_B = \frac{0.3V}{10K} = 30\times10^{-6}A \quad I_B = 300mA$$

$I_C = 50(30\times10^{-6})$ I_B

$I_C = 1.5mA$ //

$I_E = 1.53mA$ //

$V_{CE} = V_{CC} - I_C(R_C + R_E)$

$= 5.5 - I_C(2+3.1)K\Omega$

$= 5.5 - I_C(2+3.1)K$

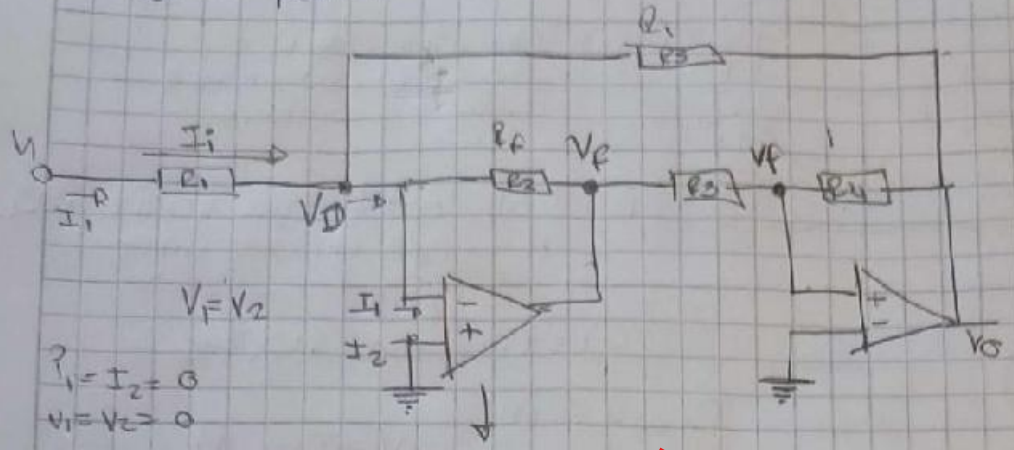
$= 5.5 - 1.5\times10^{-3}(5.1)K$

$= 5.5 - 7.65$

$= -2.15$ ← JFET en corte ✓

+3P

Segundo toma



$R_1 = 1K\Omega$

$R_2 = 2K\Omega$

$R_3 = 2K\Omega$

$R_4 = 2K\Omega$

$R_5 = 3K\Omega$

$V_i = 5\sin \omega t$

$I_i = \frac{-5-0}{1K} = \frac{-5}{1000} = -5mA$ 1 + 8 p

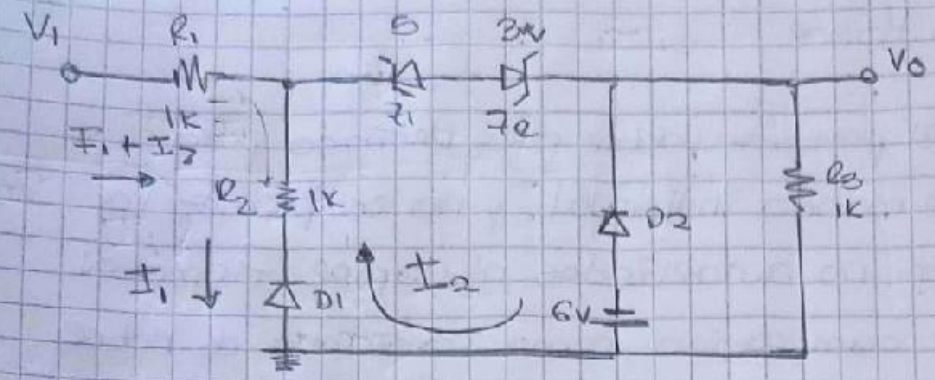
$V_D = 5\left(\frac{3K}{1K+3K}\right) = 3.75$

Entrada Amplificador Inversor

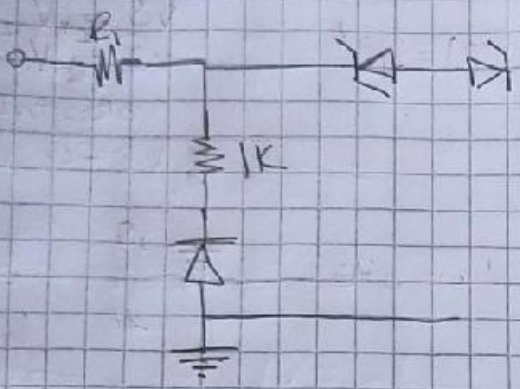
$V_f = -\frac{R_f}{R_1} V_D = -\left(\frac{2K\Omega}{1K\Omega}\right)(3.75) = -7.5\,V$

$V_o = \frac{R_4}{R_3} V_f = \left(\frac{2}{2}\right) V_f = 1(V_f) = -7.5\,V$

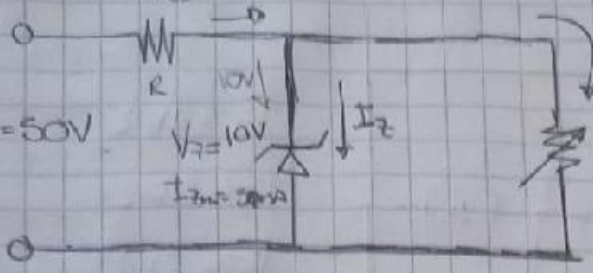
Tercer tema



Graficar V_o vs V_i $0 < V_i < 15V$



Tema 4



a) Valor mínimo de R_L para que el diodo tenga condiciones de conducción

b) Calcular el valor máximo de R_L para que el diodo no se queme

c) Potencia max disipada

a)

$$10 = 50\left(\frac{R_L}{1K+R_L}\right)$$

$(1K+R_L)10 = 50(R_L)$

$10K + 10R_L = 50R_L$

$10K = 50R_L - 10R_L$

$10K = 40R_L$

$$R_{L_{min}} = \frac{10K}{40} = 250\,\Omega$$

$R_L > 250\,\Omega$ para que el diodo tenga conducción

+1 P

b)

$I_{max} = 32mA$

$V_Z = 10V$

$V_Z = I_{Z_{max}} R_L$

$$R_L = \frac{V_Z}{I_{Z_{max}}} = \frac{10}{32mA}$$

$R_L = 312\,\Omega$

$R_{L_{max}} = 312\,\Omega$

+2 P

c)

$P_{max} = V_{DC} I_{DC}$

$P_{max} = 10V(32mA)$

$P_{max} = 320\,mW$

+5 P

Compromiso de Honor

Reconozco que el presente debate esta diseñado para ser resuelto de manera individual, y no se permite la ayuda de fuentes no autorizadas ni copiar. Firmo al pie del presente compromiso, como constancia de haber leido y aceptar la declaración anterior

José Coello, Del Pozo

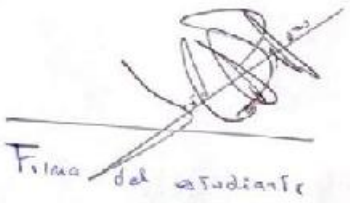
P-2

Examen IP- Electrónica

54/10

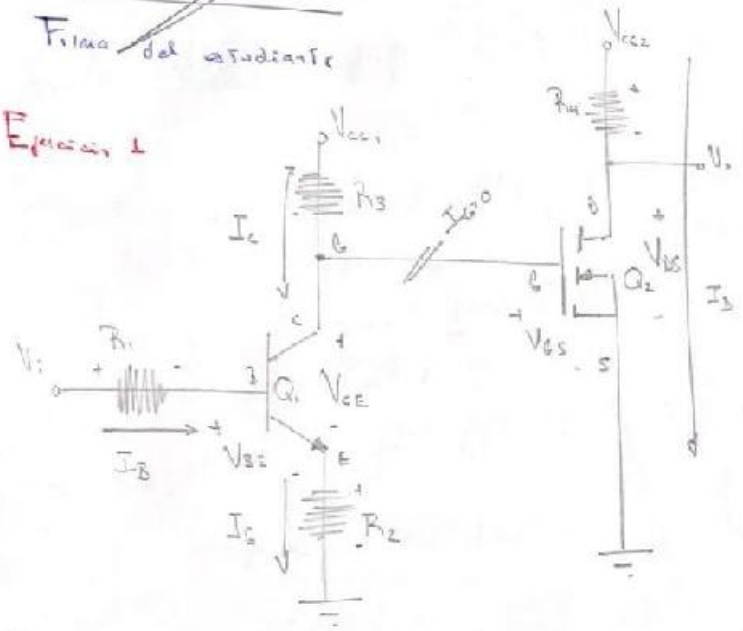
Compromiso Ético

Reconozco que el presente debe estar diseñado para ser resuelto de manera individual, y no se permite la ayuda de fuentes no autorizadas ni copiar. Firmo a pie del presente compromiso, como constancia de haber leído y aceptar la declaración anterior



Firma del estudiante

Ejercicio 1



$V_{cc1} = 5.5\ [V]$

$V_{cc2} = 30\ [V]$

$R_1 = 10\ [K\Omega]$

$R_2 = 2\ [K\Omega]$

$R_3 = 3.1\ [K\Omega]$

$R_4 = 2\ [K\Omega]$

$V_{BE} = 0.7\ [V]$

$Q_1 \Rightarrow \beta = 50\ [V]$; $V_{CE_{sat}} = 0.4\ [V]$

$Q_2 \Rightarrow V_T = 2\ [V]$, $K = 1\ [\frac{mA}{V^2}]$

a) $V_i = 0.3\ [V]$

malla $V_i \rightarrow R_2$

$I_E = (\beta + 1) I_B$

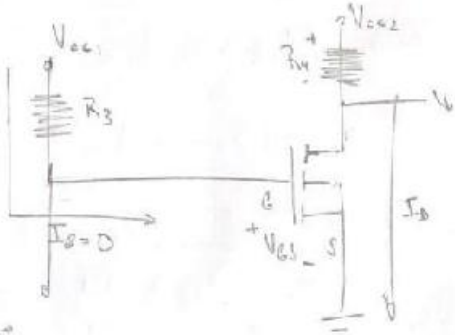
$-V_i + R_1 I_B + V_{BE} + I_E R_2 = 0$

$-V_i + R_1 I_B + V_{BE} + I_B \beta + I_B = 0$

$I_B (R_1 + \beta + 1) = V_i - V_{BE}$

$I_B = \frac{V_i - V_{BE}}{R_1 + \beta + 1}$ $[mA]$ $\Rightarrow$ $I_B = 0.6 \times 10^{-3}\ [mA]$

+3P



malla $V_{cc1} \rightarrow V_{GS}$

$-V_{cc1} + R_3 I_G^{\,0} + V_{GS} = 0$

$\Rightarrow V_{GS} = V_{cc1} = 5.5\ [V]$

Sabemos, $I_D = K(V_{GS}-V_T)^2$

$I_D = 12.25$ [mA]

Malla $V_{CC2} \Rightarrow V_{DS}$

$-V_{CC2} + R_4 I_D + V_{DS} = 0$

$V_{DS} = V_{CC2} - R_4 I_D$

$V_{DS} = 5.5$ [V] y como

$V_o = V_{DS}$

$V_o = 5.5$ [V]

+4p

Q_1: Apagado

Q_2 [5.5V, 12.25 mA]

+1p $V_{ds,cond} < V_{d,}$

b) $V_i = 3$ [V]

Sabiendo la ecuación [1]

$\Rightarrow I_B = \frac{V_i - V_{BE}}{R_1 + \beta + 1} \Rightarrow I_B = 0.04$ [mA]

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

$I_E = 2.04$ [mA] // Q_1 = [

y $I_C = \beta I_B \Rightarrow I_C = 2$ [mA]

malla $V_{CC1} \to R_2$

$-V_{CC1} + R_3 I_C + V_{CE} + R_2 I_E = 0$

$V_{CE} = V_{CC1} - R_3 I_C - R_2 I_E$

$\Rightarrow V_{CE} = -4.78 < 0.4$ [V]

$\Rightarrow Q_1$ está en saturación

Q_1 [0.4V, 2 mA]

+3p

Ahora, $V_B = V_{CE} = 0.4$ V

y $V_G = V_{GS}$

$\Rightarrow V_{GS} = 0.4$ [V] $< V_T$

$\Rightarrow Q_2$: apagado, $V_o = 0$

c) $V_o = 17.5$ [V]

Sabemos $V_{DS} = V_o = 17.5$ [V]

malla $V_{CC2} \to V_{DS}$

$-V_{CC2} + R_4 I_D + V_{DS} = 0$

$I_D = \frac{V_{CC2} - V_{DS}}{R_4} \Rightarrow I_D = 6.25$ [mA]

Q_2: [17.5V, 6.25 mA]

+3p

Sabemos $I_D = K(V_{GS} - V_T)^2$

$\sqrt{I_D} = V_{GS} - V_T$

$V_{GS} = \sqrt{I_D} + V_T \Rightarrow V_{GS} = 4.5$ [V]

Sabemos $V_G = V_{GS}$, y $I_C = \frac{V_{CC1} - V_C}{R_3}$, también $V_{CE} = V_G$

$\Rightarrow I_C = 0.32$ [mA] y $I_B = \frac{I_C}{\beta}$

$\Rightarrow I_B = 6.4 \times 10^{-3}$ [mA]

$\Rightarrow I_E = (\beta+1) I_B \Rightarrow I_E = 0.33$ [mA]

malla $V_i \rightarrow R_2$

$-V_i + R_1 I_B + V_{BE} + R_2 I_E = 0$

$V_i = R_1 I_B + V_{BE} + R_2 I_E$

$V_i = 1.42\,[V]$

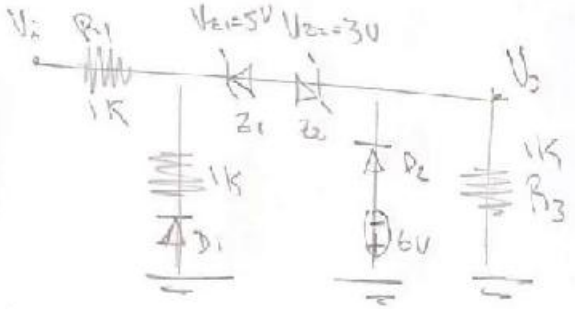
$Q_1 = [4.5[V], 0.32\,[mA]]$

+5p

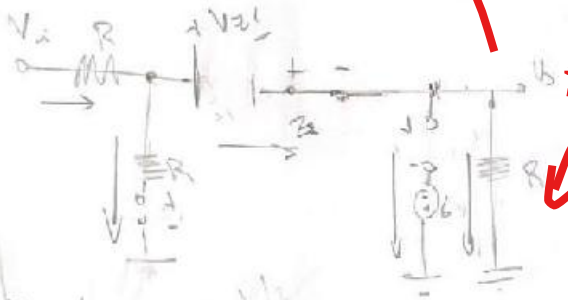
+5p

Ejercicio 2

Ejercicio 3



De manera manual



Promedio entre

V_o

$V_o = \frac{V_i - 5}{2}$

V_i

$V_o = \frac{(V_i - V_{z1})(R)}{R+R}$

$V_o = \frac{V_i - 5}{2}$

Tramo 1

$\rightarrow V_o = \frac{V_i - 5}{2}; 0 < V_i < 5$

+6p

z_1

$I_{z_1} = \frac{V_o + V_{z1} - V_i}{R} > 0$

$\frac{V_i - 5}{2} + V_{z1} - V_i > 0$

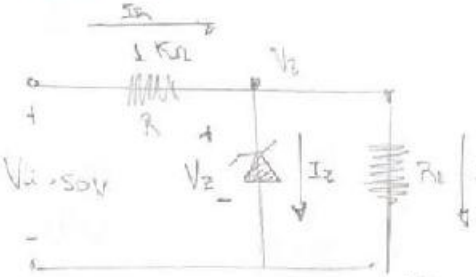
$V_i - 5 + 10 - 2V_i > 0$

$-V_i + 5 > 0$

$V_i - 5 < 0$

$V_i < 5$

Ejercicio 4



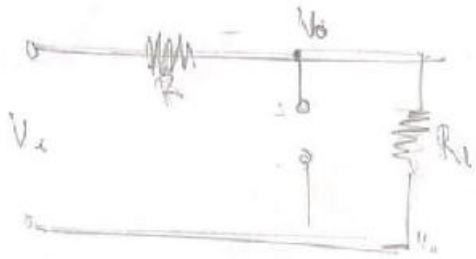
$V_z = 10\ [V]$

$I_{z_z} = 32\ mA$

$I_R = I_z + I_L$

$I_R = \frac{V_i - V_z}{R}$; $I_L = \frac{V_z}{R_L}$ ∴ $I_z = \frac{V_i - V_z}{R} - \frac{V_z}{R_L}$

a) R_L para que conduzca



$V_o = \frac{V_i R_L}{R + R_L} = 10$

$\frac{R + R_L}{V_i R_L} = \frac{1}{10}$

$R + R_L = \frac{V_i R_L}{10}$

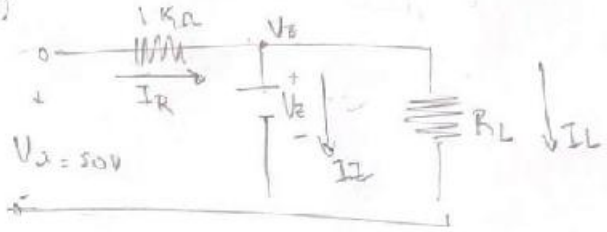
$R = \frac{V_i R_L}{10} - R_L$

$R = R_L \left(\frac{V_i}{10} - 1\right)$

$R_L = \frac{R}{\frac{V_i}{10}}$

∴ $R_L = 250\ [\Omega]$

b)



$I_z = 32\ [mA]$

$I_R = \frac{V_i - V_z}{R} = 0.04\ [A] = 40\ [mA]$

$I_L = I_R - I_z = 40 - 32$

$I_L = 8\ [mA]$ $I_L = \frac{V_z}{R_L}$

$R_L = \frac{V_z}{I_L}$

$\Rightarrow R_L = 1250\ [\Omega]$

c) Sabemos

$P_{max} = I_{max} \cdot V_z$

$P_{max} = (32\ mA)(10\ V)$

$P_{max} = 0.32\ [W] = 320\ [mW]$

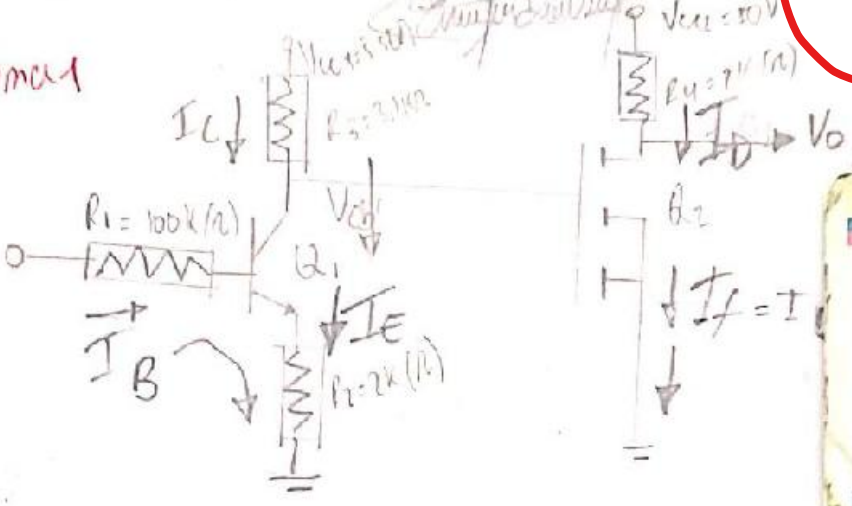
Examen Electrónica

Nombre: Enrique David Dávila Vidal

Reconozco que el presente debe ser desarrollado por mi propia cuenta de manera individual y no se permite la copia de fuente no autorizada [illegible] del presente compromiso, caso contrario

83/105

Tema 1



$V_{eb} = 0.2V$

$V_i = 0.3$ [V]

Para Q_1:

Se considera: $V_i = 0.3V$; asumimos que Q_1 se encuentra en zona de corte

$V_i = 10 I_b + 0.7 + 2(\beta+1) I_b$

$V_i = 112 I_b + 0.7$

Como $V_i < 0.7 \Rightarrow I_B < 0$; Q_1 se encuentra en zona de corte

$Q_1 \begin{cases} I_B = 0[A]; I_C = 0[A]; I_E = 0[A] \\ V_{CE} = 5.5V \end{cases}$

+1p

Para Q_2: $I_D = 1\,mA/V^2 (V_{GS} - 2)^2 = I_D = (V_{GS} - 2)^2$ [mA]

$V_{GS} = V_C = V_{CE} = 5.5V$

$I_D = (5.5 - 2)^2 = 12.25\,mA$; $Q_2 \begin{cases} V_{GS} = 5.5$ [V] \\ $I_D = 12.25$ mA \end{cases}$

+4p

b) $V_i = 3\,(V)$, Para Q_1 como pide que hicimos

$V_i = 111\,I_B + 0.7$

Despejando $I_B = \frac{V_i - 0.7}{111} = \frac{3 - 0.7}{111} = 0.02054 \approx 205\,(\mu A)$

$I_C = \beta I_B = 50\,(I_B) = 50(0.02054) = 0.1027 \approx 1.03\,[mA]$

$I_C = I_B + I_C = 0.021 + 1.03 = 1.051\,(mA)$

$V_{CE} = 5.5 - I_C(3.1) - I_E(1)$

$V_{CE} = 5.5 - (1.03)(3.1) - (1.051) = 0.205\,(V)$

$Q_1 = \begin{cases} I_B = 20.54\,mA \\ I_C = 1.03\,mA \\ I_E = 1.051\,mA \end{cases}$ y $V_{CE} = 0.205\,(V)$

