Q. P. Code - 27576 · ECAD.

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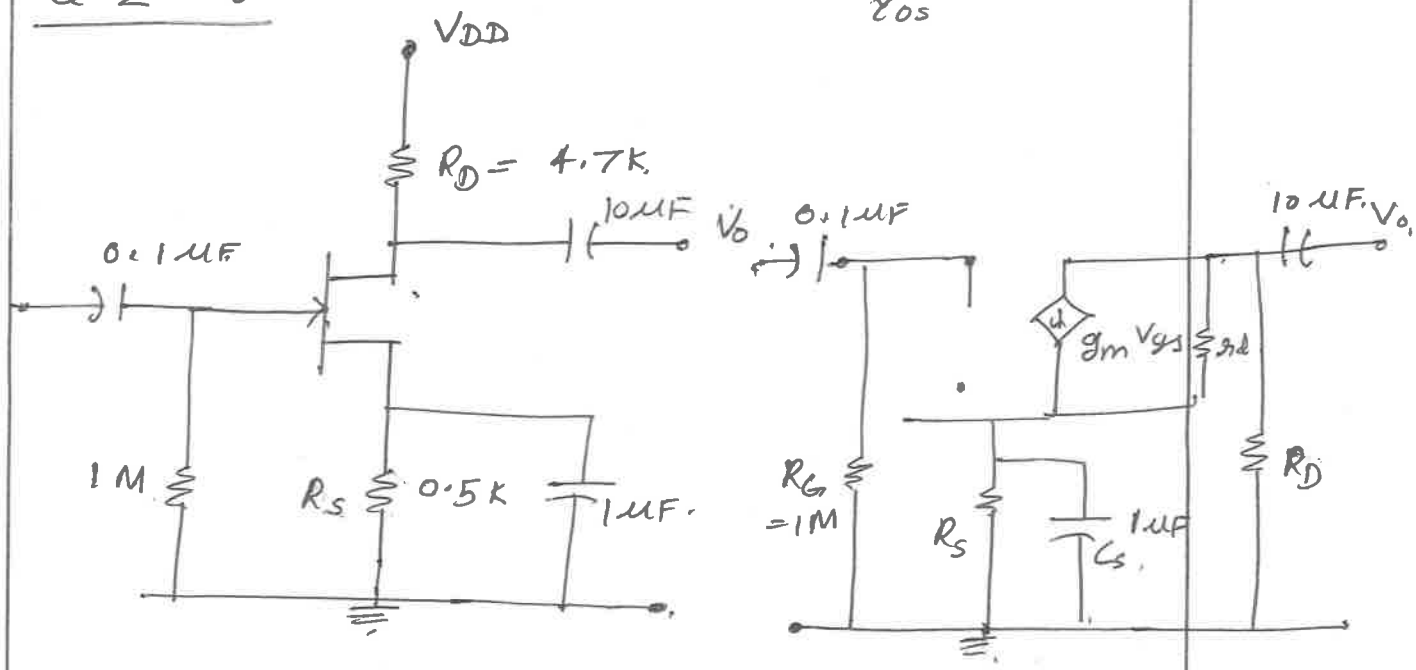
5E - Sem-III - BME - CBCGS

$\gamma_{os} = 20\,ms$. Page No.....

$\therefore r_d = \frac{1}{\gamma_{os}} = 50\,k\Omega$

Q. No. Q-2 – a

Marks



(1) $f_{L_{C_{in}}} = \frac{1}{2\pi R C_{in}} = \frac{1}{2\pi \cdot R_{C_{in}} \cdot C_{in}}$.

$R_{C_{in}} = R_G =$

$\therefore f_{L_{C_{in}}} = \frac{1}{2\pi \times 1M \times 0.1 \times 10^{-6}} \Rightarrow$

(2) $f_{L_{C_S}} = \frac{1}{2\pi R_{C_S} \cdot C_S}$. where $R_{C_S} = \frac{1}{2\pi \cdot \left[0.5 \,||\, \frac{1}{g_m}\right] C_S}$.

$g_m = g_{mo} \left[1 - \frac{V_{GS}}{V_P}\right]$ $= \frac{1}{2\pi \left[0.\right.}$

(3) $f_{L_{C_{o_2}}} = \frac{1}{2\pi R_{C_{C_2}} \cdot C_{C_2}}$. $R_{C_{C_2}} = R_D \,||\, r_d$.

