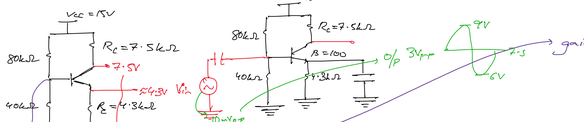
Lab 7

Thursday, 28 March 2024 1:38 PM



gain is dependent on Rc & RE

$gain = \frac{-R_c}{R_E} = \frac{-7.5}{4.3} \approx 1$

Change Gain But don't alter DC point.

→ Bypass Capacitor.

Assumed to be 0.7

→ Gives us V_{BE}, I_C, V_{CE}

* Do a DC Analysis to check the Operating point.

Thevenin Theorem

$V_{TH} = 5V$

$R_{TH} = 27k\Omega$

Assuming voltage across 27kΩ is very less

$\Rightarrow I_E \approx \frac{5-0.7}{4.3k\Omega} = 1mA.$

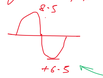
$\Rightarrow I_C \approx 1mA$

$\therefore \boxed{V_C \approx 7.5V}$

Good Point → On this 7.5 if I apply a small signal, O/p is amplified ridding on 7.5V.

If AC amplified = 2Vp-p

$\Rightarrow$

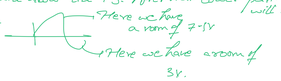


As we increase gain this value will go down

But $\boxed{V_C = 4.3V}$

So it will allow till 4.3. After that lower part will be truncated as transistor will enter saturation region.

So we



$V_{BE} < 0.7$ (Cutoff)

$V_{BE} > 0.7$ (Saturation or Active Region)

For getting the BJT transistor to work like an amplifier ⇒ Forward Active Region.

$V_{BE} \geq 0.7$

* If $V_{BE} \approx 10V$ ($>> 0.7V$) ⇒ $I_B = \frac{I_C}{\beta}$ → $I_C = I_S \exp\left(\frac{V_{BE}}{V_T}\right)$

For $V_{BE} \approx 0.7V \Rightarrow I_B \approx 10\mu A - 20\mu A$

For $V_{BE} \approx 1V \Rightarrow I_B \approx$ Exponentially High. (Not Possible)

⇒ V_{BE} will maximum go to 0.8V.

Because I_C can go max to 100mA

$\Rightarrow \boxed{I_B = \mu A - mA}$ → At this range V_{BE} won't deviate by a large amount.

DC Analysis is still same.

Retain 4.3

Re → $R_{E1} = 0.75k\Omega$, $R_{E2} = 3.5k\Omega$

AC analysis

C_E → Current will follow this capacitor.

$\therefore$ Now $Gain = \frac{-R_C}{R_{E2}} = 10$

But the DC point is still same as $(R_E)_{net} = R_{E1} + R_{E2}$

In this case

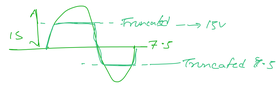
$gain = -g_m R_C$ → $7.5k\Omega$

$g_m = \frac{(I_C)_{DC}}{V_T} \approx \frac{1mA}{25mV} = 0.04$

$\therefore$ Gain $= -0.04 \times 7.5k\Omega = -300$

Suppose $V_{in} = 100mV$

$V_{out} = 30V_{p-p}$ ridding on 7.5V



What should be the maximum voltage so that we can get a full swing (No truncation)

8Vp-p

As in Cover Half after 3V there is a truncation

Frequency Control ??