Para Q_2

$V_{GS} = V_G - V_S = V_{GG} + 2I_E = 0.21 + 2(1.051)$

$V_{GS} = 2.31\,V$

$I_D = (V_{GS} - 2)^2 = (2.31 - 2)^2 = 0.096\,mA$

$Q_2 = \begin{cases} V_{DS} = 2.31\,V \\ I_D = 0.096\,mA = I_S \end{cases}$

$V_o = 30 - 2I_D = 30 - 2(0.096)$

$V_o = 29.81\,V$

Vds > Vds calc

-3 p

-2 p

+4 p

c) $V_o = 17.5\,V$

$I_B = \frac{V_i - 0.7}{112} = \frac{17.5 - 0.7}{112} = 0.15\,mA$

$I_C = (50)(0.15) = 7.5\,mA$

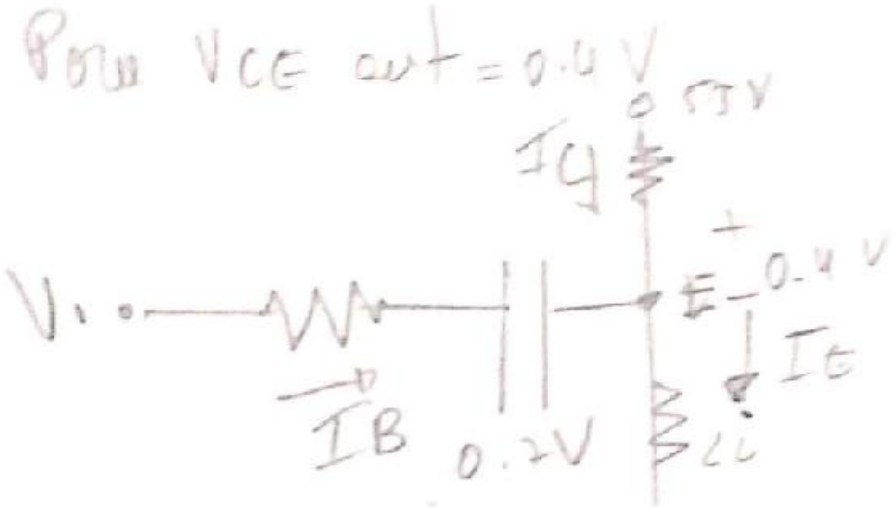
$I_E = I_B + I_C = 0.15 + 7.5 = 7.65\,mA$

$V_{CC} = 5.5 - I_C(3.1) - 2I_B$

$V_{CC} = 5.5 - 7.5(3.1) - 2(7.65)$

$V_{CC} = -33.05\,(V)$ se encuentra en corte

Para $V_{CE\,sat} = 0.4\,V$

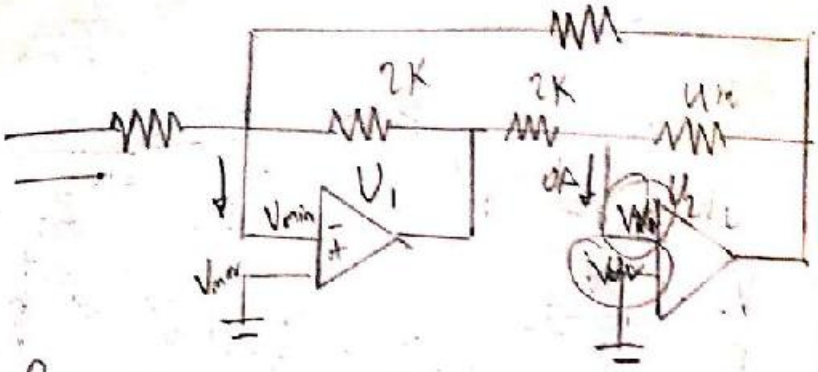


$V_i = 10 I_B + 0.7V + 2 I_E$

$V_{LT} = 10 I_B + 0.7 + 2 I_E$

$$\begin{cases} 10 I_B + 2 I_E = 16.6 \\ 5.1 I_C + 2 I_E = 5 \\ I_B + I_C - I_E = 0 \end{cases}$$

Tema 2



Para $U_1 \Rightarrow V^-.V_1 = V^+.V_2 = 0[V]$

$I_1 = \frac{V_i}{1K} = V_i\,(mA)$ +1 sp

Para $U_2 \Rightarrow V^+.U_2 = V^-.V_1 = 0[V]$

$V_o = -\frac{4}{2}V_x = -2V_x$

$V_x = -2V_i - \frac{3}{2}V_o = V_o = -2\left(-2V_i - \frac{3}{2}V_o\right)$

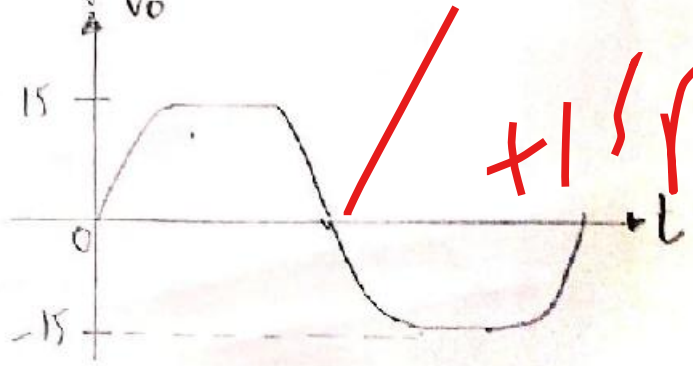
$V_o = 4V_i + \frac{3}{2}V_o \Rightarrow \frac{1}{2}V_o = -4V_i$

$V_o = -8V_i$ // ; $V_i = 5\sin\omega t$ → $V_o = -40\sin\omega t$

Dado la ecuación para seno

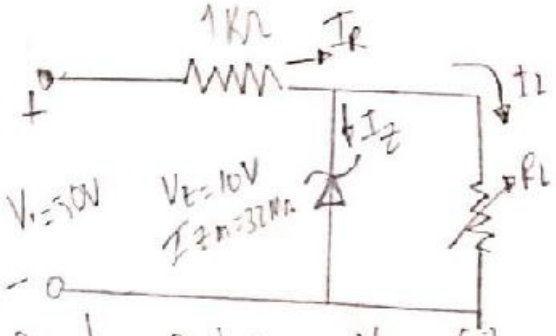
$\therefore -15V \leq V_o \leq 15V$

Grafiamente V_o



+1 sp

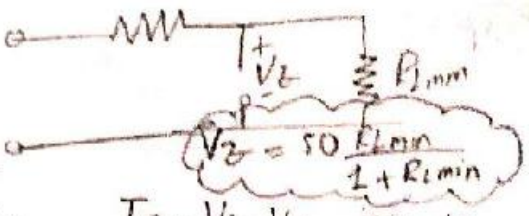
Tema 4



Donde: Diodo Zener = $V_Z = 10[V]$

I_Z máxima: 32 mA

Alimentación = $V_i = 50[V]_{DC}$



Donde: $I_L = \frac{V_Z}{R_L}$

$I_R = I_Z + I_{RL}$ (1)

$I_1 = I_R - I_Z$ (2)

$I_R = \frac{V_i - V_Z}{R} = \frac{50 - 10}{1K\Omega} = 40$ [mA]

$\frac{V_Z}{R_L} = 40 - I_Z$

Despejando R_L:

Para que el diodo no llegue a quemarse

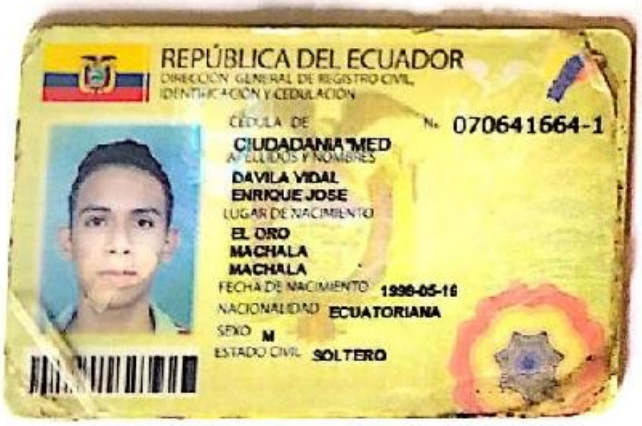
a) $R_L = \frac{V_Z}{40 - I_Z} = \frac{10}{40 - 32} = 1.25[K\Omega]$ (máximo)

Para que el diodo tenga amperaje

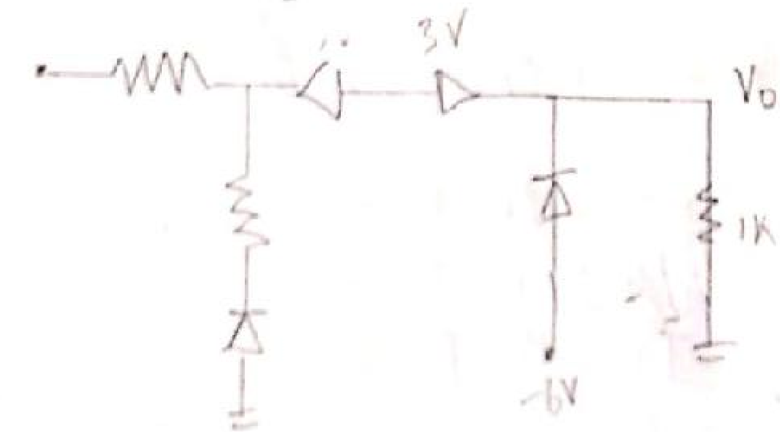
b) $R_{L_2} = \frac{V_Z}{40 - I_Z} = \frac{10}{40 - 0} = 0.25[K\Omega]$ (mínimo)

c) $P_{Z máx} = VI = V_Z I_{Z máxima}$

$P_{Z máx} = 10(32) = 320$ mW



Tema 3

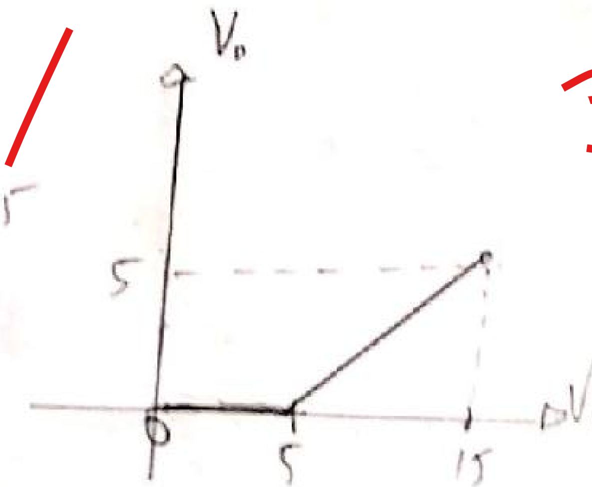


Para el D1, Z1, Z2, D2 lo encontramos apagado

$V_0 = 0V$; $V_1 \geq 5V$

$0 \leq V_1 < 5$

$V_0 = \frac{(V_1 - 5)}{2} \rightarrow 5 \leq V_1 \leq 15$



+10p

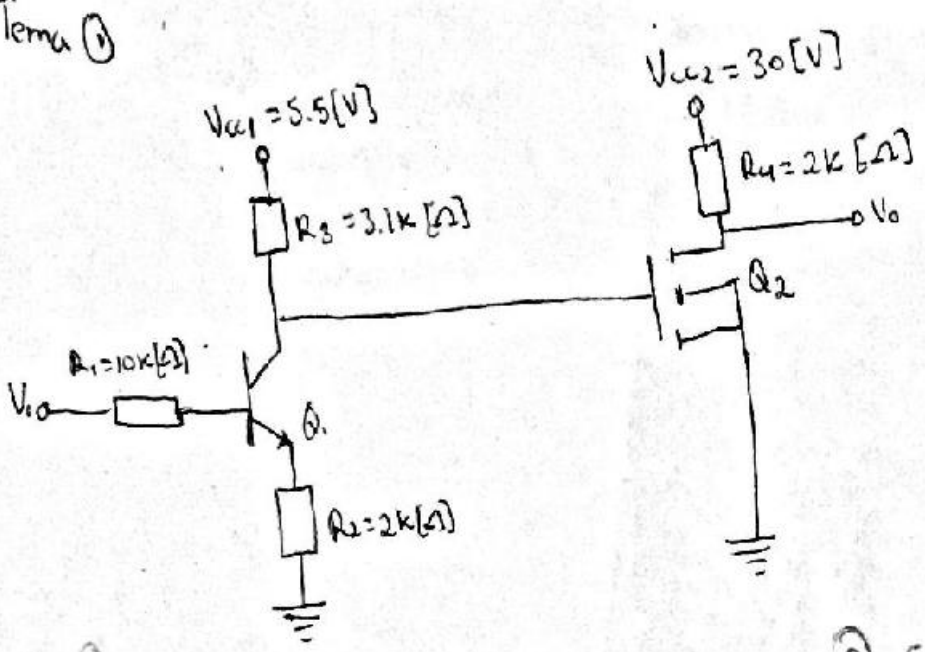
Compromiso de Honor

Reconozco que el presente deber esta diseñado para ser resuelto de manera individual, y no se permite la ayuda de fuentes no autorizadas ni copiar. Firmo al pie del presente Compromiso, como constancia de haber leido y aceptar la declaración anterior.

Firma del Compromiso del Estudiante

22/100

Tema ①



① $V_i - 10k I_b - 0.7V - 2k I_e = 0$;

$I_e = I_b + I_c$

$V_i - 10k I_b - 0.7V - 2k(I_b + I_c) = 0$; $I_c = \beta I_b$

$V_i - 10k I_b - 0.7V - 2k I_b - 2k I_c = 0$

$V_i - 10k I_b - 0.7V - 2k I_b - 2k(50 I_b) = 0$

② $5.5V - 3.1k I_c - V_{cc} - 2k I_c = 0$

③ $5.5 - 3.1k I_c - V_{GS} = 0$

$V_{GS} = 5.5 - 3.1k I_c$

④ $I_{DS} = I_{DSS}\left(1 - \frac{V_{GS}}{V_p}\right)^2$

$V_{DD} = 30V - 2k I_D$

a) V_o para $V_i = 0.3[V]$

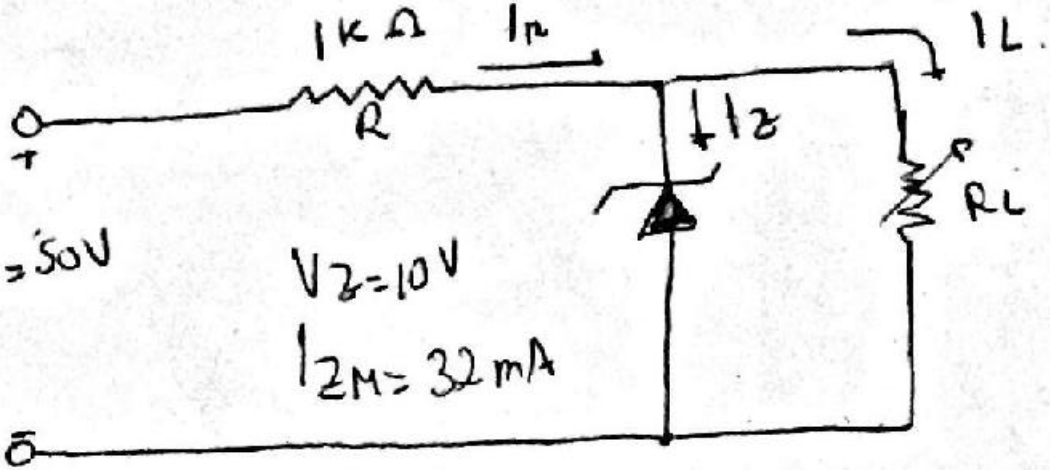
① $I_b(-10k - 2k - 100k) = -V_i + 0.7V$

$I_b(-112k) = -0.3 + 0.7V$

$I_b = \frac{-1}{-112k} = 8.93 \times 10^{-6}[A]$

$I_b < V$ Q_1 corte

Tema (4)



$I_R = \frac{V_i}{R}$

$I_R = \frac{50V}{1K\Omega} = 0.05A$

$I_R = I_Z + I_L$

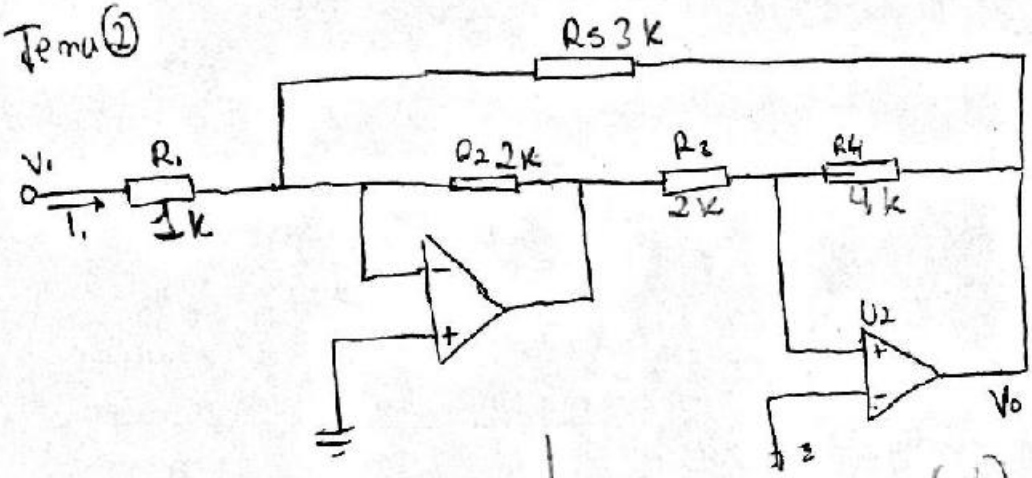
$I_L = 0.05 - 32m$

$I_L = 0.018$ X

$\frac{V_Z}{I_L} = R_L = \frac{10V}{0.018} = 555.56$ X

+2P

Tema ②



a)

$V_o = 0[V]$; $V_i = 5\,sen\omega t$

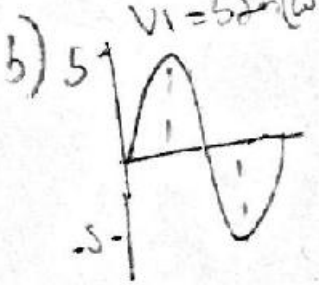
$I_1 = \frac{V_1 - 0}{1K}$

$I_1 = \frac{5\,sen(\omega t)}{1k}$

$I_1 = 5\times10^{3}\,sen(\omega t)\ [A]$

+1 SP

b)



$V_1 = 5\,sen(\omega t)$

- Si $V_i = 5 \wedge V_o = -15$

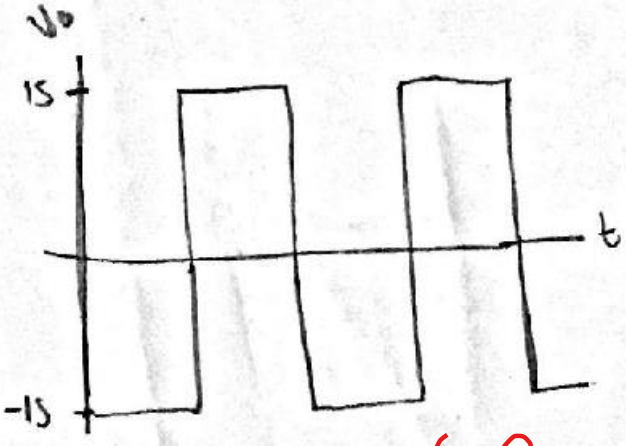
$V_{ref} = -2K\left(\frac{5}{1K} + \frac{(-15)}{3K}\right)$

$V_{ref} = -10 + 10 = 0$

- Si $V_i = -5 \wedge V_o = 15$

$V_{ref} = -2K\left(\frac{-5}{1K} + \frac{15}{3K}\right)$

$V_{ref} = +10 - 10 = 0$



+5 SP

NOMBRE: FREIRE SÁNCHEZ CARLOS AARÓN PARALELO 7

EXAMEN ELECTRÓNICA 25-2021

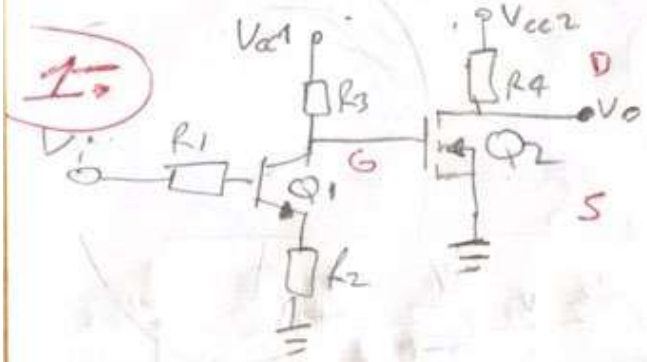
25/100

COMPROMISO HONOR

RECONOZCO QUE EL PRESENTE DEBER ESTÁ DISEÑADO PARA SER RESUELTO DE MANERA INDIVIDUAL, Y NO SE PERMITE LA AYUDA DE FUENTE NO AUTORIZADA NI COPIA. TODO AL CONTRARIO DEL PRESENTE COMPROMISO, COMO CONSTANCIA DE HABER LEÍDO Y ACEPTAR LA DECLARACIÓN ANTERIOR.

FIRMA COMPROMISO

1.