$= \frac{1}{2 \times \pi \times 10 \times 10^{-6} \cdot X}$

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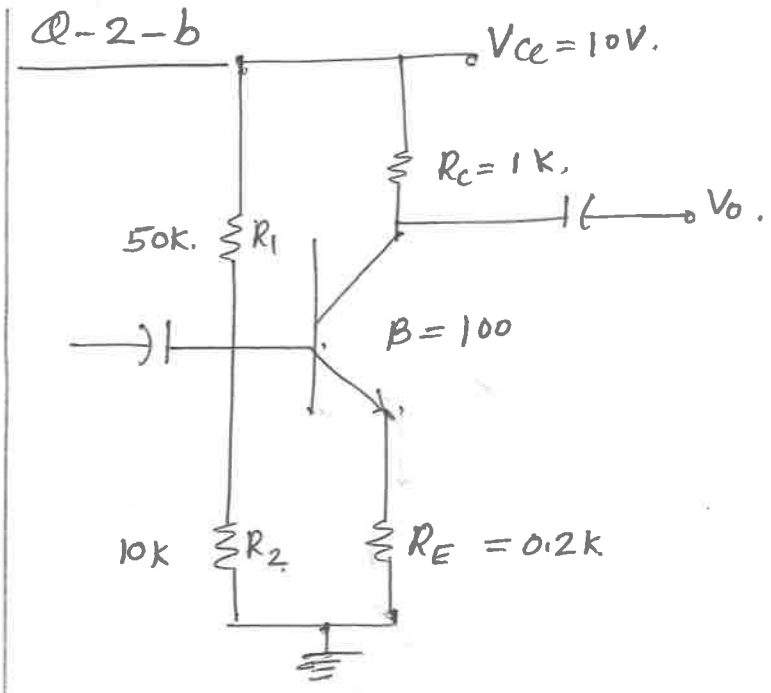
Q. No. Q-2-b

Marks



$$R_{th} = \frac{R_1 R_2}{R_1 + R_2} = \frac{50k \times 10k}{60k} = 8.33k.$$

$$V_{th} = V_{cc} \times \frac{R_2}{R_1 + R_2} = 10 \times \frac{10k}{60k} = 1.66V.$$

$$I_{BQ} = \frac{V_{th} - V_{BE}}{R_{th} + (1+\beta) R_E} = \frac{1.66 - 0.7}{8.33k + (101 \times 0.2k)}$$

$$= \frac{0.96}{28.53k.}$$

$$= 0.033 \text{ mA.}$$

$$I_{CQ} = \beta I_{BQ} = 100 \times 0.933 \text{ mA}$$

$$= 3.36 \text{ mA.}$$

$$V_{CEQ} = V_{cc} - I_C (R_C + R_E)$$

$$= 10 - 3.36mA (1K + 0.2k)$$

$$= 10 - 4.03 = 5.97 \text{ V.}$$

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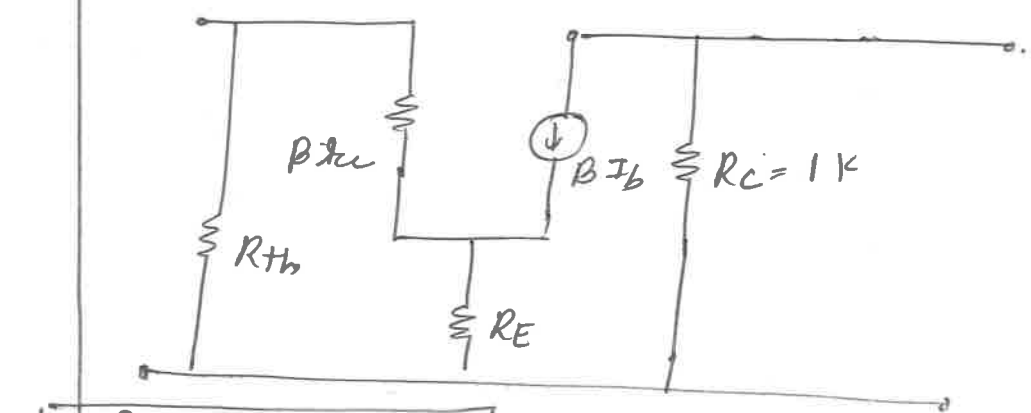
ac equivalent



