Lab 9

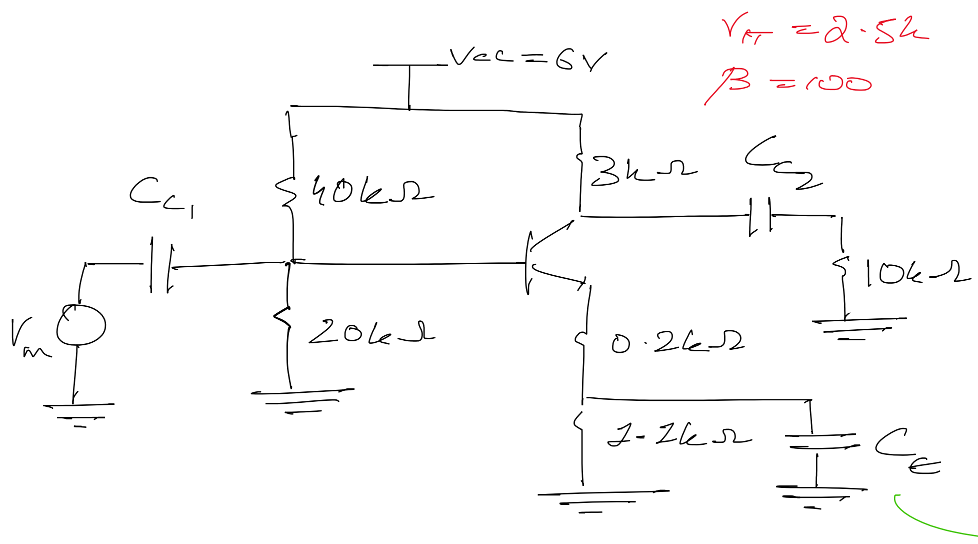
Thursday, 11 April 2024 1:34 PM

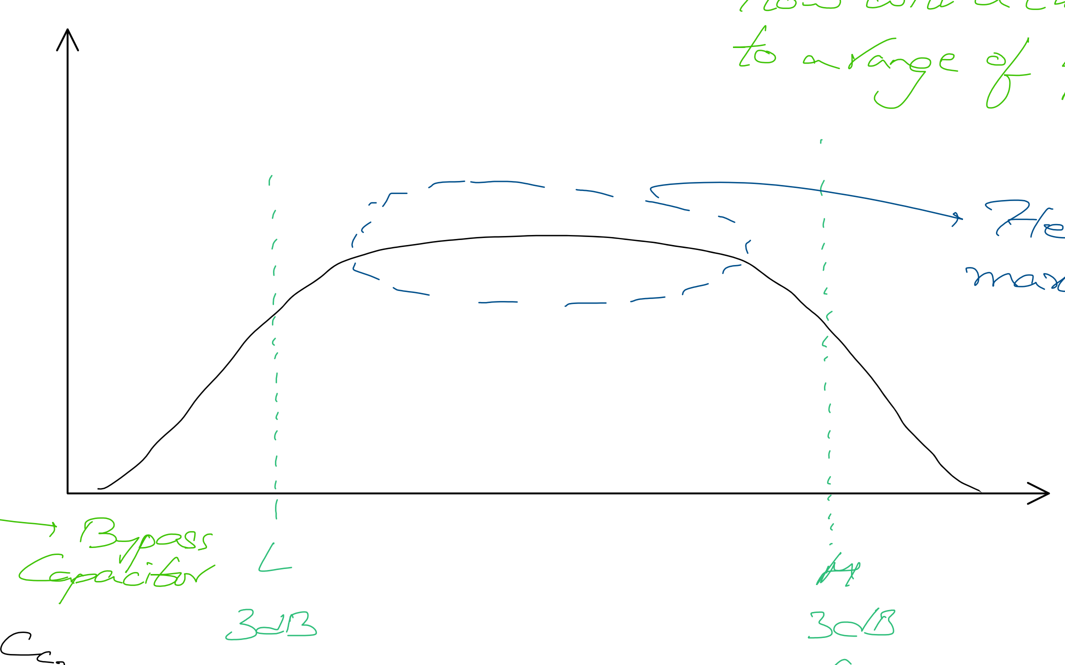
Frequency Response

↳ How will a ckt respond to a range of i/p frequency?