DATOS

$Q_1 = ?$ 1 $Q_2 = ?$

$\beta = 50$ | $V_t = 2V$

$V_{CE\,SAT} = 0.4V$ | $K = 1 \frac{mA}{V^2}$

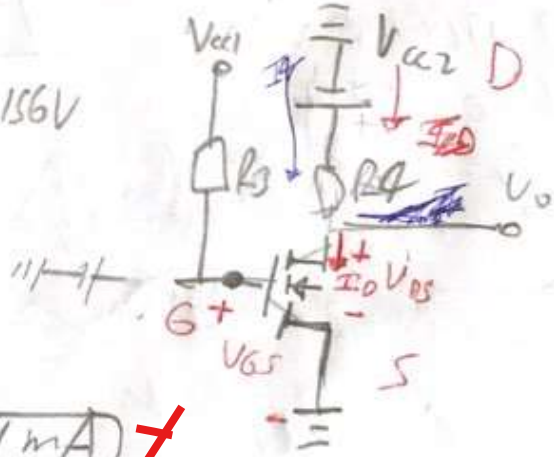
$Q_2 = V_{GS} = V_G - V_S$ (S a 0)

$V_G = V_{cc1}\left(\frac{R_2}{R_2+R_3}\right) = 5.5\left(\frac{2k}{2k+7.1k}\right) = 2.156V$

$V_S = 0$

$I_D = K(V_{GS} - V_T)^2 = 1(2.156-2)^2$

$I_D = 0.024605 \simeq \boxed{24.61\,mA}$ ✓



$+V_{cc2} - I_4 R_4 - V_{DS} = 0$

$I_4 = I + I_D$

$I = I_4 - I_D$

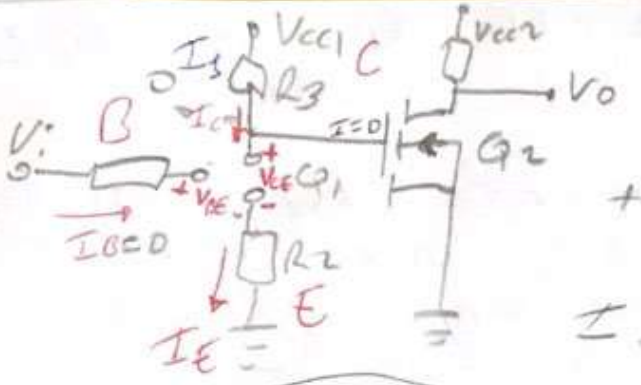
$V_{DS} = I_4 R_4 - V_{cc2}$

$V_{DS} = 30 - 30 = 0$

$Q_2 = [V_{DS} = 0,\ I_D = 24.61\,mA]$ ✓

$I_D =$

$V = I_R$



$Q_1 = [I_C = 0 ; V_{CE} = 22V]$

$+V_{CC1} - I_1 R_3 - V_{CE} - I_E R_2 = 0$

$I_C = I_1 = 0$

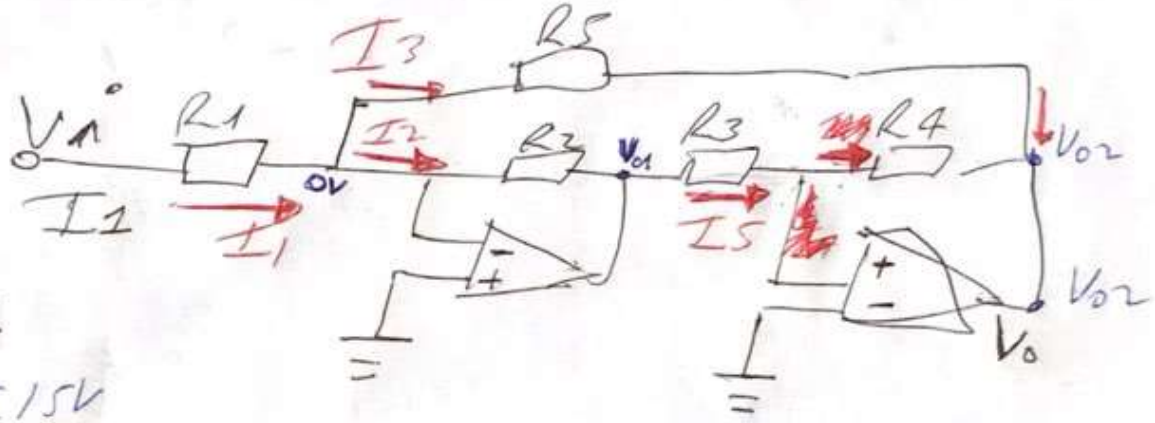
$V_{CC1} = V_{CE}$

$V_{CE} = 22\,[V]$

$Q_1 = [I_C = 0, V_{CE} = 22V]$

$Q_2 = [V_{DS} = 0, I_D = 24.6\,mA]$

2.



DATOS:

$V_{CC} = \pm 15V$

$R_1 = 1K$; $R_3 = 2K$; $R_5 = 3K$;

$R_2 = 2K$; $R_4 = 4K$; $V_i = 5\sin\omega t$;

LCK: $I_1 = I_2 + I_3 \rightarrow \frac{V_i}{R_1} = \frac{0 - V_{01}}{R_2} + \frac{0 - V_{02}}{R_5}$

$V_i = R_1\left(\frac{-V_{01}}{R_2} - \frac{V_{02}}{R_5}\right)$

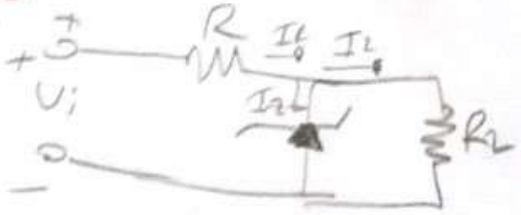
$I_1 = I_2 + I_3$

$I_1 = \frac{-V_{01}}{R_2} - \frac{V_{02}}{R_5}$

LCK con $V_{01} = 0V$

$V_{02} =$

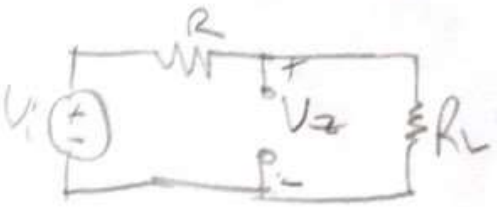
7.-



DATOS

$V_Z = 10V$; $I_{ZMAX} = 32mA$

$V_i = 50V$; $R = 1K\Omega$



$V_Z = V_{RL} = V_i\left(\frac{R_L}{R_L+R}\right)$ no puede ser mayor que V_Z

$V_i\left(\frac{R_L}{R_L+R}\right) < 10 \rightarrow 50\left(\frac{R_L}{R_L+1000}\right) = 10 \rightarrow 5R_L = R_L + 1000$

$4R_L = 1000 \rightarrow \boxed{R_{L_{min}} = 250\Omega}$

$P_{Zmax} = V_Z \cdot I_{Zmax}$

$V_{Zmax} = 8.6V$

$P_{Zmax} = V_Z I_{Zmax} = (10)\left(\frac{32mA}{1000}\right) = 0.32W \rightarrow P_{Zmax} = 0.32W$

Examen Primer Parcial

Nombre: Victor Emanuel Gonzalez Quinto

Paralelo 2

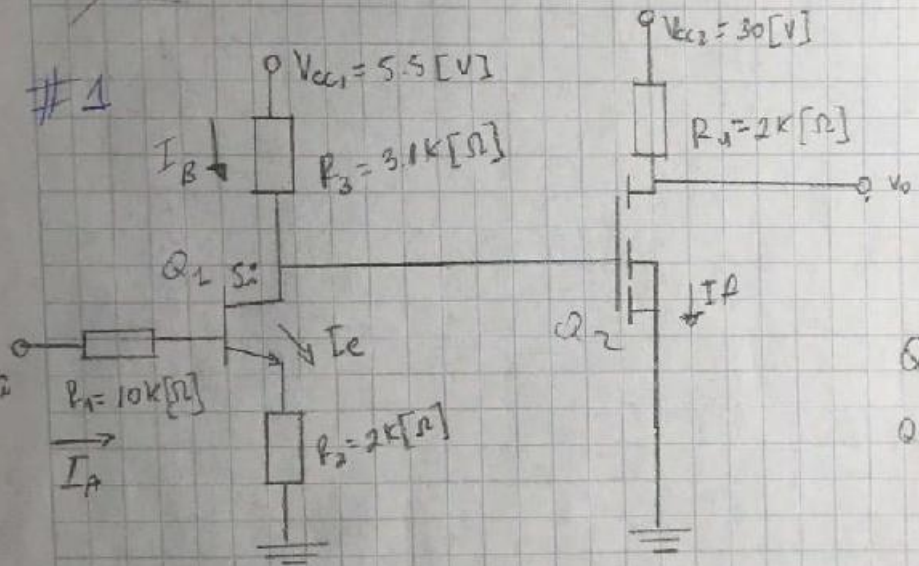
Compromiso de Honor

Reconozco que el presente taller está diseñado para ser resuelto de manera individual, y no se permite la ayuda de fuentes no autorizadas ni copiar. Firmo al pie del presente compromiso, como constancia de haber leído y aceptar la declaración anterior.

Victor Gonzalez Quinto

28/30

#1



Q_2 es Si, $\beta = 50$, $V_{ACT} = 0.2V$, $V_{DS} = 0.2[V]$

$Q_2 = V_t = 2[V]$, $K = 1[mA/V^2]$

Q_1:

$V_i = I_A R_1 + V_{ACT} + I_C R_2$, $I_C = (\beta+1) I_A$

$V_i = I_A R_1 + V_{ACT} + (I_B)(\beta+1) R_2$

$$I_A = \frac{V_i - V_{ACT}}{R_1 + (\beta+1)R_2} = \frac{V_i - 0.7}{(10) + (50+1)(2)} = \frac{V_i - 0.7}{112}$$

$$V_{CE} = 5.5 - I_A (R_3 \beta + R_2(\beta+1)) = 5.5 - 252 I_B$$

Para Q_2

$$5.5 = R_3 \beta I_A + V_{GS}$$

$$V_{GS} = 5.5 - R_3 \beta I_A //$$

$$I_f = K(V_{GS} - V_t)^2 // \; ; K = 1 \; V_t = 2$$

$$I_f = 1(V_{GS} - 2)^2$$

✓ +3p

a) $V_o = ?$ $\quad I_b = 0 \rightarrow Q_1$ en corte

$V_i = 0.3$

$V_{CE} = 5.5\ V$

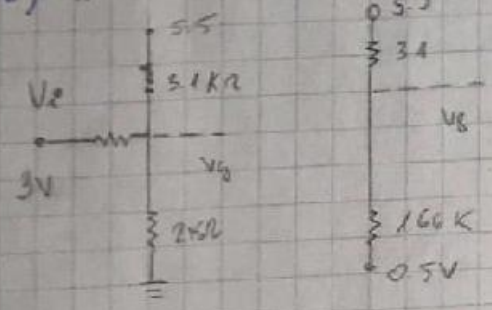
$V_{GS} = 5.5\ V$

$I_f = 12.25\ mA \rightarrow Q_2$ en zona lineal

$V_{DS} = 5.5\ V = V_o //$

✓ +4p

b) $V_i = 3V$



$V_{CE} = \checkmark V$

$I_f = 2.05 \times 10^{-2}$ mA

+3p

$V_g = \frac{(5.5 - 0.5)}{\quad}$ +1p

$V_g = 2.25$

$I_b = 0.0526$ mA ✓ +4p

c)

Si $V_o = 17.5V$

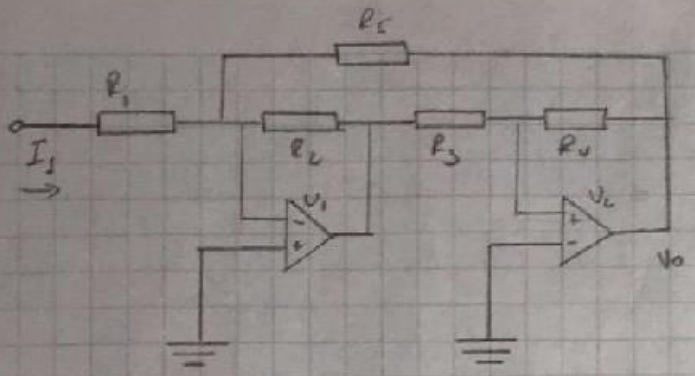
$V_i = ?$

$V_o = V_{DS} = 17.5V \rightarrow I_f = \frac{30 - V_{DS}}{2} = 6.25$ mA ✓ +3p

$V_{GS} = 2 + \sqrt{I_o} = 4.5V //$ $\quad I_B = \frac{5.5 - V_{GS}}{1.55} = 6.45$ mA

$V_i = 112 I_A + 0.2V = 1.42V //$ ✓ +5p

#2



$V_{cc} = \pm 15\,[V]$

$R_1 = 1K\Omega$

$R_2 = 2K\Omega$

$R_3 = 2K\Omega$

$R_4 = 4K\Omega$

$R_5 = 3K\Omega$

$V_i = 5\,Sen\,\omega t\,[V]$

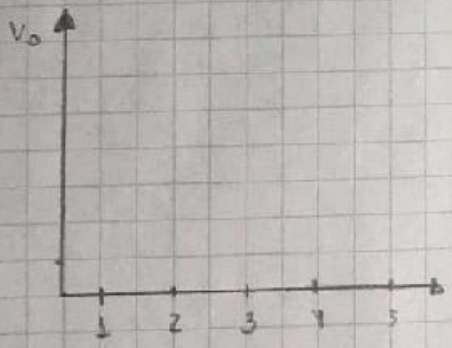
$V^- = ?$

$$I_1 = \frac{V_i - V^-}{R} = \frac{5\,Sen\,\omega t - 0^{\circ}}{1K}$$

$$I_1 = 5\,Sen\,\omega t\,[mA]$$

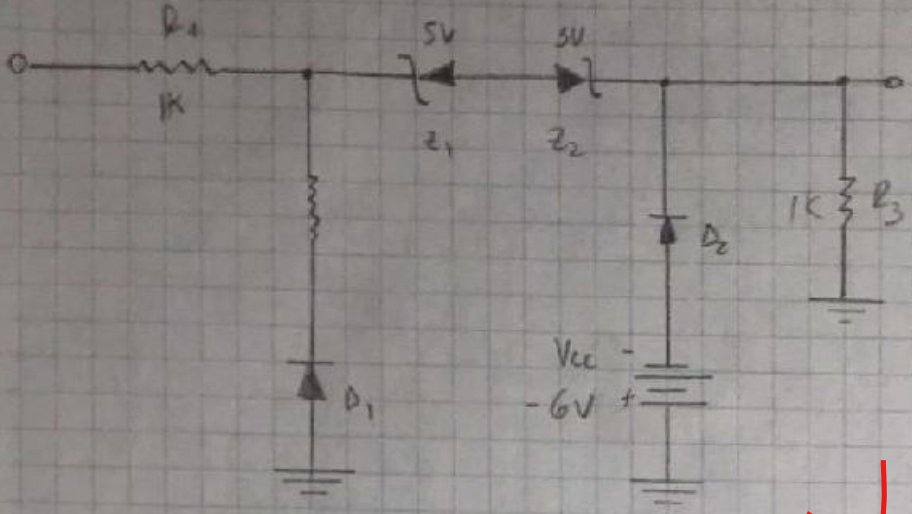
$I_1 = 5\,Sen\,\omega t$

+ 15p

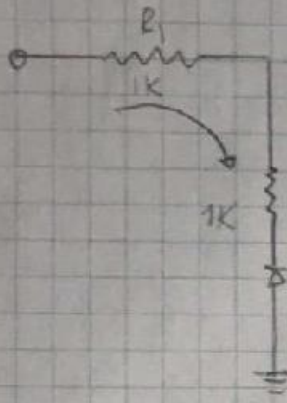


#3

$0 < V_i < 11.5V$



+10p



Entonces si $V_i \to 0V$ para $V_i > 0$

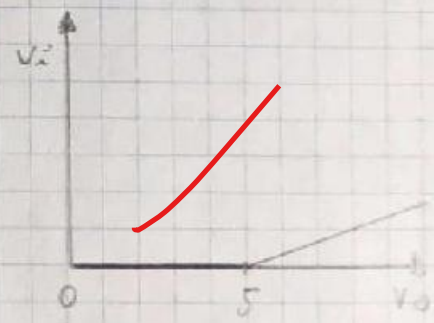
{ Z1, Z2, Z3, Z4 } OFF - apagados

Si $V_i \geq 5$

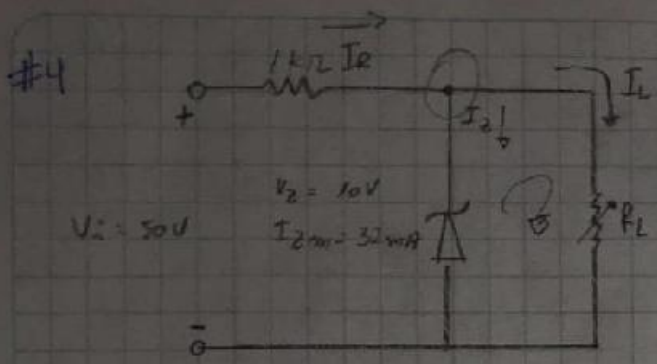
$V_o = 0 \to 0 < V_i < 5$

$5 < V_i \leq 15$

$V_o = \frac{V_i}{2}$



#4



$V_i = 50V$

$V_z = 10V$

$I_{Z\,max} = 32\,mA$

$I_{Z\,min} = 0\,mA$

$I_L = \frac{V_Z}{R_L}$

$I_R = I_L + I_Z$

$I_L = I_R - I_Z$

$I_R - I_Z = \frac{V_Z}{R_L}$

$I_R = \frac{V_i - V_Z}{R} = \frac{50 - 10}{1k\Omega} = 40\,mA$ //

Remplazamos

$I_R - I_Z = \frac{10}{R_L}$

$40 - I_Z = \frac{10}{R_L}$

$R_L = \frac{10}{40 - I_Z}$ (1)

Si es mínimo

a) $R_L = \frac{10}{40 - 0} = 0.25k\Omega$ // +10p

c) $P = VI$

$P_{max} = V_Z I_{max}$

$P_{Z\,max} = (10V)(32mA)$

$P_{Z\,max} = 320\,mW$ // +5p

máximo

b) $R_L = \frac{10}{40 - 32} = 1.25k\Omega$ // +10p

Reconozco que el presente deber está diseñado para ser resuelto de manera individual, y no se permite la ayuda de fuentes no autorizadas ni copias. Firmo al pie del presente compromiso, como constancia de haber leído y aceptar la declaración anterior.

5N
100

Madeleine Guale.
Firma

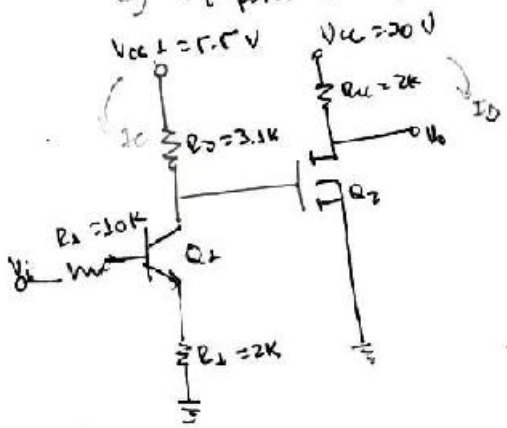
1ero Zonas y estados de trabajo para transistores Q_2 y Q_2 usando valores de V_i provistos c/literal

Q_1 de Si con $\beta = 50$, $V_{ce\,saturación} = 0.4$

$Q_2 = V_t = 2$, $k = 1$

a) V_o para $V_i = 0,3$
b) V_o para $V_i = 3$
c) V_i para $V_o = 17,5$

Q_1 Q_2 Q_3 V_{o4}



Q_1: $V_i = I_B R_1 + V_{BE} + I_E R_2$

$V_{cc} = 5.5 = I_B(\beta R_1 + R_2(\beta+1))$

$I_B = \frac{V_i - V_b}{R_1 + (\beta+1)R_2} = \frac{V_i - 0.7}{112}$

(Z. Corte)

Q_2: $-5.5 + R_3 I_D + V_{GS} = 0$

(Lineal)

$I_D = k(V_{GS} - V_t)^2$

$I_D = (V_{GS} - 2)^2$

$V_{GS} = 5.5 - R_3 \beta I_B$

$V_{GS} = 5.5 - 155 I_B$

$V_{DD} = 30 - R_D I_D = 30 - 2 I_D$

b) $V_i = 3V$ $I_B = 2.0 \times 10^{-2}$ $V_{CE} = 0.2V$ -> Saturación

+2P

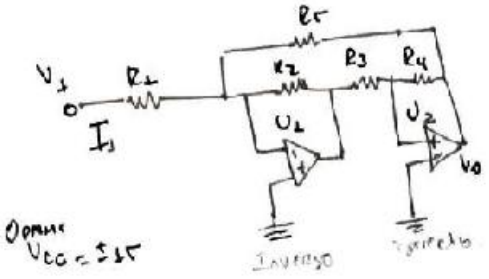
+2P

a) $V_i = 0.3$
$I_B = 0$
$V_{CE} = 5.5V$
$V_{GS} = 5.5V$
$V_{RE} = 5.5V$
$I_D = 12.5$
$V_o = V_{DS} = 5.5V$

2do Circuito Opams ideales (30)

a) Encontrar expresión literal para I_1

b) Graficar V_o vs t



$R_1 = 1\,k\Omega$

$R_2 = 2\,k\Omega$

$R_3 = 2\,k\Omega$

$R_4 = 4\,k\Omega$

$R_f = 3\,k\Omega$

$V_i = 5\,\mathrm{sen}\,\omega t$

✓ +15p

$V_{cc} = \pm 15$

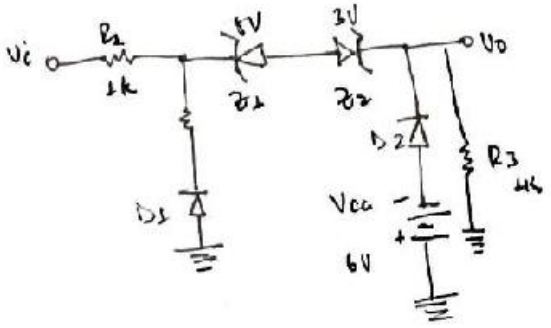
a) $I_1 = \frac{V_1 - V}{R_1} = \frac{V_i}{R_1} = \frac{5\,\mathrm{sen}\,\omega t}{1k} = 5\,\mathrm{sen}\,\omega t\,[mA]$

V_o

t

3ero Graficar V_o vs V_i en el intervalo $0 < V_i < +15V$

(diodos ideales)



$V_i = 0V$

D_1 = OFF

Z_1 = OFF

Z_2 = OFF

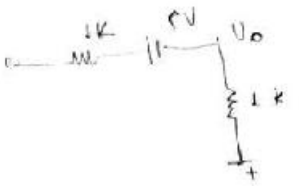
D_2 = OFF

$V_i > 0$

$V_i \geq 5$

Z_1 on Z_2 bloqueado

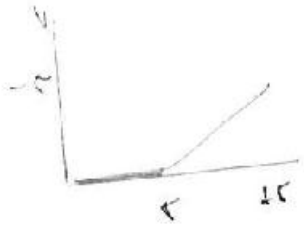
$V_o = 0 ; 0 \leq V_i < 5$



$V_o = (V_i - 5)\frac{1k}{2k}$

$V_o = \frac{V_i - 5}{2}$ Para $5 < V_i < 15$

+1,2p

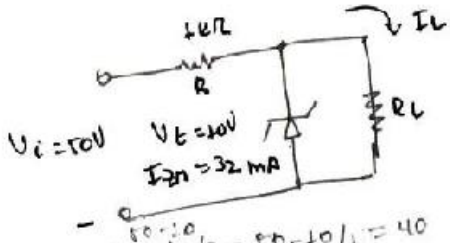


4to Cuarto (2)

a) Calcular Mínimo R_L para Zener comience a conducir

b) Calcular Máximo R_L Zener no se queme

c) Potencia Máxima q' puede disipar diodo Zener.



diodo Zener $V_Z = 10V$ $I_{Z\,MAXIMA} = 32mA$

Alimentación $V_i = 50$ Vdc.