R_E is bypassed,

$$A_V = \frac{R_C}{R_E} \cdot \frac{R_C}{r_e}$$

$$= \frac{1K}{}$$

$$= 0.129 \times 10^3.$$

$$A_V = 129$$

$$r_e = \frac{26mv}{I_{CQ}}$$

$$= \frac{26mv}{3.36mA}$$

$$= 7.73\Omega.$$

$$R_i = R_{th} \| [\beta r_e + (1+\beta) R_E]$$

$$= 8.33 \| [100 \times 7.73 + 101 \times 0.2k.]$$

$$= 8.33 \| [773 + 20.2k]$$

$$= 8.33k \| 20.97k.$$

$$= \frac{8.33 \times 20.97}{8.33 + 20.97} = \frac{174.68}{29.3} = 5.96\ k.$$

$$R_o = R_C = 1k.$$

R_E unbypassed

$$A_V = \frac{R_C}{R_E.} = \frac{1\ K.}{0.2k} = 5.$$

$|A_V| = 5$

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(2)	If R_L is connected – R_E unbypassed. – $\lvert A_V \rvert = \frac{R_C \parallel R_L}{R_E}$.	
	If R_L is connected. R_E bypassed. $= \lvert A_V \rvert = \frac{R_C \parallel R_L}{R_e}$ $= \frac{1\text{K} \parallel 10\text{K}}{\quad}$	
	R_L is not mentioned. Student can assume & proceed.	

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Q-3 — Different design approaches can be considered.

Given $|Av| \geq 70$, $V_o = 1.5\ V$. (Peak is given).

$f_L = 15\ Hz$.

R_i not specified select suitable transistor.

BC147A or BC147B.

From data sheet min or typical values can be taken.

Step I - Selection of transistor. — (1)

II - selection of R_C from gain eq^n — (2)

III - Determination of operating point — (2)

Q. (V_{CEQ}, I_{CQ}). - Check operating condition — (2)

$I_{CQ} \cdot R_C > V_o$(Peak).

IV - selection of R_E. — (1)

V - Selection of V_{CC}. — (2)

VI - Design of R_1 & R_2. — (2)

VII - Design of C_{cin}, C_{co}, C_E. — (3)

IX - Designed ckt to be drawn. — (2)

- Calculate A_V — (1)

Z_i — (1)

Z_o. — (1)

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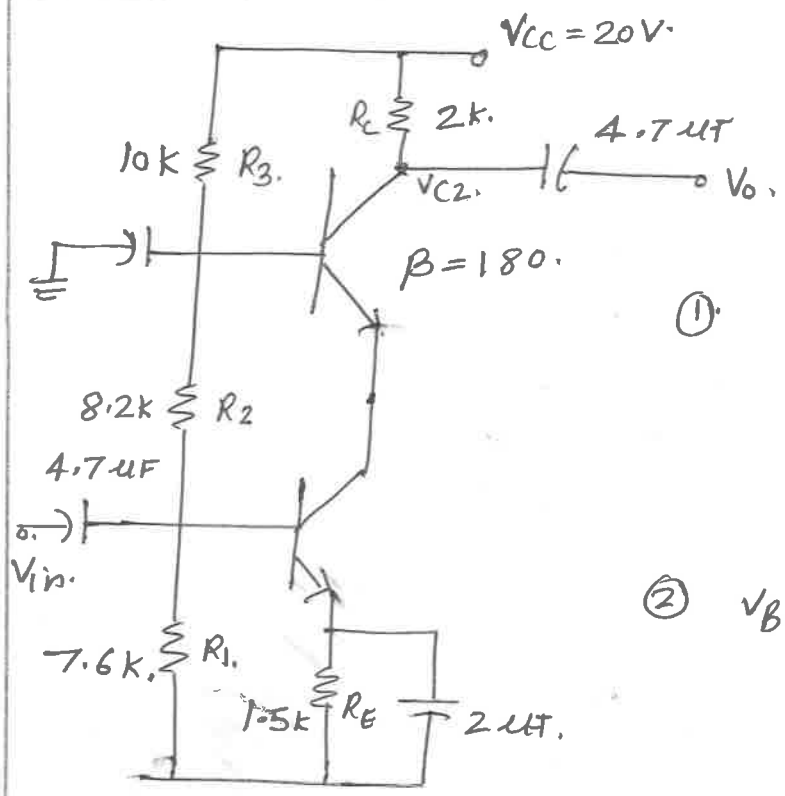
Q. No. Q-5-C

