Final term Examination

Spring 2021

CSE-206 Electronic circuit

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Class Section: B

"On my honor, as student of University of Engineering and Technology, I have neither given nor received unauthorized assistance on this academic work."

Student Signature: _____

Submitted to:
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July 29, 2021

Department of Computer Systems Engineering
University of Engineering and Technology, Peshawar

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(Question NO 1)

Given:

my I_B value is,

$I_B = 60\ \mu A$

$V_{CE} = 4V$

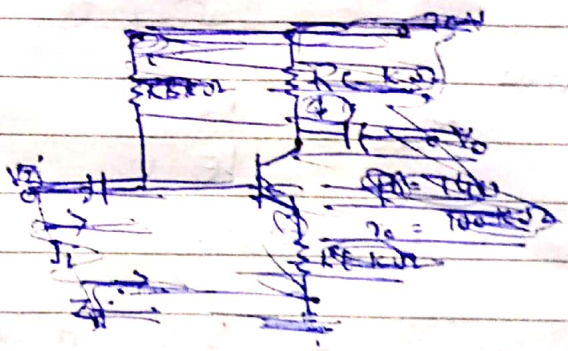
Required:

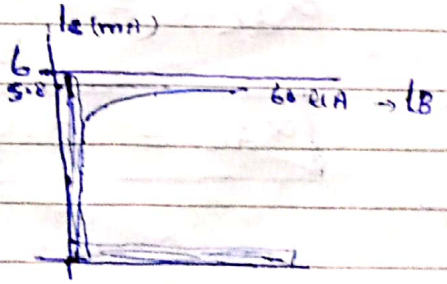
$\beta_{dc} = ?$

$\alpha_{dc} = ?$

$I_E = ?$

Sol





As $I_B = 60\ \mu A$

So from graph

$\boxed{I_C = 5.8\ mA}$

Now for dc,

$$\beta_{dc} = \frac{I_C}{I_B}$$

$$\beta_{dc} = \frac{5.8\ mA}{60\ \mu A}$$

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$\beta_{dc} = 0.096 \times 10^3$

$\boxed{\beta_{dc} = 96}$

Now we know that

$I_E = I_C + I_B$

$I_E = 5.8\,mA + 60\,\mu A$

$I_E = 5.8 \times 10^{-3} A + 0.060 \times 10^{-3} A$

$I_E = (5.8 + 0.060)\, 10^{-3} A$

$\boxed{I_E = 5.86\ mA}$

Now

$$\alpha_{dc} = \frac{I_C}{I_E}$$

Put values

$$\alpha_{dc} = \frac{5.8\,mA}{5.86\,mA}$$

$\boxed{\alpha_{dc} = 0.989}$

—xx— —xx— —xx— —xx—

END of Q 1:

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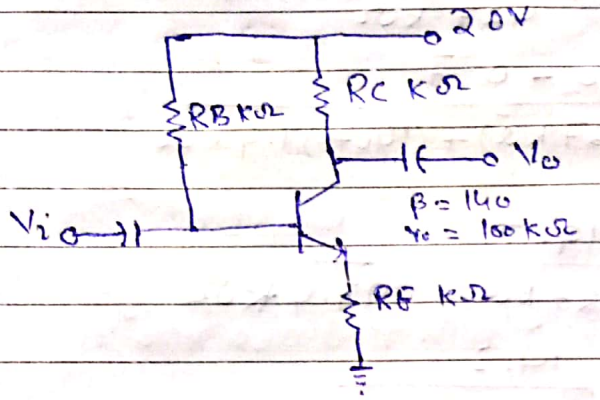
(Question NO : 2)

Given:



$r_o = 100\ K\Omega$

$R_B = 427K\Omega$

$R_C = 1.66\ K\Omega$

$R_E = 1.4\ K\Omega$

$\beta = 140$

Required:

a) $I_B = ?$

b) $I_C = ?$

c) $V_{CE} = ?$

d) $V_C = ?$

e) $V_E = ?$

Sol

a) $I_B = ?$

As we know that

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

P + T + O

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Put values

$V_{cc} = 20\ V$

$V_{BE} = 0.7\ V$ for Silicon

$\beta = 140$

$R_E = 1.4\ k\Omega$

$R_B = 427\ k\Omega$

$$I_B = \frac{20 - 0.7}{(427\ k\Omega) + (140+1)\,1.4\ k\Omega}$$

$$I_B = \frac{19.3}{427\ k\Omega + 197.4\ k\Omega}$$

$$I_B = \frac{19.3}{624.4\ k\Omega}$$

$$I_B = 0.030 \times 10^{-3}\ A$$

$$\boxed{I_B = 30\ \mu A}$$

(b) $I_c = ?$

Sol

As we know that

$I_c = \beta I_B$ put values

$I_c = (140)(30\ \mu A)$

$I_c = 4200 \times 10^{-6}\ A$

$$\boxed{I_c = 4.2\ mA}$$

(c) $V_{CE} = ?$

Sol

$V_{CE} = V_{cc} - V_{RC}$ As $V_{RC} = I_C R_C$

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$V_{CE} = V_{cc} - I_c R_c$ put values