$I_R = V_i - V_Z / R = 50 - 10 / 1 = 40$

$I_L = I_R - I_Z$

$\frac{10 - V_L}{R_L} = 40 - I_Z$

$R_L = \frac{10}{40 - I_{Z\,MAX/MIN}}$

c) $R_{L\,MIN} = \frac{10}{40 - I_{ZMAX}} = \frac{10}{40-32} = 1.25\,[k\Omega]$

d) $R_{L\,MIN} = \frac{10}{40 - I_{ZMIN}} = \frac{10}{40} = 0.25\,[k\Omega]$

$P = VI$

e) $I_{ZMAX} = 32\,mA$; $V_Z = 10\,V$

$P_{MAX} = 320\,mW$

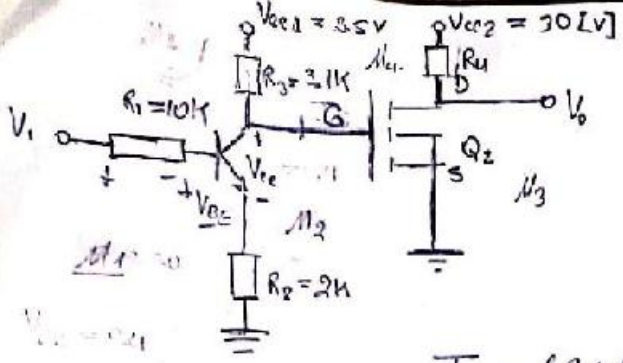
+10p

+10p

+5p

54/100

Compromiso de honor



$I_E = (\beta+1) I_B$

$I_B + I_C = I_E$

$\Rightarrow I_C = I_E - I_B$

$I_C = (\beta+1) I_B - I_B$

$I_C = \beta I_B$

M1

$$-V_i + I_B R_1 + V_{BE} + I_E R_2 = 0$$

$$\Rightarrow -V_i + I_B R_1 + V_{BE} + (\beta+1) I_B R_2 = 0$$

$$V_i = I_B \left[R_1 + (\beta+1) R_2 \right] + V_{BE}$$

V_{BE} osciló entre 0.7V

$$I_B = \frac{V_i - V_{BE}}{(R_1 + 51)} \quad ; \quad V_{BE} = V_B - V_E$$

$$I_B = \frac{V_i - 0.7}{\left[R_1 + 51 R_2 \right]} = \frac{}{10 + 102}$$

$$I_B = \frac{V_i - 0.7}{112}$$

M2

$$-V_{cc1} + I_C R_3 + V_{cc} + I_E R_2 = 0$$

$$-V_{cc1} + I_C R_3 + 0.4 + (\beta+1) I_B R_2 = 0$$

$$\Rightarrow -V_{cc1} + \beta I_B R_3 + V_{ce} + (\beta+1) I_B R_2 = 0$$

$$V_{ce} = V_{cc} - \beta I_B R_3 - (\beta+1) I_B R_2$$

$$V_{ce} = 5.5 - \left[(50)(3.1) - (51)(2) \right] I_B$$

$$V_{ce} = 5.5 - 257 I_B$$

Q2

$$I_D = K (V_{GS} - V_T)^2$$

$$I_D = (V_{GS} - 2)^2$$

M3

$$-V_{cc2} + I_D R_4 + V_{DS} = 0$$

$$\Rightarrow V_{DS} = V_{cc2} - I_D R_4$$

$$V_{DS} = 30 - 2 I_B$$

Para $V_i = 0.3V \Rightarrow I_B = -3.57 \times 10^{-3}$ mA

$\Rightarrow V_{ce} \approx 5.5$ V

M4

$$-V_{cc1} + I_C R_3 + V_{GS} = 0$$

$$\Rightarrow V_{GS} = V_{cc1} - I_C R_3 \approx 0$$

$V_{GS} = V_{cc1} - \beta I_B$ corte

$V_{GS} \approx V_{cc1} = 5.5V$

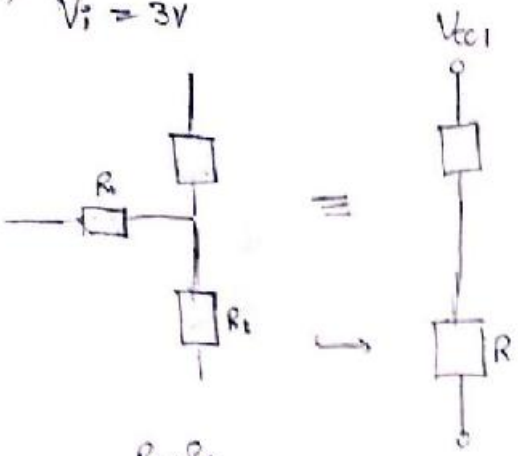
$\Rightarrow V_{GS} = V_o = 5.5V$

+3p ✓ Q1: corte

+7p ✓

b)

$V_i = 3V$



$$\frac{R_1 \cdot R_2}{R_1 + R_2}$$

$$R = \frac{20}{12} = 1.6\,k$$

$$V_R = 0.5$$

$$-V_{cc1} + I_c(3.1) + (1.5)(I_B) + V_\gamma = 0$$

?

c) V_i si $V_o = 14.5V$; $V_{DS} = 17.5V$

$$-V_{cc2} + V_{DS} + 2I_D = 0$$

$$\Rightarrow I_B = \frac{V_{cc2} - V_{DS}}{2}$$

$$I_b = \frac{30 - V_{DS}}{2}$$

$$I_b = \frac{30 - 14.5}{2}$$

$$I_b = 6.25\,mA$$

$I_D = I_b$?

$$\Rightarrow V_i - 0.7 = I_B(R_1 + 51R_2)$$

$$V_i = (6.25)(111) + 0.7$$

$$\boxed{V_i = 1.01\,V}$$

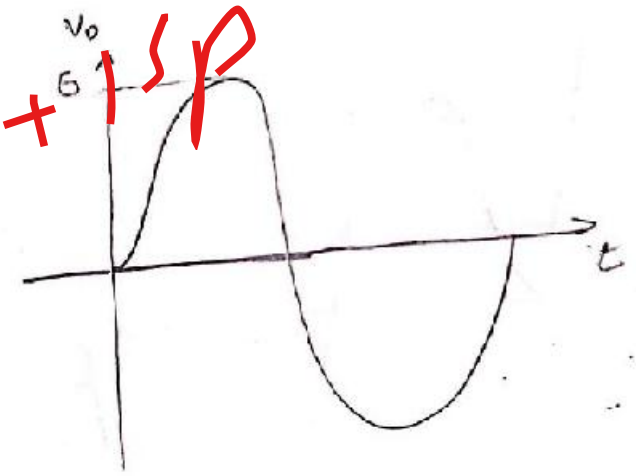
+5p

2)

$$V_1 - V = I_1 R_1$$

$$I_1 = \frac{V_1 - V}{R_1} = \frac{V_1}{R_1} = \frac{5\,Sen(\omega t)}{1K}$$

$$I_1 = 5\,Sen(\omega t)\ [mA]$$



3)

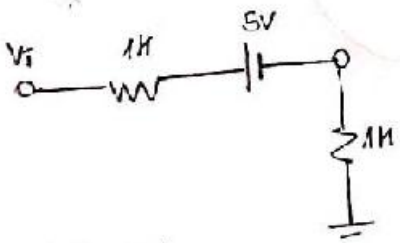
Si $V_i \to 0$

$D_1 = D_2$ = apagado

$Z_1 = Z_2$ = apagado

$V_o = 0$

$5 < V_i < 15$



$$2V_o = (V_i - 5)$$

$$V_o = \frac{V_i - 5}{2}$$

$V_i = 15$

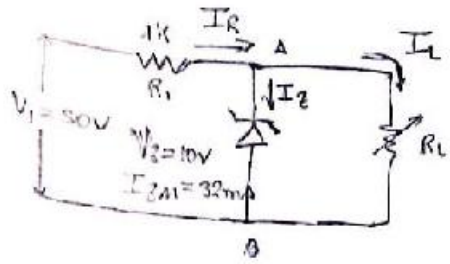
$$V_o = \frac{5 - 5}{2}$$

$$V_o = \frac{15 - 5}{2}$$

$\boxed{V_o = 0}$

$\boxed{V_o = 5}$

a)



$$I_R = \frac{V_{AB}}{R_1}$$

$$V_{AB} = V_1 - V_2 = 50 - 10 = 40V$$

$$I_R = \frac{V_{AB}}{R_1} = \frac{40}{1K} = 40mA$$

A: $I_Z + I_L = I_R \Rightarrow I_Z = I_R - I_Z$

$$I_L = I_R - I_Z$$

$$I_L = \frac{V_Z}{R_L} = \frac{V_{RL}}{R_L} = \frac{10}{R_L}$$

$$\Rightarrow I_R - I_Z = \frac{V_{RL}}{R_L}$$

$$I_R - I_Z = \frac{10}{R_L}$$

$$R_L = \frac{10}{I_R - I_Z}$$

b) $R_{L\min} \Rightarrow I_Z = 0 \quad R_L = \frac{10}{40} \Rightarrow \boxed{R_L = 0,25\ \Omega}$

b) $R_{L\max} \Rightarrow I_Z = 32mA \Rightarrow R_L = \frac{10}{40 - 32} \Rightarrow \boxed{R_L = 1,25\ \Omega}$

c) $P_{max} = V_Z I_Z \quad ; \quad I_Z = 32mA \cdot \frac{1A}{1000mA} = 32 \times 10^{-3} A$

$V_Z = 10V$

$$\boxed{P_{max\ Z} = 0,32\ W}$$

compromiso

Franchesca Iñiguez Herrera - Paralelo no. 2

42/40

Compromiso de Honor

Reconozco que el presente deber está diseñado para ser resuelto de manera individual, y no se permite la ayuda de fuentes no autorizadas ni copias. Firmo al pie del presente compromiso, como constancia de haber leído y aceptar la declaración anterior.

Iñiguez

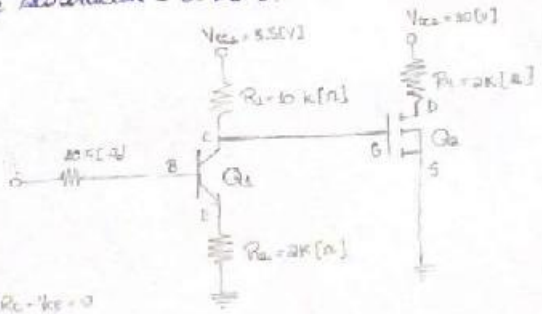
PRIMER TEMA

En el circuito adjunto determine las zonas y estados de trabajo para los transistores Q_1 y Q_2 usando los valores de V_i provistos en cada literal.

Q_1 transistor de silicio con $\beta = 50$, V_{CE} saturación = 0.4 [V].

Q_2 : $V_t = 2$ [V], $K = 1$ [mA/V²].

a) Calcular V_o para $V_i = 0.3$ [V]
Calcular V_o para $V_i = 3$ [V]
Calcular V_i para $V_o = 17.5$ [V]



a) En la malla BE de Q_1:

$V_i = 0.3$ [V]

$I_{CE} = 0$

$V_{CC} - I_C R_C - V_{CE} = 0$

$V_{CE} = V_{CC} = 5.5$ V

Entonces $V_{CE} = V_{DS}$

5.5 es mayor

$I_D = I_C (V_{GS} - V_t)^2$

$I_D = 0.3 (5.5 - 2)^2$

$I_D = 3.675$

$V_O = V_{DD} - V_{CC} - I_D R_4$

$V_o = 30 - (3.675)(2K)$ → $V_o = 22.65$ [V] ✓

c) Cuando $V_o = 17.5$

$V_o = V_{DS}$

$= V_{DD} - I_D R_4$

$I_D = \frac{V_{DD} - V_o}{R_4} = \frac{30 - 17.5}{2K}$ +2P

$I_D = 6.25$ mA

Suponiendo que Q_2 se encuentra en saturación:

$I_D = (V_{GS} - V_t)^2$

$V_{GS} = \sqrt{\frac{I_D}{K}} + V_t = \sqrt{\frac{6.25}{1}} + 2$

$V_{GS} = 4.5$ [V]

$I_C = \frac{V_{CC} - V_{CE}}{R_1} = \frac{6 - 5.5}{10K} = 5 \times 10^{-5}$ [A]

b) $I_B = \frac{3}{50} = 0.06$ [mA]

$I_C = \beta I_B$

$I_C = (50)(0.3) = 15$ mA

$V_{CC} - I_C R_C - V_{CE} = 0$

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

$V_{CE} = (5.5) - (1.5 \times 10^{-3})(10K)$

$V_{CE} = 9.5$ [V]

$V_{GS} - V_{CE} = 9.5$ [V] < V_T +1P

$V_o = V_{CC} - I_D R_D$

$V_o = I_{CC}$

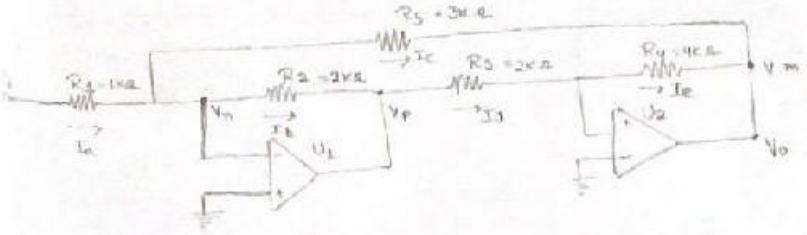
$V_o = 30$ [V] //

TEMA 2

En el siguiente circuito de OPAMPS ideales, se pide:

a) Encontar la expresión literal para I_2

b) Graficar V_0 vs t.



$$I_a = \frac{-V_n}{R_1} = \frac{-V_m}{1K} \qquad I_c = \frac{V_n - V_m}{R_5} = \frac{V_n - V_m}{3K}$$

$$I_d = \frac{V_p - V_m}{R_2} = \frac{V_p - V_m}{2K} \qquad I_b = 0 - V_o$$

$$I_b = 0 - V_o$$

$$I_b = -V_o$$

+ SP

$$I_a = I_b + I_c$$

$$I_a = -V_o + \frac{V_n - V_m}{3K} = \frac{-3KV_o + V_n - V_m}{3K}$$

$$I_e = I_c + I_d$$

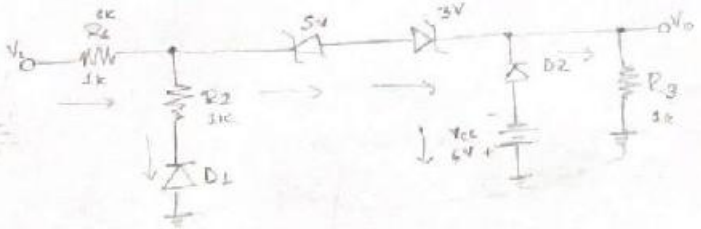
$$I_e = \frac{V_n - V_m}{3K} + \frac{V_p - V_m}{2K} = \frac{2V_n - 2KV_m + 3KV_p - 3KV_m}{6K} = \frac{2V_n + 2KV_p - 6KV_m}{6K}$$

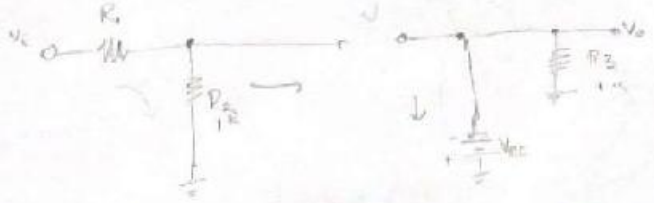
$$\frac{V_o}{R_4} = V\left(\frac{1}{R_3} + \frac{1}{R_2} + \frac{1}{R_1}\right) = V\left(\frac{1}{3} + \frac{1}{2} + \frac{1}{1}\right) = V\left(\frac{11}{6}\right)$$

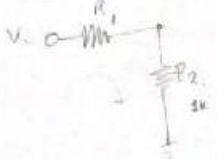
TEMA 3.

Para el circuito adjunto, grafica V_o vs V_i en el intervalo $0 < V_i < 15$

Todos los diodos son ideales







+3P

$-V_{cc} - R_3 I_3 = 0$

$V_{cc} = R_3 I_3$

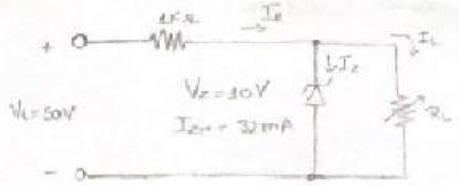
$V_{cc} = (1k)\, I_3$

$R_1 I_1 + R_2 (I_1 + I_2)$

TEMA 4

ej Para el siguiente circuito, se pide:

a) Calcular el valor mínimo de R_L para que el diodo Zener comience a conducir.
b) Calcular el valor máximo de R_L para que el diodo Zener no se queme.
c) Calcular la potencia máxima que puede disipar el diodo Zener.



Datos: Diodos zener $V_Z = 10V$, $I_{máxima} = 32mA$, Alimentación $V_i = 50Vdc$

a)

$V_L = V_Z$

$= V_i \times \frac{R_L}{R_L + R}$

$R_{Lm} = \frac{V_Z R}{V_i - V_Z}$

Si la resistencia es mayor a R_{Lm} entonces el diodo zener [illegible] conducción

$R_{Lm} = \frac{(10)(1k)}{50 - 10}$

$R_{Lm} = 250\ [\Omega]$ //

+5p ✓ +10p

b) $V_R = V_i - V_Z$

$V_R = 50 - 10$

$V_R = 40\ V$

$I_R = \frac{V_R}{R} = \frac{40V}{1k} = 40\ [mA]$

$I_{Lm} < I_R - I_{ZM}$

$I_{Lm} = 40 - 32$

$= 8\ mA$

$R_{Lm} = \frac{V_L}{I_{Lm}} = \frac{10}{8}$

$R_{Lm} = 125\ [\Omega]$ //

+10p

c) $P_{máxima} = (V_Z)(I_{ZM})$

$P_{máxima} = (10)(32\ mA)$

$P_{máxima} = 320\ mW$ //

+5p

Electrónica

DD MM AA

Giuseppe Steven Intriago Camacho.

6.8

Cac 2013 - 108

Compromiso de Honor

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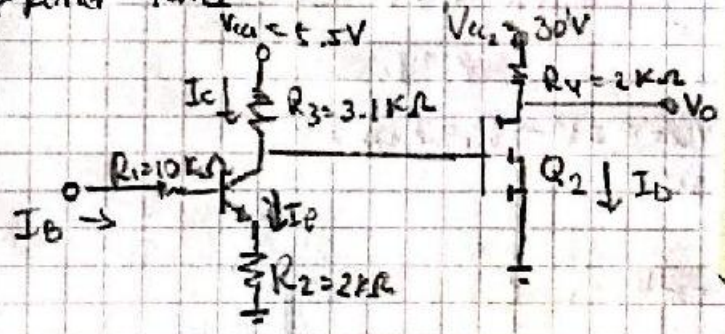
Primer Tema



$I_c = (\beta+1) I_B$

Q_1

$V_i = I_B R_1 + V_{be} + I_e R_2$

$I_B = \frac{V_i - V_{be}}{R_1 + (\beta+1) R_2} = \frac{V_i - 0.7}{10 + (51)2}$

$V_{ee} = 0.7V$
$Q_1: \beta = 50$
$V_{ce\,sat} = 0.4V$

$Q_1: V_T = 2V$
$K = 1mA/V^2$

$V_{cc} = 5.5 - I_B(R_3\beta + R_2(\beta+1))$
$V_{cc} = 5.5 - [3.1K\Omega(50) + 2(51)] I_B$
$V_{cc} = 5.5 - 257 I_B$

Q_2

$V_{cc} = R_3 \beta I_B + V_{GS}$
$V_{GS} = 5.5 - R_3 \beta I_B \rightarrow V_{GS} = 5.5 - \beta_3 \beta I_B$
$V_{GS} = 5.5 - 155 I_B$

$I_D = K(V_{GS} - V_t)^2$

$I_D = (V_{GS} - 2)^2$

$V_{DS} = 30 - R_4 I_D = 30 - 2I_D$

a) $V_i = 0.3$

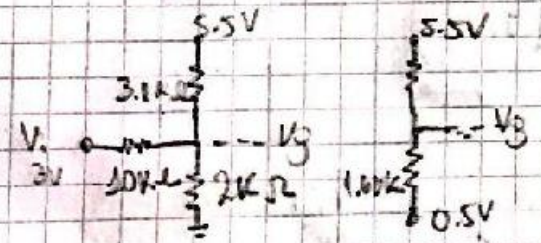
$I_D = 0$ $V_{CC} = 5.5V$ Q_1: zona de corte

$V_{GS} = 5.5V$ $I_D = 12.25mA$

$V_o = V_{DS} = 5.5V$ Zona lineal $\} Q_2$

b) $V_i = 3V$ $I_B = \frac{3 - 0.7}{112}$

$I_B = 2.05 \times 10^{-2} mA$ $V_{CE} = 0.2V \rightarrow Q_1$: Zona de saturación



$V_g = (5.5 - 0.5)\frac{1.66}{(1.66 + 3.1)} + 0.5$

$V_g = 2.24V$ $V_{GS} = 2.24V$ Q_2 Zona lineal

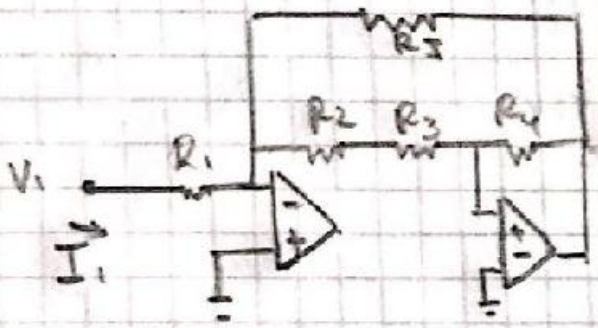
$I_D = (2.24 - 2)^2$ $I_D = 0.05951mA$

$I_D = 0.05954mA$

$V_{DS} = 30 - (2 0.05454))$

$V_o = V_{DS} = 29.88V$ $V_o = 29.88V$

Segundo Tema

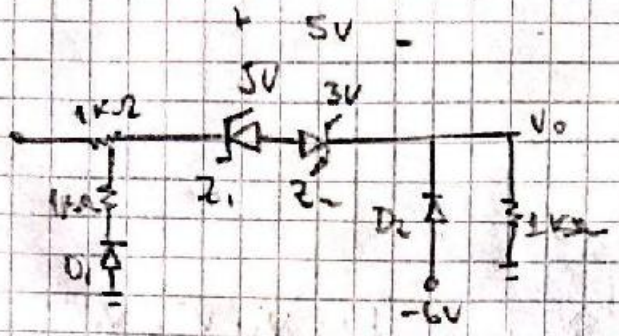


$V^- = 0\,v$

$$I_1 = \frac{V_1 - V^-}{R_1} = \frac{V_1}{R_1}$$ ✓ +1 sp

$$I_1 = \frac{5\sin\omega t}{1k} = 5\sin(\omega t)\ [mA]$$

TERCER TEMA



Si se tiene $V_i \to 0V$

D_1 "Off" Z_1 "Off" Para $V_i > 0$

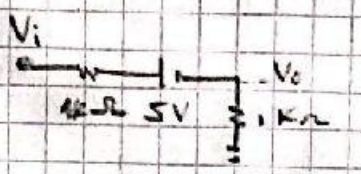
Z_2 "off" Para $V_i \geq 5$

D_2 "off"

Z_1 "Diodo"

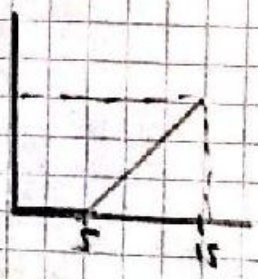
$V_o = 0V$

$\to V_o = 0 \to 0 \leq V_i < 5$



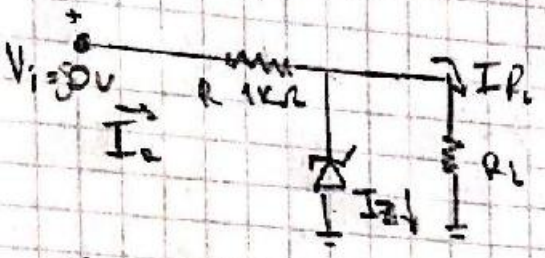
$V_o = (V_i - 5)\frac{1k}{2k}$

$V_o = \frac{V_i - 5}{2}$ → Para $5 < V_i < 15V$



Giuseppe Steven Iriago Camacho

Cuarto Tema



$V_z = 10V$

$I_{Z\,min} = 0\,mA$

$I_{Z\,max} = 32\,mA$

$I_R = I_Z + I_L$

$I_L = I_R - I_Z$

$10V \leftarrow \frac{V_z}{R_L} = 40 - I_Z$

$R_L = \frac{10}{40 - I_Z}$

$I_L = \frac{V_z}{R_L}$ $\quad I_R = \frac{V_i - V_z}{R} = \frac{40}{1K\Omega}$

$I_R = 40\,mA$

$R_{L\,max} = \frac{10}{40 - I_{Z\,max}}$

$R_{L\,max} = \frac{10}{40 - 32} = 1.25K\Omega$ //

$R_{L\,min} = \frac{10}{40 - I_{Z\,min}} = \frac{10}{40 - 0} = 0.25K\Omega$

a) $R_{L\,min} = 0.25K\Omega$ //

c) $P_{Z\,max} = V_z I_{Z\,max}$

$P_{Z\,max} = (10V)(32mA)$

$P_{Z\,max} = 320\,mW$ //

Nombre: Cristhian Andres Macay Erazo Paralelo: 2

Examen 1° Parcial

14/100

Reconozco que el presente deber está diseñado para ser resuelto de manera individual, y no se permite la ayuda de fuentes no autorizadas ni copiar. Firmo al pie del presente compromiso como constancia de haber leído y aceptar la declaración anterior.