Marks



① $I_{C_1} \cong I_{C_2} \cong I_{E_1} \cong I_{E_2}$

② $V_{B_1} = R_1 \times \frac{V_{CC}}{R_1 + R_2 + R_3}$

$= 20 \times \frac{7.6k}{25.8k} = 5.89V.$

③ $V_{B_2} = V_{CC} \cdot \frac{R_1 + R_2}{R_1 + R_2 + R_3}$

$= 20V \times \frac{7.6 + 8.2k}{25.8k}$

$= 12.24.V.$

$V_{CE_2} = V_{C_1}.$

④ $V_{E_2} = V_{B_2} - V_{BE_2}.$

$= 12.24 - 0.7 = 11.54.V$

$V_{C_2} = V_{CC} - I_{C_2} \cdot R_C.$

$= $ [illegible]

⑤ $V_{E_1} = V_{B_1} - V_{BE_1}$

$= 5.89 - 0.7V = 5.19V.$

$V_{CE_2} = V_{C_2} - V_{E_2}$

~~$I_{C_2} = \frac{V_{CC} - V_{C_2}}{R_C}$~~

$I_{E_1} = \frac{V_{E_1}}{R_E}$

$= \frac{5.19V}{1.5k}$

$I_{E_1} = 3.46\ mA. \cong I_{CQ}.$

$$r_e = \frac{26mV}{I_{CQ}} = \frac{26mV}{3.46mA} = 7.51\,\Omega.$$

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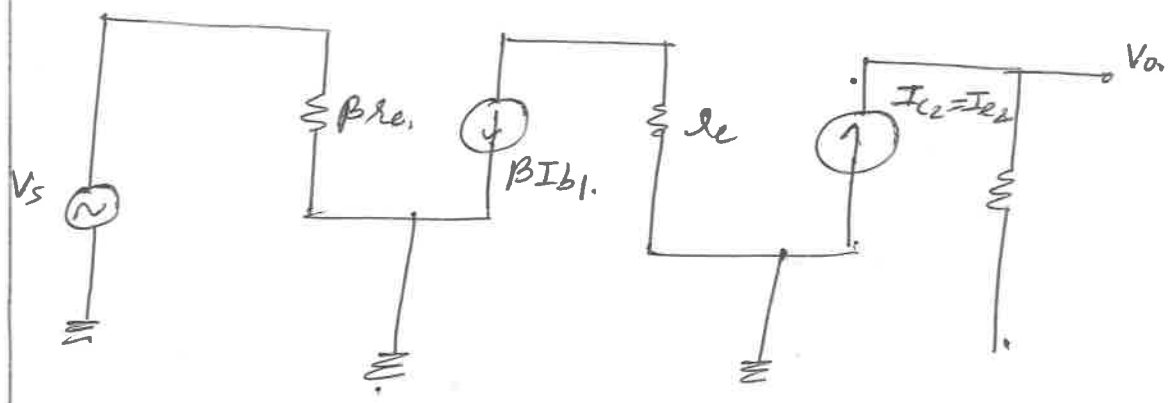
a.c analysis –



$$Z_i = R_{BB} \parallel \beta . r_e .$$

$$= (R_1 \parallel R_2) \parallel \beta . r_e = (7.6 \parallel 8.2) \parallel [180 \times 7.51]$$