$r_\pi = 2.5k$

$\beta = 100$





Here gain is maximum. (For this frequency response)

Low & High Cutoff frequency.

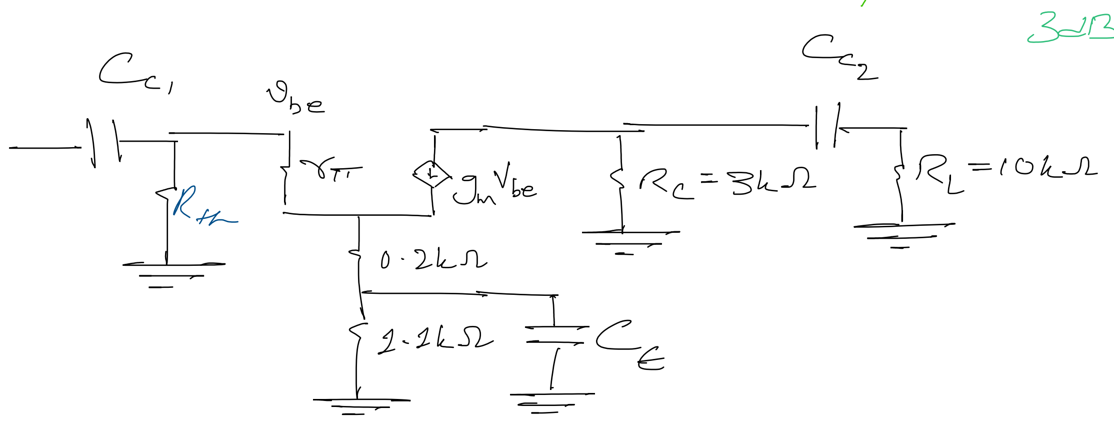
* Generally ckt operate in a band of frequency.
* There is a low & High frequency.

$f_H|_{3dB}$ → Associated with low Capacitance

$f_L|_{3dB}$ → Associated with High Capacitance.

* We can't control $f_{H_{3dB}}$ as that is determined by internal capacitance. ⇒ f_{H3dB} = fixed.

What I can change is $f_{L_{3dB}}$ → Depends on the 3 capacitances



→ We are trying to design f_L.

→ C_{C_1} → will block DC & will pass only A.C. → It will ensure that the DC operating point of our circuit doesn't shift.

→ C_{C_2} will remove the DC offset.

Associate an equivalent RC circuit for each capacitance so that they make a contribution in f_L.

$R_{C_{C_1}} \to C_1$

$R_{C_{C_2}} \to C_2$

$R_{C_{C_E}} \to C_E$

→ Resistance seen from capacitance terminal.

Make all possible sources 0.

Short Circuit the capacitance.

$$\boxed{R_{C_{C_1}} = R_{th} \parallel (r_\pi + (\beta+1)R_{E_1})}$$

$$\underbrace{\frac{1}{2\pi R_{C_{C_1}} * C_{C_1}}}_{f_1}$$ → gives one component of f_L

↳ Here I can change C_{C_1}.

↳ $R_{C_{C_1}}$ is basically fixed as we don't want to disrupt DC operating point or gain.

$$\boxed{R_E = R_{E_2} \parallel R_{E_1} + \frac{r_\pi}{\beta+1}}$$

$$\underbrace{\frac{1}{2\pi R_{C_E} * C_E}}_{f_2}$$

$$\boxed{R_{C_{C_2}} = R_L + R_C}$$

$$\underbrace{\frac{1}{2\pi R_{C_{C_2}} * C_{C_2}}}_{f_3}$$

$$\boxed{f_L|_{3dB} = f_1 + f_2 + f_3}$$

C_E dominates in the f_L contribution so we make its contribution to 80%.

$R_{C_E} < R_{C_{C_1}}$ & $R_{C_{C_2}}$

⇒ f_{3dB} contribution by C_E is always higher.