Macay

(1)

Q_1: Transistor de Si $\beta = 50$, $V_{CE} = 0.4\,[V]$ Saturación

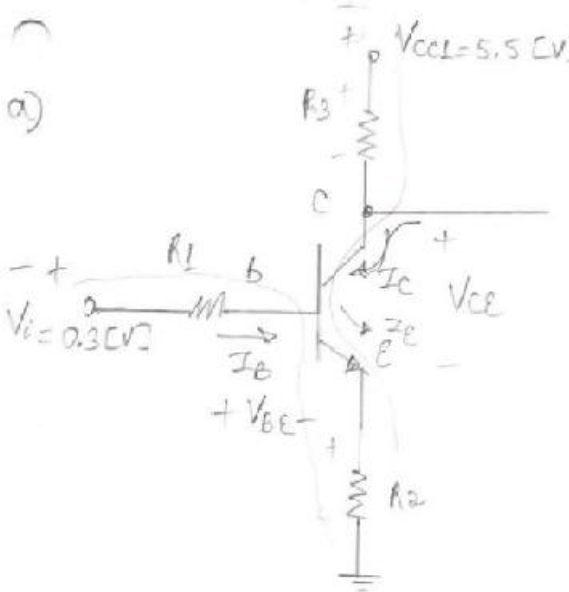
Q_2: $V_t = 2\,[V]$, $K = 1\,[mA/V^2]$

⊕ Transistor BJT

$I_E = (\beta+1) I_B$

$I_C = \beta I_B$

a)



i) C-E

$-V_{CC1} + R_3 I_E + V_{CE} + R_2 I_E = 0$

$R_3 I_C + R_2 I_E = V_{CC1} - V_{CE}$

$R_3 [(\beta+1) I_B] + R_2 [\beta I_B] = V_{CC1} - V_{CE}$

$I_B [R_3(\beta+1) + R_2\beta] = V_{CC1} - V_{CE}$

V_{CE} de saturación

$$I_B = \frac{V_{CC1} - V_{CE}}{R_3(\beta+1) + R_2\beta} = \frac{5.5 - 0.4}{(3.1K\Omega)(50+1) + (2K\Omega)(50)}$$

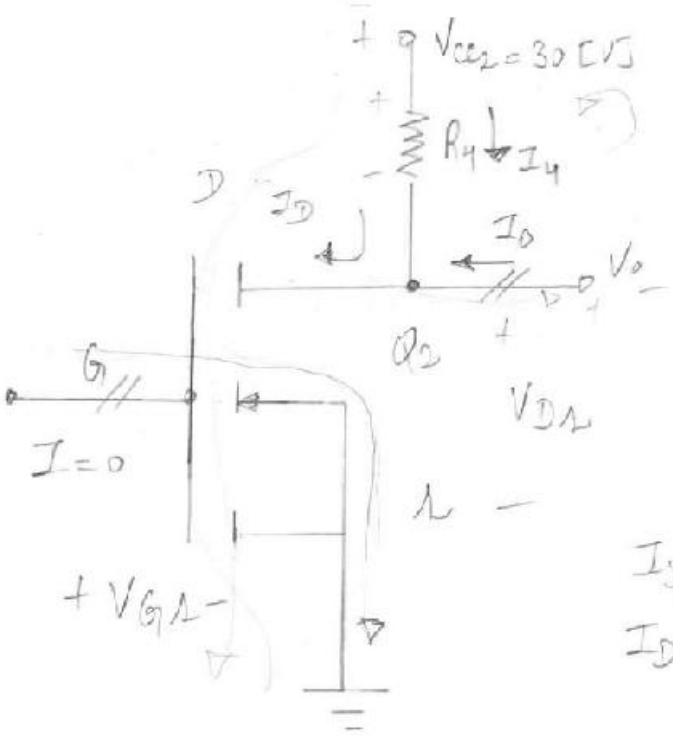
$I_B = 19.76\,\mu A$

ii) B-E

$-V_i + R_1 I_B + R_2 I_E + V_{BE} = 0$

$V_{BE} = V_i - R_1 I_B - R_2 I_E = 0.3 - (10K)(19.76\mu A) - (2K)(51)(19.76\mu A)$

$V_{BE} = -1.913\ [V]$



$V_{GS} = V_G - V_S = 0$

$V_{GS} = V_G = V_{CC1} = 5.5V$

$I_D = K(V_{GS} - V_T)^2$

$I_D = (1)[5.5 - 2]^2 = 12.25mA$

$I_4 = \frac{V_{CC2}}{R_4} = \frac{30}{2K} = 0.015\ A$

$\sum$ KV: $-V_o + V_{DS} = 0$

$V_o = V_{DS}$

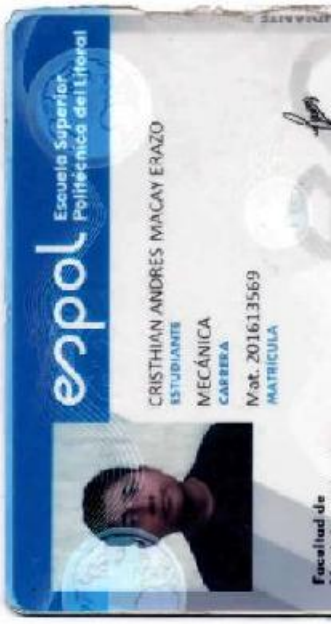
$V_{DS} = V_{CC2} - R_4 I_4$

+2p

Punto de operación

$Q_1 (-1.913, 19.76\mu A)$

$Q_2 (30V, 784mA)$



b) Solo cambian los valores, similar análisis

$I_B = \frac{V_{CC1} - V_{CE}}{R_3(\beta+1) + R_2\beta} = 19.76\mu A$

$V_{BE} = V_i - R_1 I_B - R_2 I_E = 3 - (10K)(19.76\mu A) - (2K)(51)(19.76\mu A)$

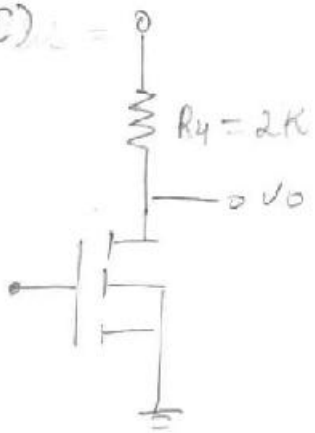
+2p

$V_{BE} = 0.787\ [V]$, $I_B = 19.76\mu A$

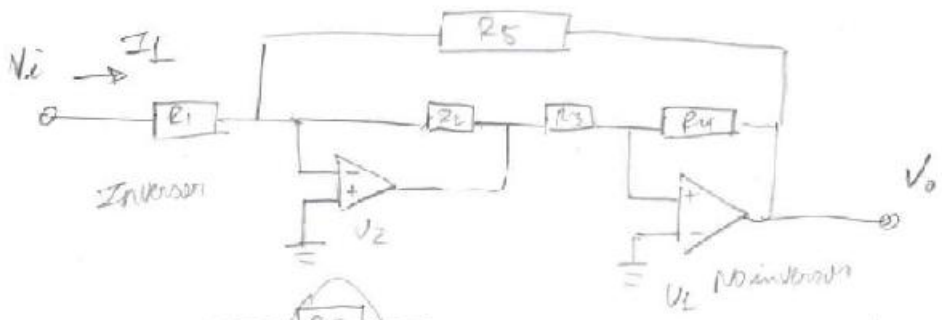
$V_{DS} = 30\ [V]$, $I_D = K(V_{GS} - V_T)^2 = 12.25mA$

//R

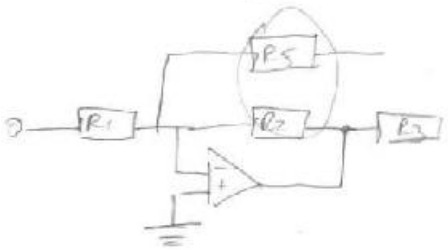
C)



(2)



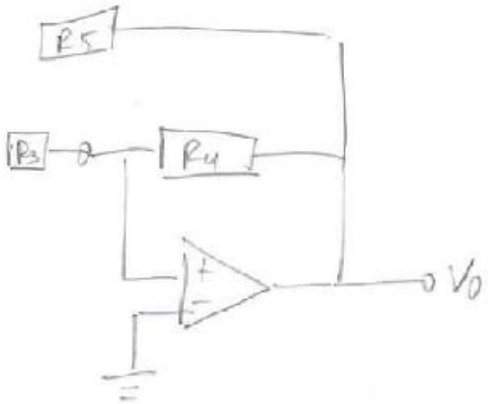
Fuente controlada por voltaje



$$R' = \frac{R_5 \cdot R_2}{R_5 + R_2} = 1.2\ K\Omega$$

$$V_o = \left(1 + \frac{RF}{R_1}\right) V_2 = \left(1 + \frac{R'}{R_1}\right) V_L$$

$$V_o = \left(1 + \frac{1.2K}{1K}\right) 5 \operatorname{Sen} wt = 11 \operatorname{Sen} wt$$

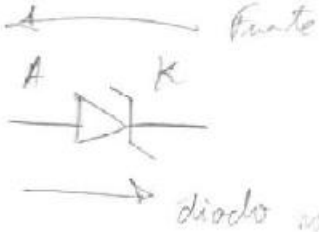


$$V_o = I_1 R' \longrightarrow I_1 = \frac{V_o}{R'}$$

$$I_1 = \frac{11 \operatorname{Sen} wt}{1.2K\Omega} = (9.17 \operatorname{Sen} wt)\ mA \ //R$$

(3)

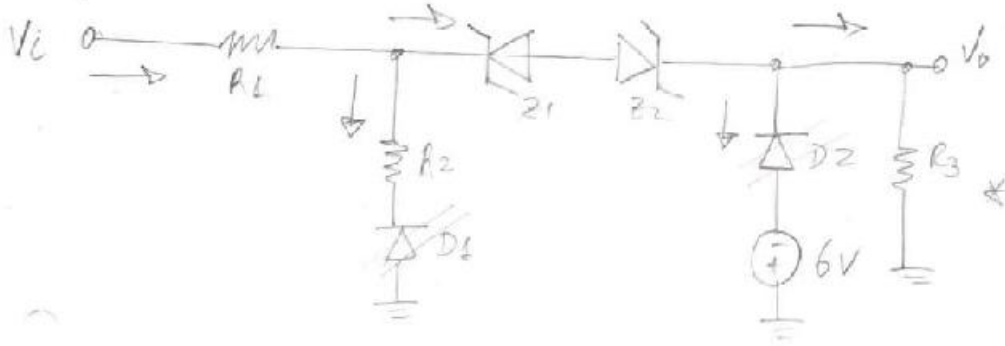
Diodo zener



Fuente

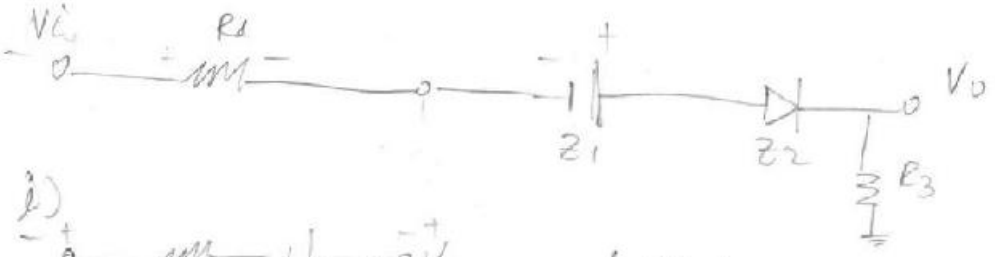
diodo normal

Asumir dirección de Corriente



* Diodos ideales
Polarización indirecta
"Se abre el circuito"

$V_{Zmax} =$



i)

$\sum VK.1:$

$-Vi + R_1 I_1 - V_{Z1} + R_3 I_3 = 0$

$Vi = -V_{Z1} + R_1 I_1 + R_3 I_3$

$\sum VK2:$

$-V_o + R_3 I_3 = 0$

$V_o = R_3 I_3$

+3p

ii)

$\sum VK2:$

$V_o = R_3 I_3$

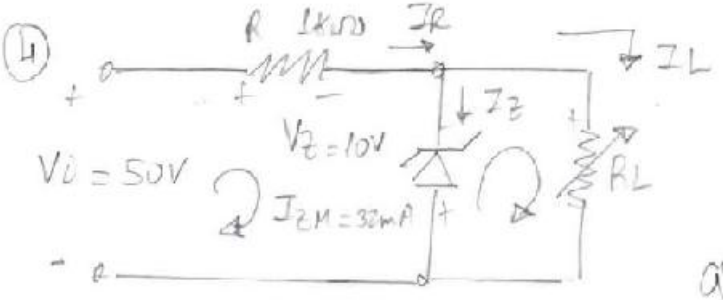
$\sum VK\ 1:$

$-Vi + R_1 I_1 + R_3 I_3 = 0$

$Vi = R_1 I_1 + R_3 I_3$

$I_3 = \frac{Vi - R_1 I_1}{R_3}$

(4)



LVK.

$-Vi + R I_R + V_z = 0$

$-50 + (1K\Omega)(I_R) + 10V = 0$

$I_R = \frac{40V}{1K\Omega} = 0.04$

LCK:

$I_R = I_z + I_L$

$I_R = I_L$

a)

$V_z = 10V$

$I_{z\,max} = 32mA$

$V_i = 50\,Vdc$

LVK:

$I_L R_L + V_z = 0$

$V_z = -I_L R_L$

$R_L = -\frac{I_L}{V_z}$

$R_L = -\frac{0.04}{32mA}$

$R_L = -1.25\,\Omega$ // R

Nunca R<0

b)

$I_R = I_z + I_L$

$I_L = I_R - I_z = 0.04 - 32mA = 8mA$

$R_L = -\frac{I_L}{V_z} = -\frac{8mA}{10} = 800\,\Omega$ // R

c)

$P = I R^2$

$P = (32mA)^2(800) = 20.48\,KW$ // R

+2P

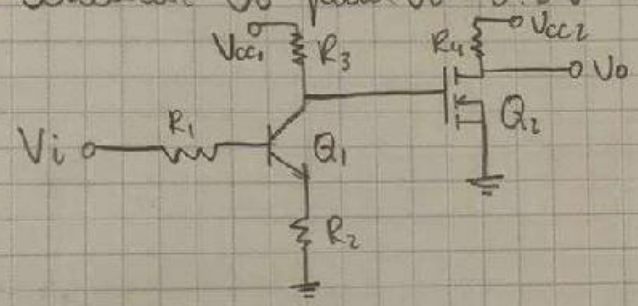
Fecha: ___/___/___

5/10

Reconozco que el presente deber[illegible] resuelto de manera individual, y [illegible] de fuentes no autorizadas ni copiar. Firmo al pie del presente compromiso, como constancia de haber leído y aceptar la declaración anterior.

1)

a) Calcular V_o para $V_i = 0.3V$



$V_{cc_1} = 5.5V$ $R_3 = 3.1K\Omega$

$V_{cc_2} = 30V$ $R_4 = 2K\Omega$

$R_1 = 10K\Omega$ $Q_1 \rightarrow \beta = 50$

$R_2 = 2K\Omega$ $\hookrightarrow V_{CE_{sat}} = 0.4V$

$Q_2 \rightarrow V_t = 2V$

$\hookrightarrow K = 1 \frac{mA}{V^2}$

$$I_B = \frac{V_i - V_{BE}}{R_1 + R_2(\beta+1)}$$

$$V_{cc_1} = R_3 I_C + V_{CE} + R_2 I_E$$

$$I_E = \left(\frac{\beta+1}{\beta}\right) I_C$$

$$V_{cc_1} = R_3 I_C + V_{CE} + R_2\left(\frac{\beta+1}{\beta}\right) I_C$$

$$V_{cc_1} = I_C\left(R_3 + R_2\left(\frac{\beta+1}{\beta}\right)\right) + V_{CE}$$

$$V_{CE} = 5.5 - I_C\left(3.1 + 2\left(\frac{50+1}{50}\right)\right)$$

$$V_{CE} = 5.5 - 5.14\, I_C$$

$$I_C = \beta I_B = \beta\left(\frac{V_i - 0.7}{1k2}\right)$$

$I_D = -3.5$ ∴ Está saturado

$I_C = 0$ Corte

$V_{CE} = 5.5V$

$V_{GS} = 5.5V$

$I_D = 1(5.5-2)^2 = 17.25mA$

$V_{DS} = 30 - (2)(17.25)$

$V_{DS} = [illegible]5V$

$V_o = 5.5V$

✓ +1P

Fecha: __/__/__

b) $V_o = ?$ $V_i = 3V$

$I_b = 20.5\ uA$

$I_c = 1.028\ mA$

$V_{CE} = 0.2V$

$V_{GS} = 2.3V$

$I_D = 0.09\ mA$

$V_{DS} = 29.82V$

$V_o = 29.82V$

Si está saturado

$+5V$

$V_{DS} = V_{CE}$ $5.5 - 3.2$

$+5V$

$V_{DS} = 30 - 2(0.09)$

c) $V_i = ?$ $V_o = 17.5V$

$I_B = 0.15\ mA$

$I_C = 7.5\ mA$

$V_{CE} = 0V$

Al ver saturado

$V_{GS} = V_G = 5.5 - 3.1(1.08)$

$V_{GS} = 2.15V$

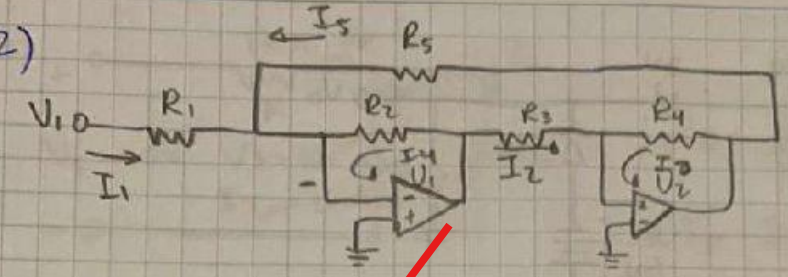
X

$I_D = 25.03\ uA$

$V_{DS} = 29.8V = V_o = 29.8V$

Fecha: __/__/__

2)



$V_{cc} = \pm 15V$

$R_1 = 1K\Omega$

$R_2 = 2K\Omega$

$R_3 = 2K\Omega$

$R_4 = 4K\Omega$

$R_5 = 3K\Omega$

$V_i = 5 \operatorname{sen} wt$

$I_1 = \frac{5 \operatorname{sen} wt}{R_1}$ ✓ +15p

$\Sigma I = 0$

$I_1 + I_5 = I_4$ $\quad I_1 = \frac{V_x - V_1}{R_2} - \frac{V_o - V_1}{R_5}$

$I_1 = -\frac{V_o \cdot R_3}{R_4 \cdot R_2} - \frac{V_o}{R_5}$

$I_1 = -V_o \left(\frac{R_3}{R_4 \cdot R_2} \cdot \frac{1}{R_5} \right)$

$I_1 + I_5 = I_4$

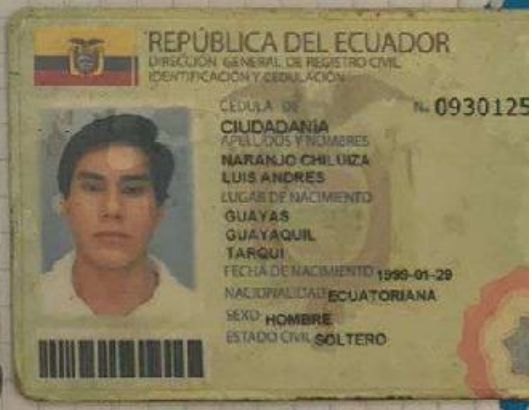
$I_1 = \frac{V_x}{R_2} - \frac{V_o}{R_5}$

$I_1 = -\frac{V_o \cdot R_3}{R_4 \cdot R_2} - \frac{V_o}{R_5}$

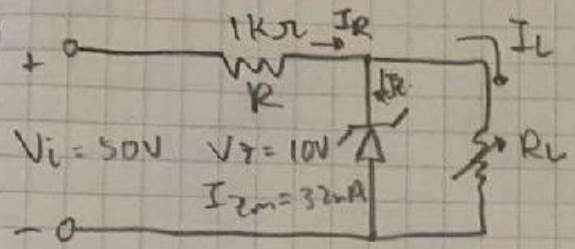
$I_1 = -V_o \left(\frac{R_3}{R_4 \cdot R_2} + \frac{1}{R_5} \right)$

$I_1 = -V_o \left(\frac{R_3 \cdot R_5 + R_4 \cdot R_3}{R_4 \cdot R_2 \cdot R_5} \right)$

$\frac{I_1}{R_1} = -V_o$



4)



$V_Z = 10V$

$I_{Zm} = 32mA$

$V_{th} = \frac{V_i \cdot R_L}{R_L + R}$

$R_{th} = \frac{R R_L}{1 + R_L}$

$I_Z = \frac{V_{th} - V_Z}{R_{th}} < 32$

$V_{th} - V_Z < 32\left(\frac{R_L}{1 + R_L}\right)$

$\frac{50R_L}{R_L+1} - \frac{32R_L}{R_L+1} < 10$

$\frac{18R_L}{R_L+1} < 10$

$18R_L < 10(R_L+1)$

$8R_L < 10$

Máximo $R_L < \frac{10}{8} = 1.25K\Omega$ +1 ✓

$P_{max} = V_Z \cdot I_{Z\,max}$

$P_{máx} = (10)(32) = 0.32W$ +1 ✓

$I_R = \frac{50}{1} = 50mA$

$I_R - I_Z - I_L = 0$

$I_R = I_Z + I_L$

$I_Z + I_L = 50mA$

$Z_Z = \frac{V_{th} - V_Z}{R_{th}}$

$V_{th} > V_Z$ $\quad 50R_L > 10(R_L+1)$

$\frac{R_L - V_i}{R_L+1} > V_Z$ $\quad 40R_L > 10$

Mínimo $R_L = \frac{1}{4}(1000) = 250\Omega$ +1 ✓

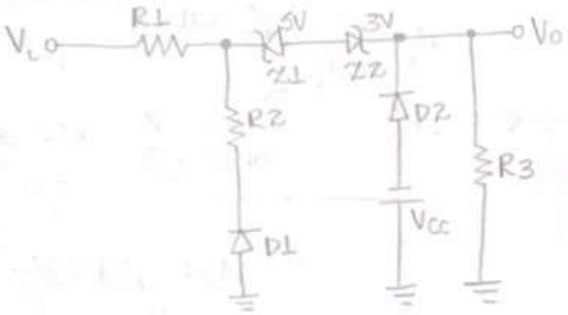
Compromiso de Honor

Reconozco que el presente deber está diseñado para ser resuelto de manera individual, y no se permite la ayuda de fuentes no autorizadas ni copiar. Firmo al pie del presente compromiso, como constancia de haber leído y aceptar la declaración anterior.