$$= \left[\frac{7.6 \times 8.2}{7.6+8.2}\right] \parallel [180 \times 7.51]$$

$$= \frac{62.32}{}$$

$$= 3.94k \parallel 1351.8 = \frac{3.94k \parallel 1.35k}{}$$

$$= \frac{3.94 \times 1.35}{3.94+1.35}$$

$$Z_i = 1.005\,K$$

$$Z_o = R_C = 2K.$$

$$A_{V_T} = \frac{-R_C}{r_e}$$

$$|A_{VT}| = \frac{2K.}{7.51}$$

$$A_V = 0.26$$

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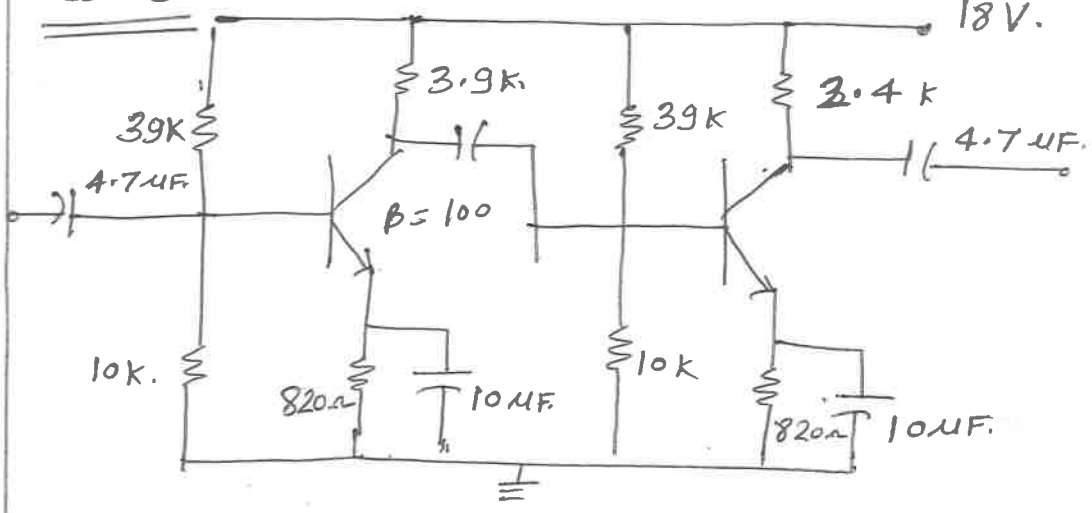
Q-6



D.C analysis :- ~~·~~ I_{CQ} remains same for both the stages.

$$R_{th} = \frac{R_1 R_2}{R_1 + R_2} = \frac{39k \times 10k}{39 + 10.} = 7.95k.$$

$$V_{th} = V_{CC} \frac{R_2}{R_1 + R_2} = 18V \times \frac{10k}{39k + 10k.} = 3.67V.$$

$$I_{BQ} = \frac{V_{th} - V_{BE}}{R_{th} + (1+\beta) R_E.}$$

$$= \frac{3.67 - 0.7}{7.95 + (101 \times 0.82k.)}$$

$$= \frac{2.97}{90.77\ k.}$$

$$= 0.032\ mA.$$

$$I_{CQ} = \beta I_{BQ} = 100 \times 0.032 = 3.2mA.$$

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$V_{CEQ_1} = V_{CC} - I_C (R_{C_1} + R_{E_1})$.

$= 18 - 3.2mA (3.9 + 0.82K)$.

$= 18 - 15.104$.

$= 2.896.V$.

$V_{CEQ_2} = V_{CC} - I_C (R_{C_2} + R_{E_2})$

$= 18 - 3.2mA (2.4K + 0.82K)$.

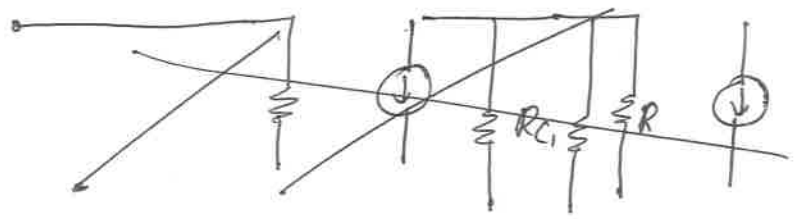
$= 18 - 10.304$

$= 7.698.V$.

If same R_C is considered while solving give full marks. (for both stages)

ac equivalent ckt.

~~$|A_V| = \cdot R_C$~~



~~$r_e = \frac{R_C}{\beta}$~~ $r_e = \frac{26mV}{I_{CQ}}$.

$= \frac{26mV}{3.2mA} = 8.125\Omega$. $\Rightarrow$ B. $r_e = 812.5\Omega$. $\Rightarrow 0.812.K$.