$V_{CE} = 20 - (4.2\,mA)(1.66\,K\Omega)$

$V_{CE} = 20 - 6.972\,V$

$\boxed{V_{CE} = 13.028\,V}$

(c) $V_E = ?$

Sol

As

$V_E = R_E I_E$ — (1)

As $I_E = I_C + I_B$

$I_E = 4.2\,mA + 30\,\mu A$

$I_E = 4.2 \times 10^{-3} A + 0.030 \times 10^{-3} A$

$I_E = (4.2 + 0.030) 10^{-3} A$

$\boxed{I_E = 4.17\,mA}$

Now

$V_E = (4.17 \times 10^{-3})(1.4 \times 10^{3})$

$\boxed{V_E = 5.838\,V}$

(d) $V_c = ?$

Now

$V_c = V_{CE} + V_E$

$V_c = 13.028 + 5.838$

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$V_c = 18.866V$ Ans

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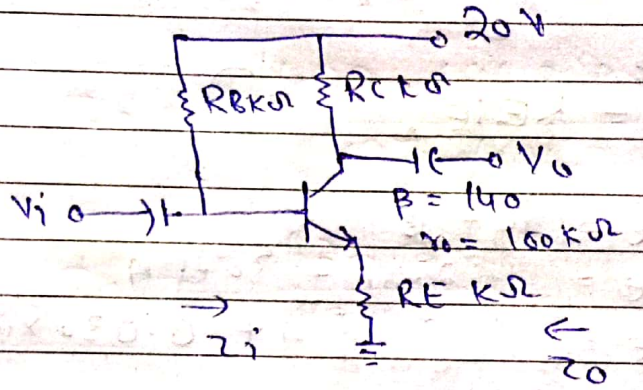
Question No: (3)

Given.



$r_o = 100\ k\Omega$

$\beta = 140$

$R_B = 427\ K\Omega$

$R_c = 1.66\ K\Omega$

$R_E = 1.4 K\Omega$

Required:

a) $r_e = ?$

(b) $Z_i = ?$

© $Z_o = ?$

(d.) $A_V = ?$

P + T+0

M□T□W□T□F□S H/W□-C/W□ Dated:...../...../20.....

Sol

a) $r_e = ?$

Sol

$$I_b = \frac{V_{cc} - V_{BE}}{R_B}$$

$$I_b = \frac{20 - 0.7}{427 \times 10^3} = \frac{19.3}{427 \times 10^3}$$

$$I_b = 0.045 \times 10^{-3}$$

$$I_b = 45\,\mu A$$

$$I_E = (\beta + 1) I_b = 141 \times 45\,\mu A$$

$$I_E = 6.48\,mA$$

Now

$$r_e = \frac{26mV}{I_E} = \frac{26mV}{6.48mA}$$

$$\boxed{r_e = 4.01\,\Omega}$$

(b) $Z_i = ?$

Sol

As we know that

$$Z_b = \beta (r_e + R_E)$$

$$Z_b = 140(4.01 + 1.4k\Omega)$$

$$Z_b = 140(4.01 + 1400)$$

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$Z_b = 140(1404.01)$

$Z_b = 196561.4\ \Omega$

$\boxed{Z_b = 196.7\ k\Omega}$

Now

$Z_i = R_B \| Z_b$

$Z_i = (427 \| 196.7)\ k\Omega$

$Z_i = \dfrac{(427 + 196.7)\ k\Omega}{(427)(196.7)\ 10^6\ \Omega}$

$Z_i = \dfrac{623.7 \times 10^3}{83990 \times 10^6}$

$Z_i = 0.0074 \times 10^{-3}$

$\boxed{Z_i = 7.4\ \Omega}$

(c) $Z_o = ?$

Sol

$Z_o = R_c = 1.66\ k\Omega$

$\boxed{Z_o = 1.66\ k\Omega}$ Ans

P ⌀ T + ⌀

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(d) $A_V = ?$

Sol

$$A_V = -\frac{\beta R_C}{Z_b}$$

$$A_V = -\frac{(140)(1.66\,k\Omega)}{196.7\,k\Omega}$$

$$A_V = -\frac{232.4\,k\Omega}{196.7\,k\Omega}$$

$$\boxed{A_V = -1.181}$$

xx xx xx

(c) Question NO = 4:

Given

$I_{DSS} = 8\,mA$

$V_P = 8\,V$

Sol

Part (a)

$I_D = I_{DSS} = 8\,mA$

$V_{GS} = 0\,V$

$I_D = 0\,mA$ and $V_{GS} = V_P = 8\,V$

At $V_{GS} = V_P/2 = 4\,V$,

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$I_D = I_{DSS}/4$

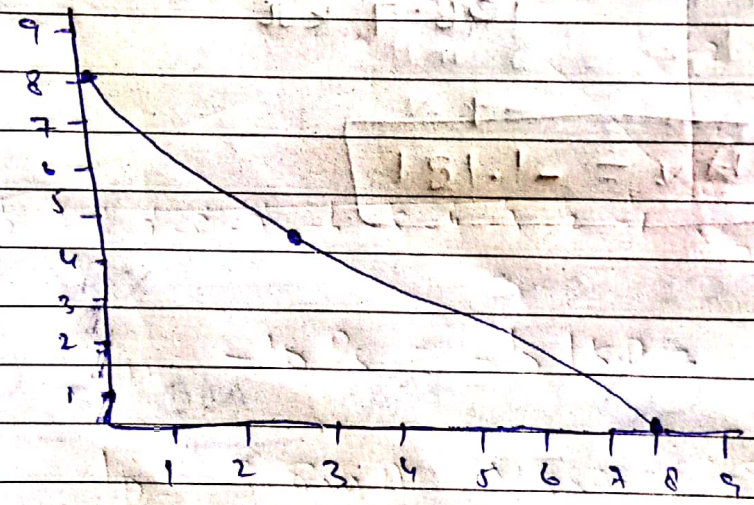
$I_D = 8mA/4 = 2mA$

at $I_D = I_{DSS}/2 = 4mA$

$V_{GS} = 0.3 V_P$

$= 0.3 (8v)$

$V_{GS} = 2.4V$



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Question No 5

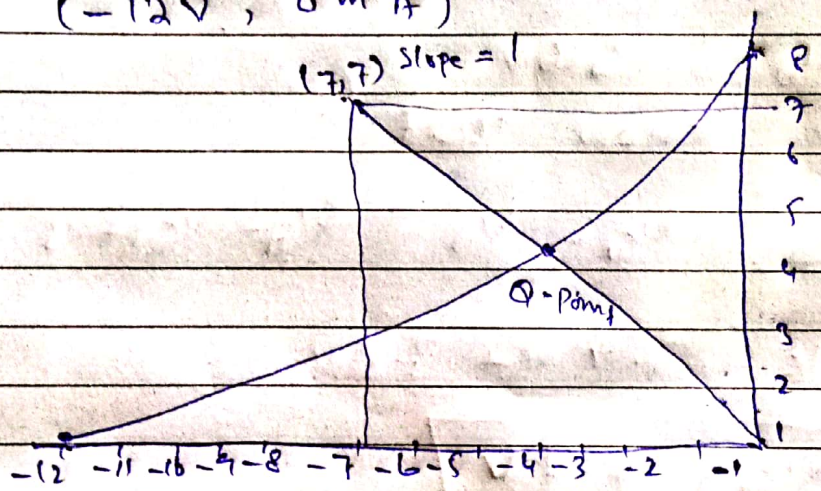
Sol

My

$I_{DSS} = 8mA$

& $V_p = -12V$

(0V, 8mA)
(-3.6V, 4mA)
(-6V, 2mA)
(-12V, 0mA)



Since $V_{GS} = -I_D \times R_S = 0$

Since $R_S = 1K\Omega$

Hence a line with slope 1 needs to be drawn

The Q point above is at 3.9V and 3.8mA so,

$V_{GSQ} = 3.9V$

$I_{DQ} = 3.8mA$

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$V_D = V_{PP} - I_{DQ}R_D$

$= 20 - 3.8mA(3.3k\Omega)$

$V_D = 20 - 12.54V$

$V_D = 7.46V$

$V_S = I_D R_S = 3.8mA \times 1k\Omega$

$V_S = 3.8V$

$V_{DS} = V_D - V_S = 7.46 - 3.8$

$V_{DS} = 3.66V$

we know that

$V_{GS} = V_G - V_S \Rightarrow V_G = V_{GS} + V_S$

$V_G = 3.9V + 3.8V$

$V_G = 7.7V$

END of paper

by ASHFAQ AHMAD

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