María Panchana O.

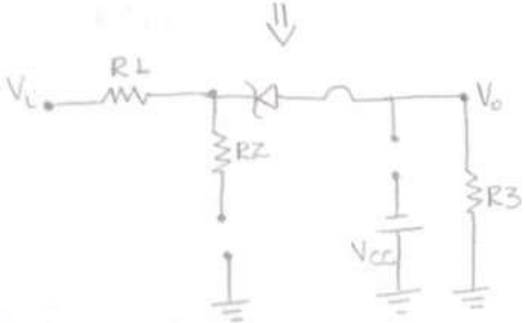
5 2
100

Tema 3.

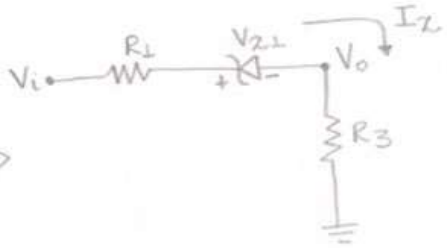


- Se tiene que Z1 on → fuente
- Se tiene que Z2 on → polarizado
- Se tiene que D1 y D2 off

para $V_i : +\infty \to 0$



=>



$V_i - V_z = (1K + 1K) I_{z1}$

$I_{z1} = \frac{V_i - V_z}{1K + 1K} = \frac{V_i - V_z}{2K}$

$I_{z1} > 0$

47P ✓

* $V_i > V_z$
* $V > 5V$

$5V < V_i < +15V$

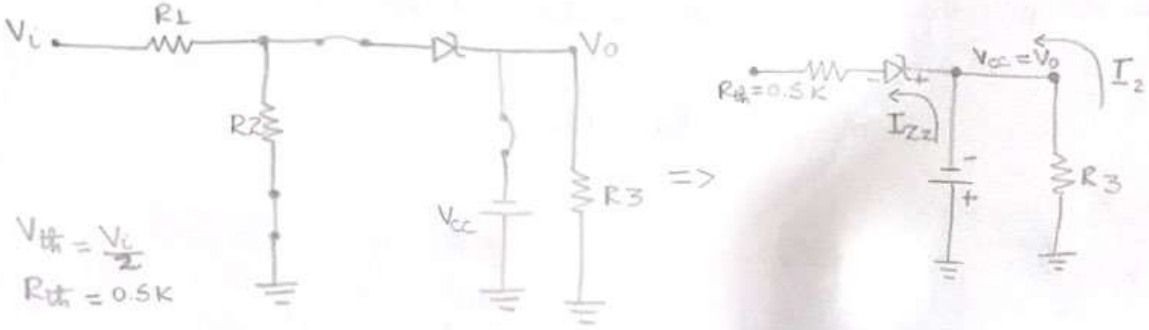
* $V_o = (I_z)(1K)$

$V_o = \left(\frac{V_i - V_z}{2K}\right)(1K) = \frac{V_i - 5}{2K}$

$5 < V_i < +15\,V\ [V]$

- Se tiene que Z_1 on →
- Se tiene que Z_2 off → no polarizado (cir abierto)
- Se tiene D1 – off y D2 – on (polarizado)

} para V_i : 10 → 0 V

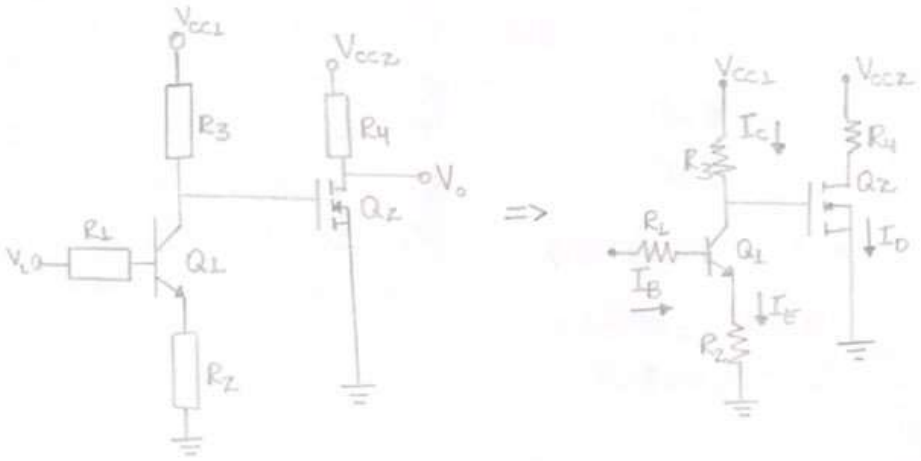


$V_o = 0$

$0 < V_i < 5$ [illegible]

V_i en función de tiempo

Tema 1.



$$V_i - V_{BE} = R_1 I_B + R_2(1+\beta) I_B$$

$$I_B(R_1 + R_2 + R_2\beta) = V_i - V_{BE}$$

$$* I_B = \frac{V_i - V_{BE}}{R_1 + R_2 + R_2\beta} = \frac{V_i - 0.7V}{10K + 2K + (2K)(50)} = \frac{V_i - 0.7V}{112K\Omega} A \qquad * I_E = \left(\frac{\beta+1}{\beta}\right) I_C$$

$$* V_{CC1} = R_3 I_C + V_{CE} + R_2 I_E$$

$$V_{CC1} - R_3 I_C - R_2 I_E = V_{CE}$$

$$V_{CE} = V_{CC1} - R_3 I_C - R_2\left(\frac{\beta+1}{\beta}\right) I_C$$

$$V_{CE} = V_{CC1} - I_C\left(R_3 + R_2\left(\frac{\beta+1}{\beta}\right)\right)$$

$$V_{CE} = 5.5[V] - I_C\left(3.1K\Omega + 2K\Omega\left(\frac{51}{50}\right)\right)$$

$$V_{CE} = 5.5[V] - I_C(5.14mA)$$

$$* I_C = \beta I_B$$

$$I_C = \frac{(50)(V_i - 0.7V)}{112K\Omega}$$

$$* V_{GS} = V_C$$

$$V_{CC1} = R_3 I_C + V_C$$

$$V_C = V_{CC1} - R_3 I_C$$

$$I_D = K(V_C - V_t)^2$$

$$V_{DS} = V_{CC} - R_4 I_D$$

a) V_o para $V_i = 0.3\,V$

$$I_B = \frac{0.3 - 0.7}{112K} = -3.5[\mu A]$$

como $I_B < 0 \rightarrow Q_1$ en zona de corte

$I_C = 0\,A$

$V_{CE} = 5.5\,V = V_{CC1}$

$\therefore Q_1(5.5V, 0\,A)$

$V_{GS} = 5.5\,V$

$I_D = 1(5.5-2)^2$

$I_D = 12.25\,mA$

$V_{DS} = 30 - (2.2)(12.25)$

$V_{DS} = 5.5\,V$

$\therefore Q_2(5.5V, 12.25\,mA)$

$V_o = V_{DS} = 5.5V$

$\therefore V_o = 5.5\,V$

+3P +3P +4P

b) V_o para $V_i = 3\ V$

$I_B = \frac{3-0.7}{112K} = 20.54\ [\mu A]$

$I_C = (50)(20.54\mu) = 1.027[mA]$

$V_{CE} = 5.5 - (1.027)(2.2) = 0.22[V]$

Q_1 saturado $\therefore Q_1(0.22V, 1.027mA)_{\|}$

$V_o = V_{DS} = 29.81\ V$

$\therefore V_o = 29.81\ V_{\|}$

$V_{GS} = V_G = 5.5 - 3.193$

$V_{GS} = 2.307\ V$

$I_D = (1)(2.307-2)^2$

$I_D = 94.25\ [\mu A]$

$V_{DS} = 30 - (2K)(94.25\mu)$

$V_{DS} = 29.81\ V$

$\therefore Q_2(29.81V, 94.25\mu A)_{\|}$

+3P +3P +4P

c) V_i para $V_o = 17.5\ V$

$V_i = 17.5\ V$

$I_B = \frac{17.5-0.7}{112K} = 0.15\ [mA]$

$I_C = (50)(0.15m) = 7.5\ mA$

$V_{CE} = 0\ V$

Q_1 saturado $\therefore Q_1(0V, 1.078mA)$

$I_C = 1.078\ mA$

$V_{GS} = V_G = 5.5 - 3.1(1.078)$

$V_{GS} = 2.158\ V$

$I_D = (1)(2.158-2)^2$

$I_D = 24.96\ [\mu A]$

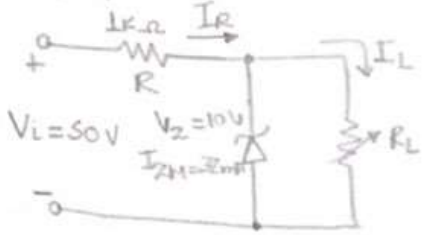
$V_{DS} = 29.95\ V$

$\therefore Q_2(29.95\ V, 24.96\ \mu A)_{\|}$

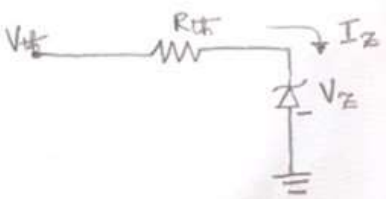
$V_o = V_{DS}$

$\therefore V_o = 29.95\ V_{\|}$

Tema 4



$\Rightarrow$



$V_{th} - V_Z = R_{th} I_Z$

$I_Z = \frac{V_{th} - V_Z}{R_{th}}$

$I_Z > 0$

$V_{th} > V_Z$

$\frac{R_L \cdot V_i}{R_L + 1} > V_Z$

$50(R_L) > 10(R_L + 1)$

$40 R_L > 10$

$R_{L\,min} > \frac{10}{40}$

$R_{L\,min} > 250\,\Omega$ // +1sp

a)

$V_{th} = \frac{V_i R_L}{R_L + R} = \frac{V_i R_L}{R_L + 1}$

$R_{th} = R \parallel R_L = \frac{(1)(R_L)}{R_L + 1}$

$R_{th} = \frac{R_L}{1 + R_L}\,[k\Omega]$ //

c) $P_{max} = V_Z \cdot I_{Z\,max}$

$P_{max} = (10)(32m)$

$P_{max} = 0.32\,W$ // +1sp

b) $I_Z = \frac{V_{th} - V_Z}{R_{th}} < 32$

$V_{th} - V_Z < 32\left(\frac{R_L}{1 + R_L}\right)$

$\frac{(50)R_L}{R_L + 1} - \frac{(32)R_L}{R_L + 1} < 10$

$\frac{18 R_L}{R_L + 1} < 10$

$18 R_L < 10(R_L + 1)$

$8 R_L < 10$

$R_{L\,max} < 1.25\,k\Omega$ // +1sp

Examen

Jhoffre Ramirez

41/50

Compromiso de honor

Reconozco que el presente diber esta diseñado para ser resuelto de manera individual y no se permite la ayuda de fuentes no autorizadas ni copiar.

Firmo al pie presente compromiso, como constancia de haber leido y aceptar la declaración

Jhoffre Ramirez

Firma de compromiso del estudiante

Primer Tema

Datos

Q_1 de Si con $B = 50$ $V_{c\,saturación} = 0,4\,[V]$

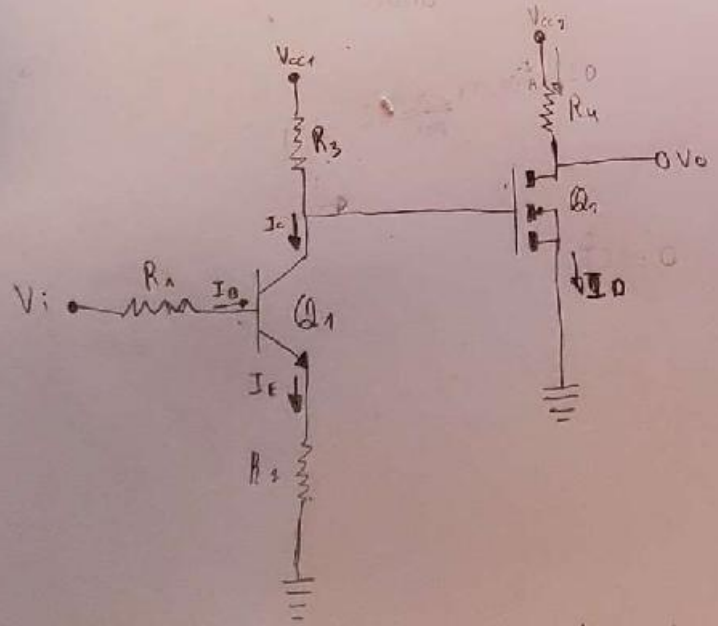
Q_2 $V_t = 2\,[V]$, $K = 1\left[\frac{mA}{V^2}\right]$

$R_1 = 10K\Omega$ $V_{cc1} = 5,5\,[V]$

$R_2 = R_4 = 2K\Omega$ $V_{cc2} = 30\,[V]$

$R_3 = 3,1K\Omega$

$\beta = \frac{I_c}{I_B}$ $I_c = \frac{V_{cc} - 0,7}{R_B}$



(a) $V_i - V_{BE} = R_1 I_B + R_2(\beta+1) I_B$

$I_B = \frac{V_i - V_{BE}}{R_1 + R_2(\beta+1)} = \frac{0,3 - 0,7}{10 + (2)(51)} = -3,57\,[mA]$

$I_E = \frac{(\beta+1)}{\beta} I_c$

$V_{cc1} = R_3 I_c + V_{CE} + R_2 I_E$

$V_{CE} = V_{cc1} - R_3 I_c - R_2\left(\frac{\beta+1}{\beta}\right) I_c$

$V_{CE} = V_{cc1} - I_c\left[R_3 + R_2\left(\frac{\beta+1}{\beta}\right)\right]$

$V_{CE} = V_{cc1} - I_c[5,140]$

$V_{CE} = 5,5 - I_c[5,140]$

$I_c = \beta I_B$

$I_c = \frac{\beta(V_i - 0,7)}{10 + (2)(51)} = \frac{50(0,3 - 0,7)}{10 + 102} = -0,17mA$

Apagado

Q_1 esta en corte // $I_c = 0\,A$

$V_{CE} = V_{cc1} = 5,5\,[V]$

$Q_1\,(0mA, 5,5V)$ //

$I_D = (5,5 - 2)^2 = 12,25\,mA$

$V_{DS} = 30 - 2K(12,25) = 5,5\,V$ +4p

$Q_2\,(12,25mA, 5,5V)$

Q_2 esta en corte ✗

$V_{DS} = V_c$

$V_{cc1} = R_3 I_c + V_c$

$V_c = V_{cc1} - R_3 I_c$

$I_D = K(V_c - V_t)^2$

$V_{DS} = V_{cc} - R_4 I_D$

+3p

(B) $V_i = 3[V]$

$I_D = 20.53\ mA$

$I_C = 1.04\ mA$

$V_{CE} = 5.5 - 1.04\ [5.14\Omega]$

$V_{CE} = 0.1544[V]$

Q_1 está saturado

Q_1 (1.04 mA, 0.1544V)

+3p

Q_2

$V_{GS} = V_G = 5.5 - 3.22$ $V_{DS} = V_D = 29.8432$

$V_{GS} = 2.28\ V$

$I_D = (2.38 - 2)^2$

$I_D = 0.0784\ mA$

$V_{DS} = 30 - 2(0.0784)$

$V_{DS} = 29.8432[V]$

Q_2 saturado ✗

+4p

Q_2 (0.0784 mA, 29.8432[V])

(C) $V_o = 17.5[V]$

$V_o = V_{DS} = 17.5$

$17.5 = 30 - 2(I_D)$

$30 - 17.5 = 2I_D$

$I_D = 6.25\ mA$

$Q_2 = (6.25\ mA, 17.5V)$

Q_2 Saturación

+2p

$8.25 = (V_{GS} - 2)^2$

$2.5 = (V_{GS} - 2)$

$0.5 = V_{GS}$

$V_{CE} = 0.5\ V$

$V_{CC} = 5.5 - I_C(5.14)$

$I_C = \frac{5.5 - 0.5}{5.14}$

$I_C = 0.94\ mA$

$I_C = \beta I_B$

$\frac{I_C}{\beta} = I_B$

$I_B = 0.019\ mA$

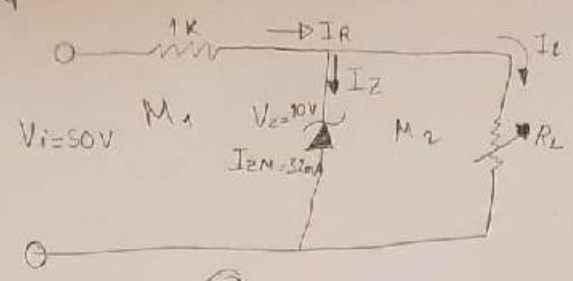
Q_1 está en corte

$I_D = \frac{V_i - 0.7}{10 + 2(51)} = 0.019$

$V_i = 0.019(10 + 2(51)) + 0.7$

$V_i = 2.83[V]$ //R

#4



M1

(a)

$V_{Th} = \frac{V_L \cdot R_L}{R_L + R} = \frac{R_L \cdot V_i}{R_L + 1K}$

$R_{th} = \frac{1K \cdot R_L}{1K + R_L}\ \Omega$

$I_L = 0$

$V_{th} - V_z = R_{th} \cdot I_z$

$I_z = V_{Th} - V_z > 0$

$V_{th} > V_z$

$\frac{R_L \cdot V_i}{R_L + 1K} > V_z$

$50(R_L) > (10)(R_L + 1K)$

$40R_L > 10$

$R_{L\,minimo} = \frac{10000}{40} = 250\Omega$

$R_{L\,min} = 250\Omega$ ✓ flop

(b) $I_z = \frac{V_{th} - V_z}{R_{th}} < 32$ $\quad V_{th} - V_z < 32\left(\frac{R_L}{1K+R_L}\right)$ $\quad \frac{50R_L}{R_L+1K} - \frac{32R_L}{R_L+1K} < 10$

$50R_L - 32R_L < 10(R_L + 1K)$

$18R_L < 10(R_L + 1K)$

$18R_L - 10R_L < 10K$

$8R_L < 10K$

$R_L < 1.25K$

$R_{L\,max} \leq 1250\Omega$ // R ✓ 1 vp

(c) $P_{max} = V_z \cdot I_{z\,max}$

$R_{max} = (10)(32 \times 10^{-3})$

$R_{max} = 3.2 \times 10^{-1}[W]$ // R ✓ 1 sp

Examen Parcial - Electrónica

27/11/2021

57/100

- Milena Riquero
- Paralelo 2

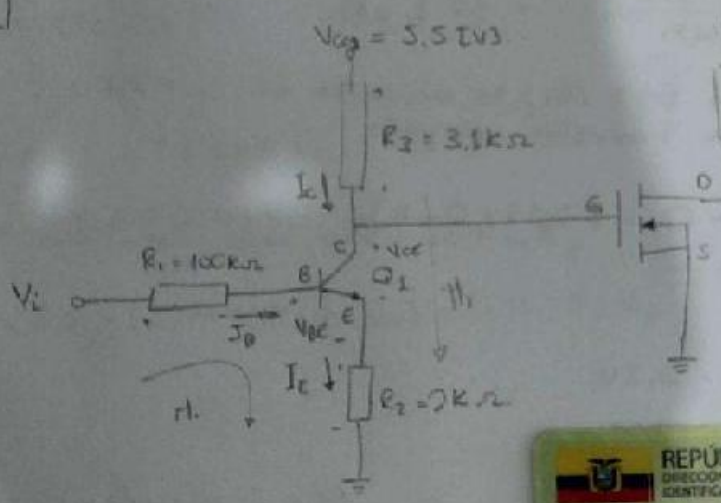
Compromiso de Honor

Reconozco que el presente deber está diseñado para ser resuelto de manera individual, y no se permite la ayuda de fuentes no autorizadas ni copiar. Firmo al pie del presente compromiso, como constancia de haber leído y aceptar la declaración anterior.