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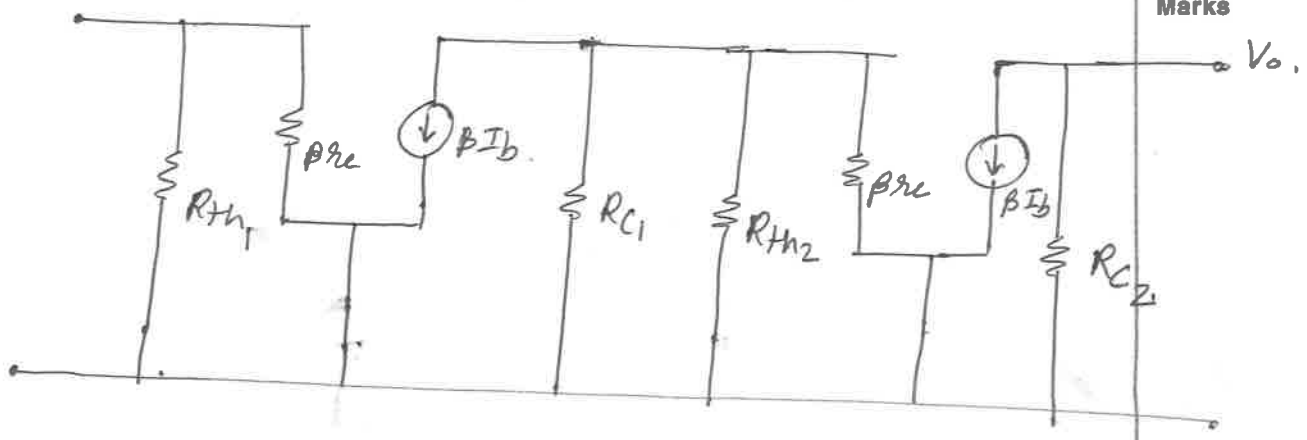

$$|A_{V_1}| = \frac{R_{C_1} \parallel R_{th_2} \parallel \beta r_e}{r_e}$$

$2.4K \parallel 7.95K \parallel 0.81K$

$$\frac{1}{R_p} = \frac{1}{2.4} + \frac{1}{7.95} + \frac{1}{0.91}$$

$$= 0.41 + 0.12 + 1.23$$

$$R_p = \frac{1}{1.76}$$

$$= 0.56\ k.$$

$$= \frac{0.56\ k}{8.12}$$

$$= 68.96$$

$$|A_{V_2}| = \frac{R_C}{r_e}$$

$$= \frac{2.4k}{8.12} = @ 295.5$$

$$A_{V(total)} = A_{V_1} \times A_{V_2}$$

$$= 68.96 \times 295.5$$

$$Z_i = R_{th_1} \parallel \beta \cdot r_e$$

$$Z_o = R_{C_2}$$

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R_S can be assumed or without R_S can be considered

Low frequency equivalent.

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$$f_{L_{CE_1}} = \frac{1}{2\pi X_{CE_1} \cdot C_{E_1}} \qquad f_{L_{CC_3}} = \frac{1}{2\pi X_{CC_3} \cdot C_{C_3}}$$

$$X_{CE_1} = R_S + (R_{Th_1} \,||\, \beta R_e) \qquad X_{CC_3} = R_C$$

$$f_{L_{CC_2}} = \frac{1}{2\pi X_{CC_2} \cdot C_{C_2}} \qquad f_{L_{CE_2}} = \frac{1}{2\pi X_{CE_2} \cdot C_{E_2}}$$

$$X_{CC_2} = R_C + (R_{Th_2} \,||\, \beta R_e) \qquad X_{CE_2} = \left\{ \frac{(R_C \,||\, R_{Th_2}) + \beta R_e}{1+\beta} \right\} \,||\, R_{E_2}$$

$$f_{L_{CE_1}} = \frac{1}{2\pi X_{CE_1} \cdot C_{E_1}}$$

$$X_{CE_1} = \left\{ \frac{(R_S \,||\, R_{Th_1}) + \beta R_e}{1+\beta} \right\} \,||\, R_{E_1}$$

Approximation. ~~formulas~~ should be considered ~~for~~.

Highest freq^n cut off is lowest one.