Milena Riquero

Firma de Compromiso del estudiante

Tema 1



$V_{CE\,sat} = 0,4\,[V]$ //

Q_1 → transistor de Si con $\beta = 50$

Q_2 → $V_t = 2\,[V]$, $K = 1\,[mA/V^2]$.

a) Calcular V_o para $V_i = 0,3\,[V]$

b) Calcular V_o para $V_i = 3\,[V]$

c) Calcular V_i para $V_o = 17,5\,[V]$

Solución:

H_1:

$$V_i - V_{BE} = R_1 I_B + R_2 I_E$$

$$V_i - V_{BE} = R_1 I_B + (\beta + 1) I_B R_2$$

$$I_B \left(R_1 + R_2 (\beta + 1) \right) = V_i - V_{BE}$$

$$I_B = \frac{V_i - V_{BE}}{R_1 + R_2 (\beta + 1)} \;//$$

$$I_C = \beta \left(\frac{V_i - 0,2}{113\,k} \right) \;//$$

$I_C = \beta I_B$

$I_E = I_C + I_B$

$= \beta I_B + I_B$

$= (\beta + 1) I_B$

$V_{CC1} = R_3 I_C + V_{CE} + I_E R_2$

$I_E = \left(\frac{\beta+1}{\beta}\right) I_C$

$V_{CC1} = R_3 I_C + V_{CE} + I_C \left(\frac{\beta+1}{\beta}\right) R_2$

$V_{CE} = V_{CC1} - I_C \left[R_3 + \left(\frac{\beta+1}{\beta}\right) R_2\right]$

$V_{CE} = 5,5 - I_C\ (5,14\,K)$

$V_{GS} = V_C$

$V_{CC1} = R_3 I_C + V_C \longrightarrow V_C = V_{CC1} - R_3 I_C$

$I_D = k\,(V_C - V_T)^2$

$V_{DS} = V_{CC} - R_4 I_D$

a) $V_i = 0,3V$

$I_B = \frac{V_i - 0,7}{112k} = \frac{0,3-0,7}{112K} = -3,57\ [\mu A]$

$I_B < 0$ → Transistor BJT (Q1) se encuentra en corte → Transistor apagado

$\left.\begin{array}{l} I_C = 0mA \\ V_{CE} = V_{CC1} = 5,5V \end{array}\right\} \longrightarrow Q_1 = (5,5V;\ 0mA)$

$V_C = V_{CC1} - R_2 I_C$

$V_C = 5,5V \longrightarrow V_{GS} = V_C = 5,5V$

$I_D = (1)(5,5-2)^2$

$\left.\begin{array}{l} I_D = 12,25\,[mA] \\ V_{DS} = 30 - (2k)(12,25m) = 5,5V \end{array}\right\} \longrightarrow Q_2 = (5,5V;\ 12,25mA)$

$V_o = V_{DS} = 5,5V$

b) $V_i = 3V$

$I_B = \frac{V_i - 0,7}{112k} = \frac{3-0,7}{112k} = 20,54\ [\mu A]$

$\left.\begin{array}{l} I_C = (51)(20,54) = 1,047\,[mA] \\ V_{CE} = 5,5 - (5,14k)(1,047m) = 0,1544\,[V] \end{array}\right\} \longrightarrow Q_1 = (0,1544V;\ 1,047mA)$

1 → Transistor saturado

$V_{GS} = V_G = 5,5 - (3,1k)(1,042mA) = 2,3[V]$

$I_D = (1)(2,3 - 2)^2 = 0,09\ mA \rightarrow \approx 90\ \mu A$

$V_{DS} = 30 - (2k)(0,09m) = 29,82\ V.$

$V_o = V_{DS} = 29,82V$ //

$\rightarrow Q_2 = (2,3V, 0,09mA)$ +3p

+4p

c) $V_o = 17,5V$

$V_o = V_{DS} = 17,5V$ //

$V_{DS} = 30 - 2k I_D$

$I_D = \frac{30 - 17,5}{2k} = 6,25\ mA$ //

$Q_2 = (17,5V, 6,25\ mA)$ +5p

$I_D = 1(V_G - 2)^2$

$6,25m = (V_G - 2)^2$

$V_G = 2,079V$ //

$V_G = 5,5 - (3,1k)\ I_G$

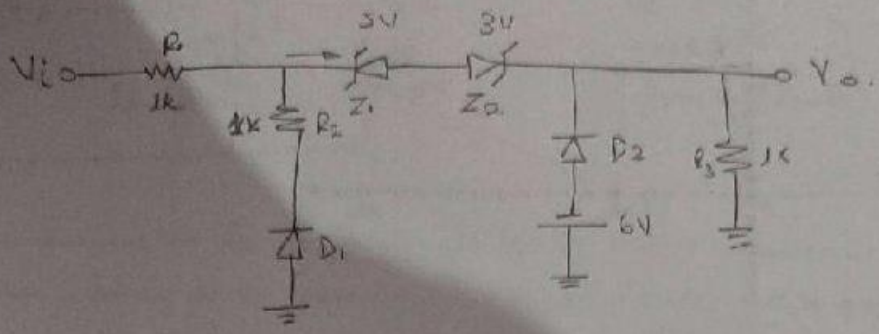
$I_G = \frac{5,5 - 2,079}{3,1K} = 1,104\ mA$ //

$\rightarrow Q_1 = (-0,175V; 1,104mA)$ //

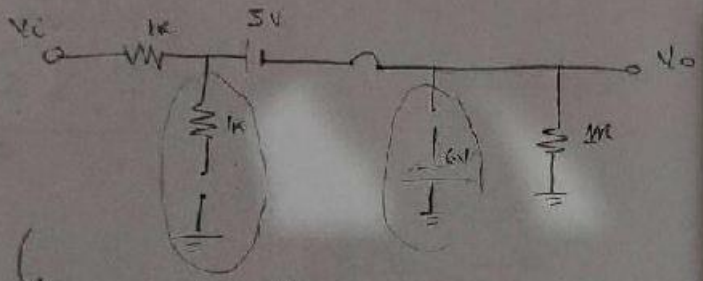
$V_{CE} = 5,5 - (5,14k)(1,104m) = -0,175\ V$ //

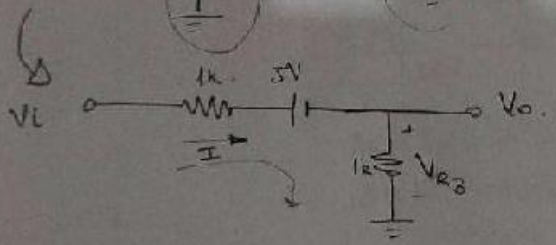
Tema 3

Graficar V_o vs V_i , $5 < V_i < 15$.



* $V_i = 0 \rightarrow 0V$ →
- D_1 → Apagado.
- D_2 → Apagado
- Z_1 → Fuente de Voltaje
- Z_2 → Cortocircuito





$V_o = V_{R3} = 1k(I)$

$V_{TH} - V_z = (1k + 1k)\, I$

$I = \dfrac{V_{TH} - V_z}{2k} > 0_a$

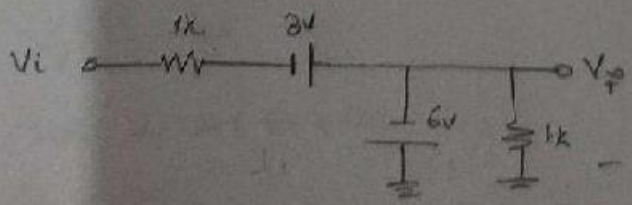
$V_i > V_z$

$V_i > 5\ [V]$

$5 < V_i < 15\ [V]$ //

$\begin{cases} V_o = \dfrac{V_i - 5}{2} \\ 5 < V_i < 15\ [V] \end{cases}$

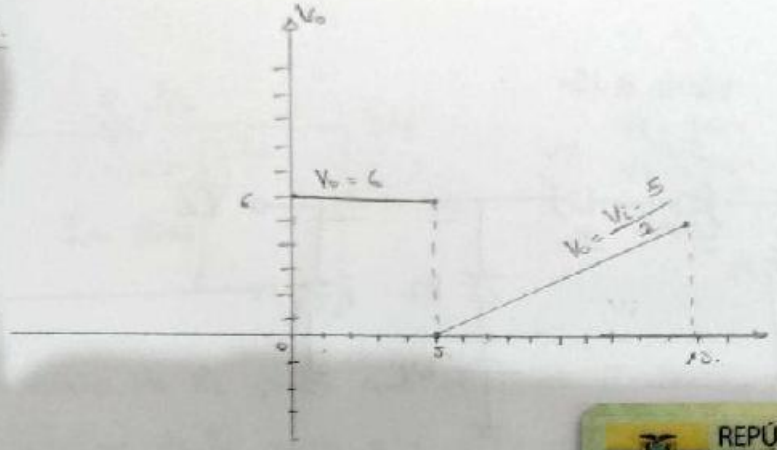
* $V_i = 10 \rightarrow 0V$
- D_1 → Apagado.
- D_2 → Encendido → Cortocircuito.
- Z_1 → Cortocircuito
- Z_2 → Fuente de Voltaje



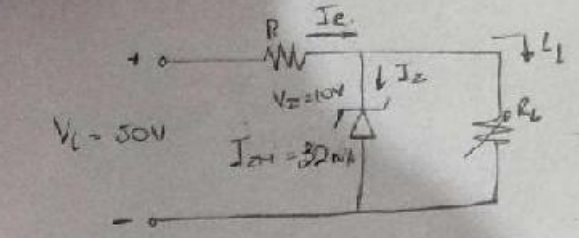
$V_o = \cancel{6V}$

$0V < V_i < 5V$

G-à Pica.



Tema 4

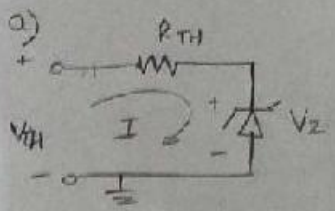


$R = 1k\Omega$
$V_L = 50V$
$V_z = 10V$
$I_{ZM} = 32mA$

a) Valor máximo de R_L para que el diodo Zener comience a conducir
b) Valor máximo de R_L para que el diodo Zener no se queme
c) Potencia máxima que puede disipar el diodo Zener.

Solución

a)



$V_{TH} - V_z = R_{TH} I$

$I = \frac{V_{TH} - V_z}{R_{TH}} > 0$

$V_{TH} = \frac{V_i \cdot R_L}{R_L + R} = \frac{V_i R_L}{R_L + 1k}$

$R_{TH} = R // R_L = \frac{R(R_L)}{R_L + R}$

$R_{TH} = \frac{1k(R_L)}{R_L + 1k}$ [Ω]

$V_{TH} > V_z$

$\frac{V_i R_L}{R_L + 1k} > V_z$

$50(R_L) > 10(R_L + 1k)$

$50R_L - 10R_L > 10k$

$40R_L > 10k$

$R_{L\,min} > \frac{10k}{40}$

$R_{L\,min} > 250\Omega$ //

b) $I_z = \frac{V_{TH} - V_z}{R_{TH}} < 32$

$V_{TH} - V_z < 32\left(\frac{(R_L)}{R_L + 1k}\right)$

$\frac{50(R_L)}{R_L + 1k} - 32\left(\frac{R_L}{R_L + 1k}\right) < 10$

$\frac{18R_L}{R_L + 1k} < 10$

$18R_L < 10(R_L + 1k)$

$8R_L < 10k$

$R_{L\,max} < \frac{10k}{8}$, $R_{L\,max} < 1.25k\Omega$

c) $P_{max} = V_z \cdot I_{z\,max}$

$= (10)(32mA)$

$= 0.32$ [W] //

Compromiso de Honor

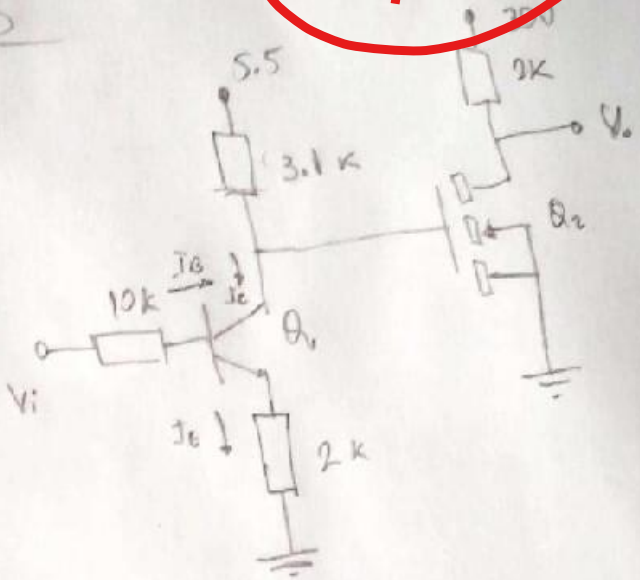
Reconozco que el presente deber está diseñado para ser [illegible] individual, y no se permite la ayuda de fuentes no autorizadas [illegible]. Firmo al pie del presente compromiso, como constancia de haber leído y aceptar la declaración anterior.

41/55

Firma de compromiso [signature] Jesus Tutiven R.

Nota: LA COPIA AMERITA NOTA DE CERO.

Tema 1:



$Q_1 \rightarrow \beta = 50, \; V_{sat} = 0.4V$

$Q_2 \rightarrow V_t = 2V, \; K = 1\left[\frac{mA}{V^2}\right]$

$$\beta = \frac{I_C}{I_B} \qquad I_E = (\beta+1) I_B$$

$$I_C = \frac{5.5}{3.1k} = 1.77\,mA$$

$$I_B = \frac{1.77\,mA}{50} = 0.035mA$$

$$I_E = (51)(0.035) = 1.78mA$$

+4P

$V_B = V_i - V_{B_1}$

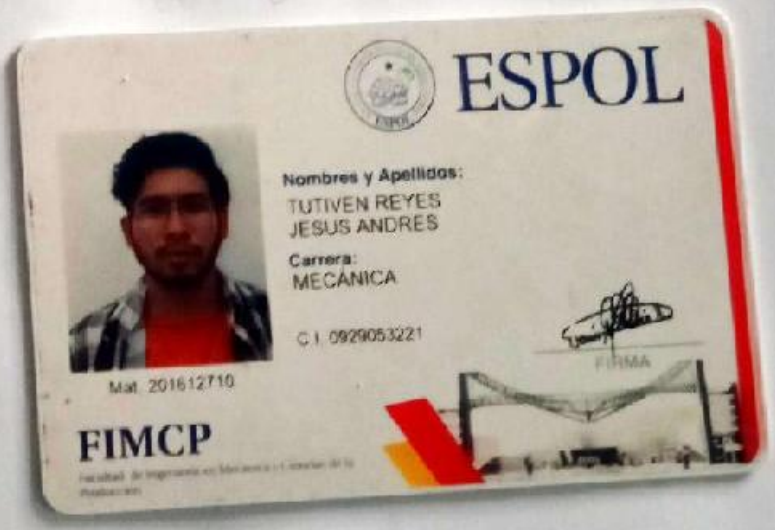
$V_{B_1} = 0.35V$

$$5.5 + 3.1 I_E + V_{CE} - V_{BE}$$

$$5.5 + 3.1 I_E + V_{CE} - (V_i - V_{B_1})$$

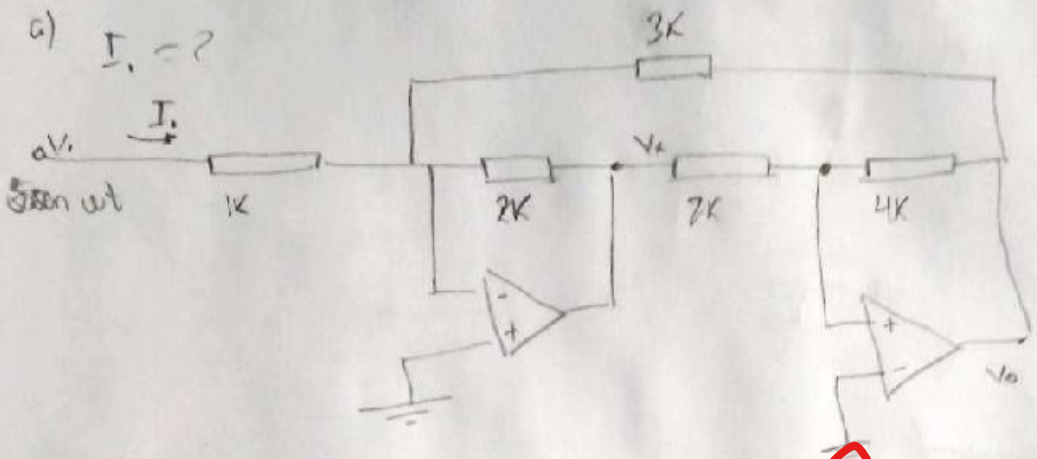
$$V_{CE} = V_i - V_{B_1} - (5.5)(1)$$

$$V_{CE} = V_i - 0.35V - 11V$$



Tema 2

a) $I_1 = ?$



$$I_1 = \frac{V_1}{R_1}$$

$$I_1 = \frac{6\,\text{sen}\,\omega t}{1K} = 0.005\,\text{sen}\,\omega t$$

$$R_{f_1} = \frac{3(2)}{5} = \frac{6}{5}$$

$$R_{f_2} = \frac{4(2)}{6} = \frac{8}{6} = \frac{4}{3}$$

$$A_{v_1} = \frac{R_{f_1}}{R_1}$$

$$A_{v_2} = \frac{R_{f_2}}{R_3}$$

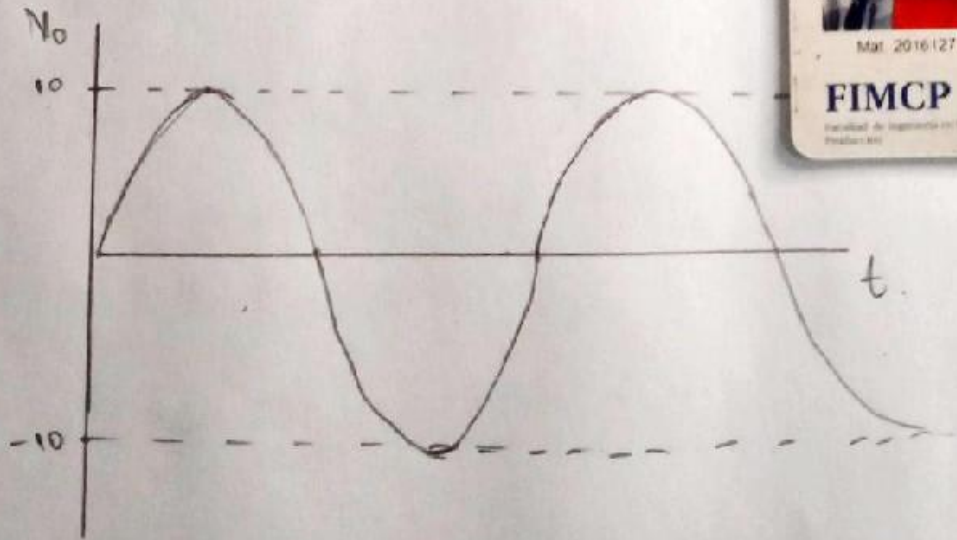
$$A_{v_1} = \frac{6}{5}K\left(\frac{1}{1K}\right) = \frac{6}{5}$$

$$A_{v_2} = \left(1 + \left(\frac{4K}{3}\right)\left(\frac{1}{2K}\right)\right) = \frac{5}{3}$$

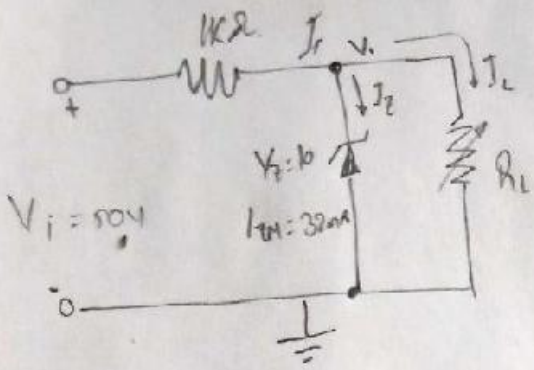
$$V_x = A_{v_1}(V_1) = \frac{6}{5}(6\,\text{sen}\,\omega t) = 6\,\text{sen}\,\omega t$$

$$V_o = A_{v_2}(V_x) = \left(\frac{5}{3}\right)6\,\text{sen}\,\omega t = 10\,\text{sen}\,\omega t$$

b)



Tema 4:



$$V_1 = \frac{R_L}{R+R_L}(V_i) \Rightarrow R_L V_1 + V_1 R = V_1 R_L$$
$$(V_i - V_1) R_L = V_1 R$$

$$I_R = I_L + I_Z$$

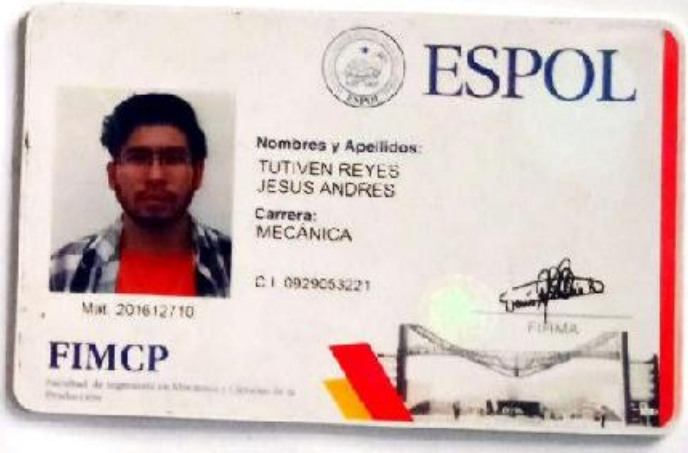
$$I_R = \frac{V_i}{R} = \frac{50V}{1K\Omega} = 0.005A$$

$$I_L = \frac{V_1}{R_L}$$

+1p

a) $V_1 = 10V$

$$R_L = \frac{V_1 R}{V_i - V_1} = \frac{10V(1K)}{50-10} = 0.25K\Omega$$



b) $I_L = I_R - I_Z$

$$\frac{V_1}{R_L} = 0.005 - 0.032$$

$$\frac{R_L(V_i)}{R+R_L} = -0.027 R_L$$

+5p

$$V_i = -0.027(R + R_L)$$

$$V_i = -0.027(R) + (-0.027 R_L)$$

$$50 - 27 = -0.027 R_L$$

$$R_L = \frac{23}{-0.027} = -851.85\Omega.$$

+2p

c) $P_{max} = I^2 R = (32\times10^{-3})^2 (0.25\times10^3)$

$$P_{max} = 0.256\,W$$

Examen Primer Parcial Electrónica

Nombre: Jefferson Iván Vega Sarango Paralelo: 2 Fecha: 23/11/2022

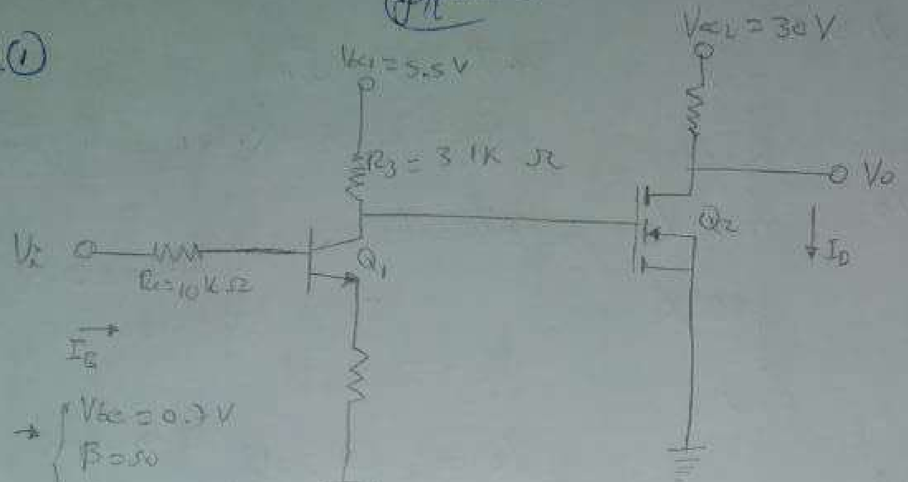
85/100

Compromiso de Honor.

Reconozco que el presente debe está diseñado para ser resuelto de manera individual y no se permite la ayuda de fuentes no autorizadas ni copiar. Firmo al pie del presente compromiso, como constancia de haber leído y aceptar la declaración anterior.

Jefferson

Tema (1)



$Q_1 \rightarrow \begin{cases} V_{be} = 0.7V \\ \beta = 50 \\ V_{ce} = 0.4V \end{cases}$

$Q_1: \quad V_i = I_B R_1 + V_{be} + I_E R_2$ ($(\beta+1) I_b$)

$V_{ce} = 5.5 - I_B (R_3\beta + R_2(\beta+1))$

$I_B = \dfrac{V_i - V_{be}}{R_1 + (\beta+1)R_2} = \dfrac{V_i - 0.7}{112}$

$\rightarrow V_{ce} = 5.5 - 257\, I_B$

$Q_2 \rightarrow \begin{cases} V_T = 2V \\ K = 1mA/V^2 \end{cases}$

$Q_2: \quad 5.5 = R_3 \beta I_b + V_{GS}$

$\rightarrow V_{GS} = 5.5 - 155\, I_b$

$I_D = K(V_{GS} - V_T)^2$

$I_D = (V_{GS} - 2)^2$

$V_{DS} = 30 - R_4 I_D$

$\rightarrow V_{DS} = 30 - R_4 I_D = 30 - 2 I_D$

a) Calcular V_o para $V_i = 0.2V$

→ $I_b = 0$; $V_{ce} = 5.5\ V$ Q_1 → Zona de corte

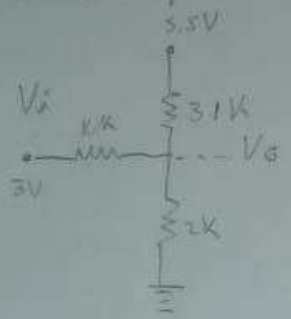
→ $V_{GS} = 5.5V$ Q_2 → Saturación

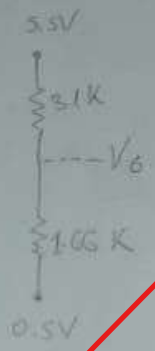
$I_D = 12.25\ mA$ → $V_o = V_{DS} = 5.5\ [V]$ //

$V_{DS} = 5.5\ V$

+1p

b) Calcular V_o para $V_i = 3V$





$I_D = 0.0576\ mA$

→ $V_{DS} 29.88\ V$

→ $V_o = V_{DS} = 29.88\ [V]$ //

+1p

→ $I_B = 2.05 \times 10^{-2}\ mA$

$V_{CE} = 0.2\ V$ Q_1 → Zona de Saturación

→ $V_o = (5.5 - 0.5)\frac{1.06}{1.06 + 3.1} + 0.5$

$V_o = 2.24\ V$

$V_{GS} - V_o = 2.24V$ Q_2 → Zona Lineal

+1p

c) Calcular V_i para $V_o = 0.5V$

→ $V_{DS} = 17.5\ V$

→ $I_D = \frac{20 - V_{DS}}{2} = 6.25\ mA$

→ $V_{GS} = 2 + \sqrt{I_D} = 4.5V$

$I_B = \frac{5.5 - V_{GS}}{1.55} = 6.45 \times 10^{-3}\ mA$

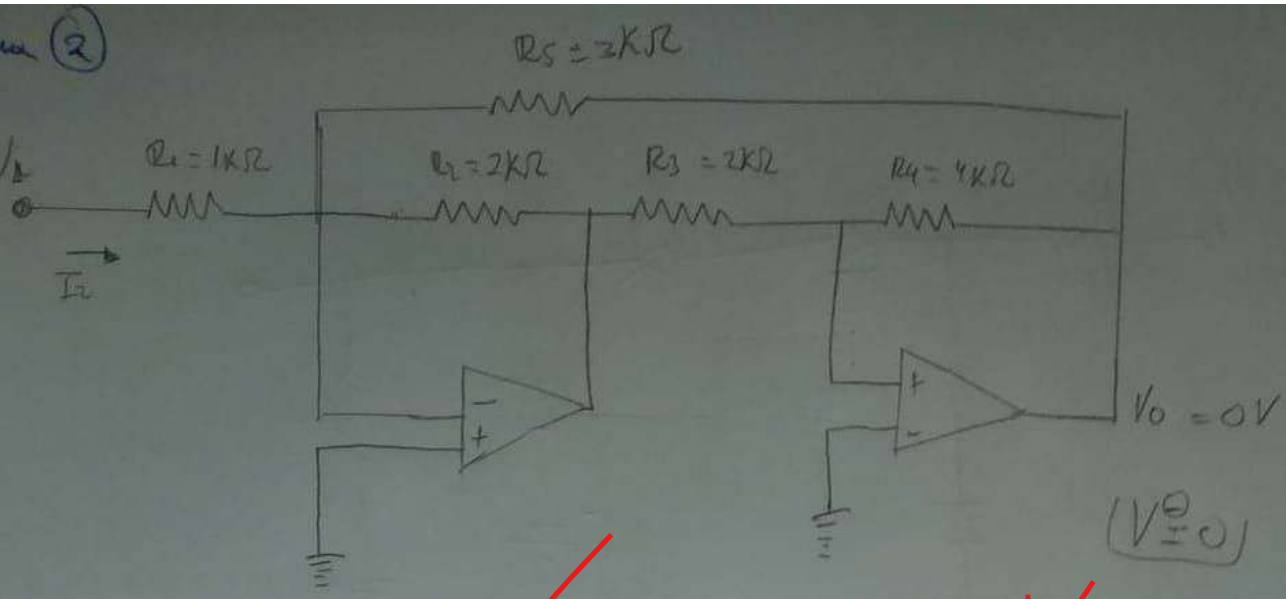
→ $V_i = 112 I_B + 0.7 = 1.42V$

$V_o = 1.42\ [V]$ //

+1p

Q_1 y Q_2 están en Zona Lineal

Tema (2)

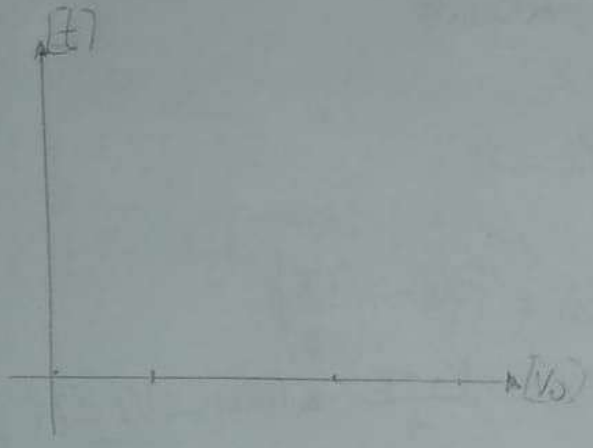


a) Encontrar la expresión para I_L

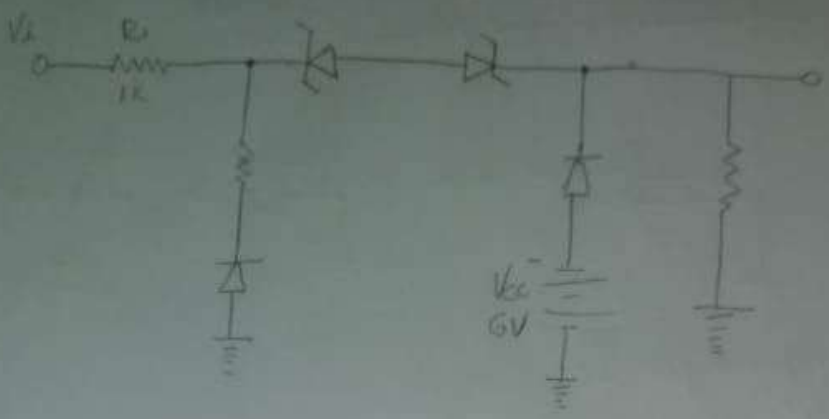
+1 sp

$$I_1 = \frac{V_1 - V^-}{R_1} = \frac{V_i}{R_1} = \frac{5\,Sen(\omega t)}{1K\Omega} = (5\,Sen(\omega t)\ [mA])\ //$$

b) Graficar Vo vs t



Tarea (3)



Cuando $V_i = 0V$

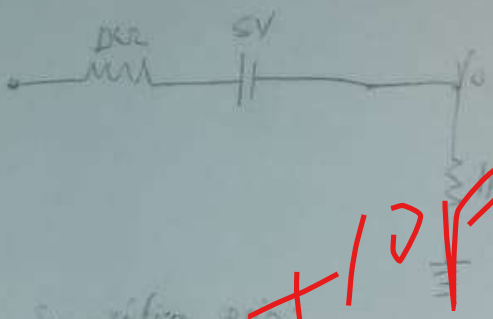
- $D_1 \rightarrow$ OFF
- $Z_1 \rightarrow$ OFF
- $Z_2 \rightarrow$ OFF
- $D_2 \rightarrow$ OFF

$V_o = 0V$

Cuando $V_i > 0$

→ Para $V_i \geq 5$

- $Z_1 \rightarrow$ Zener
- $Z_2 \rightarrow$ Diodo
- $V_o = 0$
- $0 \leq V_i < 5$

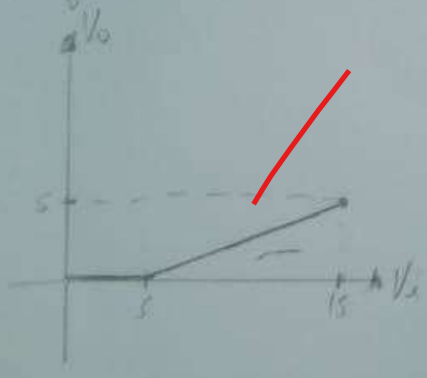


→ $V_o = (V_i - 5)\left(\frac{1K}{2K}\right)$

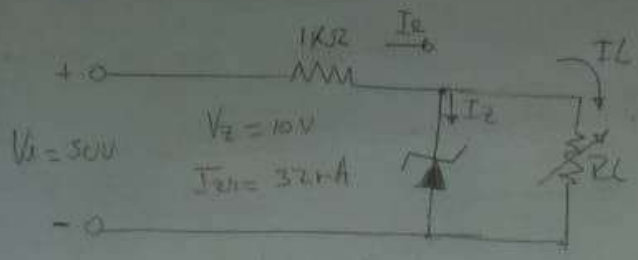
$V_o = \frac{V_i - 5}{2}$ → Para $5 < V_i < 15$

+10p

→ Su gráfica es:



Tema (4)



$V_Z = 10V$

$I_{Zmin} = 0mA$

$I_{Z\,max} = 32\,mA$

$I_R = I_Z + I_L$ → $I_L = \frac{V_Z}{R_L}$

$I_L = I_R - I_Z$

$I_R = \frac{V_1 - V_Z}{R_1} = \frac{40}{1K} = 40\,mA$

$\frac{10}{R_L} = 40 - I_Z$

$R_L = \frac{10}{40 - I_Z}$

a) $R_{Lmin} = 0.25\,K\Omega$ //

b) $R_{LMAX} = 1.25\,K\Omega$ //

c) $P_{Z\,máx} = 320\,[mW]$ //

+25P

→ $R_{L\,MAX} = \frac{10}{40 - I_{Zmín}} = \frac{10}{40 - I_Z} = 1.25\,K\Omega$

→ $P_{Z\,max} = V_Z \cdot I_{Z\,max} = 320\,[mW]$

→ $I_{Z\,máx} = 32\,[mA]$

→ $R_{L\,Min} = \frac{10}{40 - I_{Z\,máx}} = 0.25\,K\Omega$

Compromiso de Honor

Reconozco que el presente deber está diseñado para ser resuelto de manera individual, y no se permite la ayuda de fuentes no autorizadas ni copias.

Firmo al pie del presente compromiso, como constancia de haber leído y aceptar la declaración anterior.

33/10

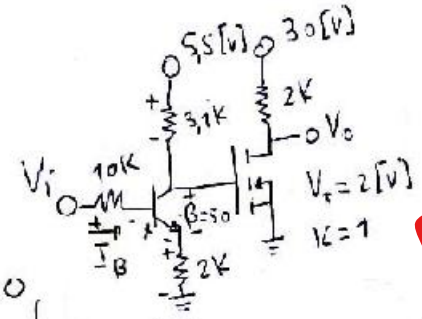
Nombre: Jose Johan Zapata Becerra

Electrónico

Paralelo: 2

Fecha: 23/11/2021

1)



$V_i = 0,3\,[V]$

$0,3 - I_B 10K - 0,7 - I_e 2K = 0$

$-I_B 10K - I_e 2K = 0,4$

$-I_B \cdot 10K - 10,2K I_B = 0,4$

$I_B (10K + 102K) = -0,4$

∴ Se observa que I_B es (-), por ende se concluye que el BJT no está trabajando

$V_i = 3\,[V]$

$3 - I_B 10K - 0,7 - I_e \cdot 2K = 0$

$I_B (10K + 102K) = 2,3$

$I_B = 0,02\,[mA]$

$I_e = 1,02\,[mA]$

$I_C = 1\,[mA]$

$V_6 = I_C \cdot 3,1K$

$V_6 = 3,1\,[V]$

$V_{GS} = 3,1\,[V]$

$I_d = (3,1-2)^2$

$I_d = 1,21\,[mA]$

$V_o = I_d \cdot 2K$

b) ∴ $V_o = 2,42\,[V]$

$I_e = (\beta+1) I_B$

$I_C = \beta I_B$

$V_o = 17,5$

$17,5 - I_B \cdot 10K - 0,7 - I_e \cdot 2K = 0$

$I_B (112K) = 16,8$

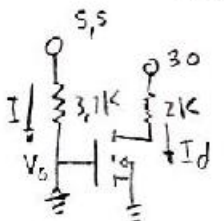
$I_B = 0,15 \cdot 10^{-3}\,[A]$

$I_e = 7,65\,[mA]$ $I_C = 7,5\,[mA]$

$V_6 = 23,25\,[V]$ ∴ $I_d = 451,56\,[mA]$

$V_{GS} = 23,25\,[V]$ $V_o = I_d \cdot 2K$

c) ∴ $V_o = 903,125\,[V]$



$I = \frac{V}{R}$

$I = 1,77\,[mA]$

$V_6 = 5,5\,[V]$

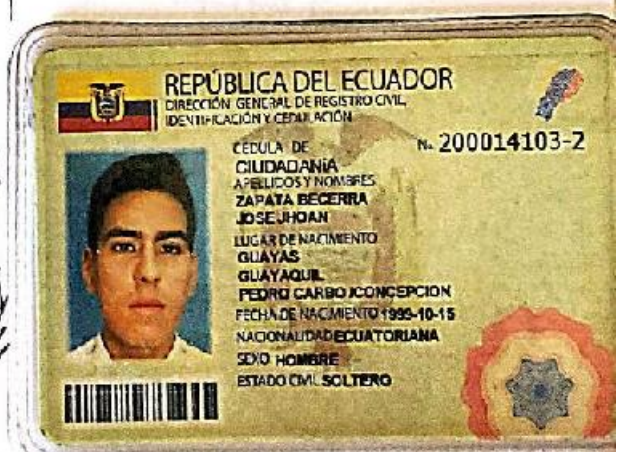
$V_{GS} = 5,5\,[V]$

$\therefore I_d = (5,5-2)^2$

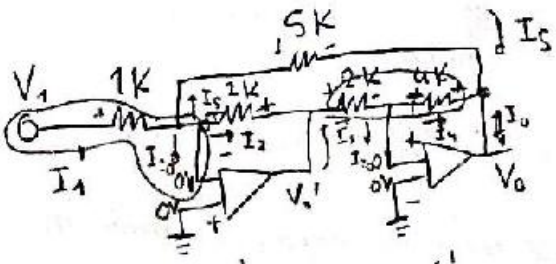
$I_d = 12,25\,[mA]$

$V_o = I_d \cdot 2K$

a) ∴ $V_o = 24,5\,[V]$



2)



I_5

$I_1 = I_2 + I_5$

$I_1 = \frac{V_o}{2K} + I_o - \frac{\frac{V_o}{2}}{4K}$

$I_2 = \frac{-V_o'}{2K}$ $\quad I_3 = \frac{V_o'}{2K}$ $\quad I_4 = -\frac{V_o}{4K}$

$I_3 = I_4$

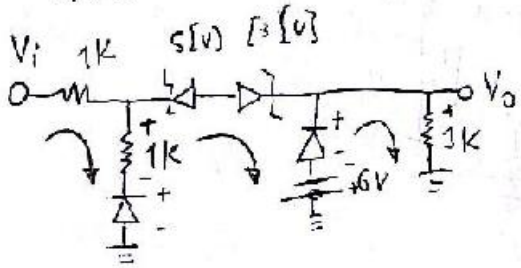
$I_5 = I_o - I_4$

$\frac{V_o'}{2K} = \frac{V_o}{4K}$

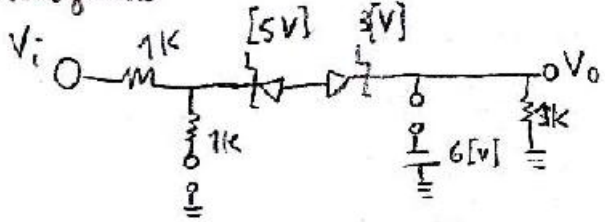
$V_o' = \frac{V_o}{2}$

3)

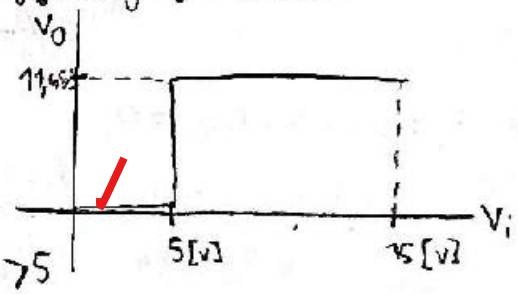
$V_i > 0$



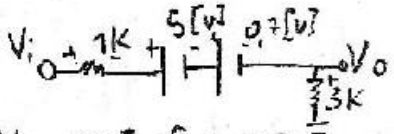
∴ Redibujando



∴ La gráfica obtenida:



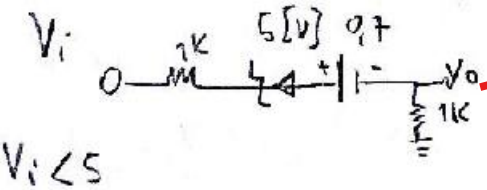
$15 > V_i > 5$



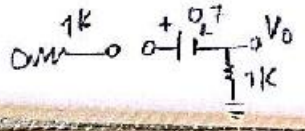
$V_i - 1K\,I - 5,7 - 3K\,I = 0$

$I = \frac{5,7 + V_i}{-4K}$

$I = \frac{V_i - 5,7}{4K}$



$V_i < 5$



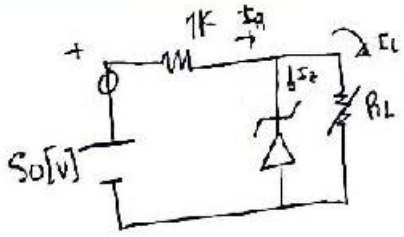
$V_i + 1K\left(\frac{V_i - 5,7}{4K}\right) - 5,7 - V_o - 3K\left(\frac{V_i - 5,7}{4K}\right) = 0$

$V_o = V_i - \frac{V_i - 5,7}{4} - 5,7 - \frac{3V_i - 17,1}{4}$

$V_o = \frac{4V_i - V_i - 5,7 - 22,8 - 3V_i + 17,1}{4}$

$V_o = 11,4\,[V]$ //

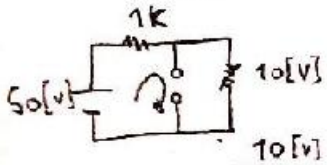
4)



$V_Z = 10[V]$

$I_Z = 32[mA]$

a) Justo antes de que empiece a conducir $V_Z \simeq 10[V]$, entonces $V_{R_L} \simeq 10[V]$



$50 - 1K\,I - RI = 0$

$I = \frac{40}{1K}$

$I = 40[mA]$

$\therefore R = \frac{V}{I}$

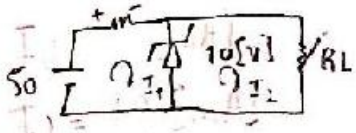
$R_L = \frac{10}{40 \cdot 10^{-3}}$

$\therefore R_L = 250[\Omega]$ //

(Justo antes que el diodo comience a conducir.

b) Por nodos

$I_L = I_R - I_Z$



M_1

$50 - 1K\,I_R - 10 = 0$

$I_R = 40[mA]$

$I_L = 8[mA]$

M_2

$10 - R_L \cdot 8 \cdot 10^{-3} = 0$

$R_L = \frac{10}{8 \cdot 10^{-3}}$

$\therefore R_L = 1250[\Omega]$ //

+25p

c) Ya que se conoce que el V_{max} y I_{max}, se hace uso de la formula de la potencia:

$P = V \cdot I$

$P_{max\,Z} = 0,32[W]$