SE - III - CBGS - BME - ECADI - T1509

QP code: 25354

M.U.P./J.Exam.2069-40,000x8pp.-2-14. Page No. (01)

Questions should be —
WRITTEN IN LEGIBLE HANDWRITING IN BLACK INK.
SIGNS, SKETCHES OR FIGURES IF ANY BE DRAWN IN NEAT BLACK INK,
so as to avoid mistakes in the printed question papers.

Duration 3:00 Hours. Total Marks assigned to the paper 80 marks

Q. No.		Marks

Solution

N.B. (1) Design approach other than mentioned here can also be considered as long as component values are valid.

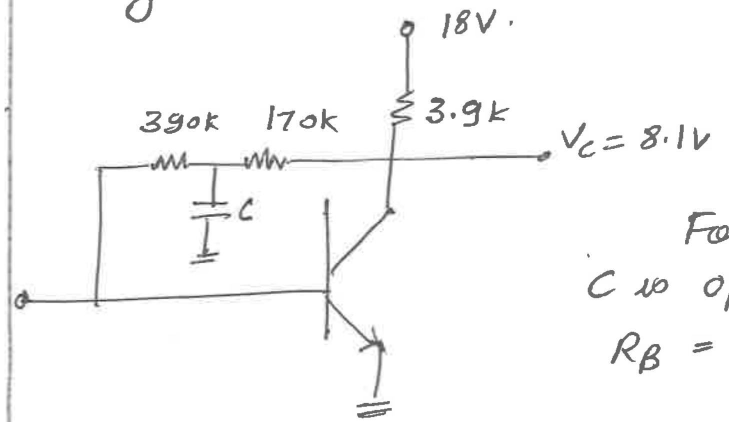
(2) Assumptions are accepted.

(3) Appropriate weightage can be given of any extra / additional information written.

Q-1-A. Both the breakdown mechanisms should be explained in detail. — (4)

Any other additional point to be added — (01)

Q-1-B.



For dc analysis, C is open circuited.

$R_B = 390k + 170k = 560k$

$$I_{BQ} = \frac{V_C - V_B}{R_B}$$

$$= \frac{8.1 - 0.6}{560k} = 13.39 \mu A$$

$$I_{BQ} + I_{CQ} = \frac{V_{CC} - V_C}{R_C}$$

$$= 2.53 \text{ mA}$$

$\therefore I_{CQ} = 2.516 \text{ mA}$

$$\beta = \frac{I_{CQ}}{I_{BQ}} = 187.2$$

$$V_{CEQ} = V_{CQ} - V_{EQ}$$

$$= 8.1 V$$

Q. No. | Marks

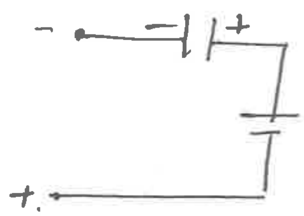
Q-1-C.

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

$$= \frac{-2I_{DSS}}{V_P}\left[1 - \frac{V_{GS}}{V_P}\right] = \frac{-2 \times 10mA}{-5}\left[1 - \frac{(-2.5)}{(-5)}\right]$$

$$= 2.5 mA.$$

Q-1-D. In $-^{ve}$ h/f cycle, D is forward biased $V_{in} = 20V$



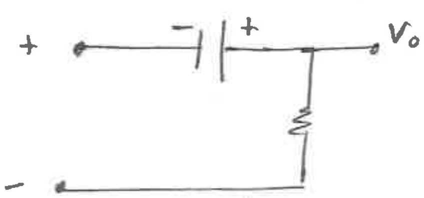
$-V_{in} + V_C - 5 = 0$

$-20 + V_C - 5 = 0$

$V_C = 25V$

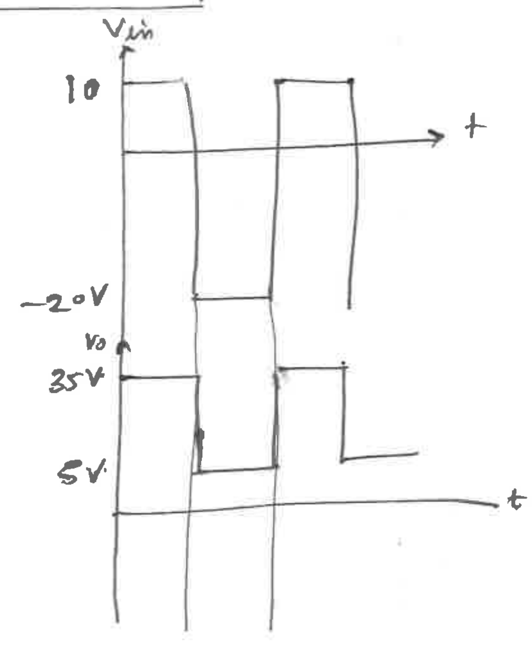
& $V_o = 5V$

In $+^{ve}$ h/f cycle, D is reverse biased. $V_{in} = 10V$.



$V_{in} + V_C - V_o = 0$

$V_o = 10 + 25 = 35V.$



Q-2-A.

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Q. No. | Marks

Single stage CS amp^{r}.

Step ① : For zero temperature drift

$0.007 I_{DQ} = 0.0022\ g_m$

$V_{GSQ} = -(|V_P| - 0.63)$

$= -1.87V.$

② $I_{DQ} = I_{DSS}\left[1 - \frac{V_{GSQ}}{V_P}\right]^2$

$= 0.44\ mA$

③ Select $R_G = 1M\Omega / 2M\Omega$

select JFET BFW 11

$V_{DS(max)} = 30$

$P_{d(max)} = 300mW.$

$I_{DSS} = 7mA$

$g_{mo} = 5000\mu\Omega$

$V_p = -2.5\ V$

$r_d = 50k$

$V_{o(peak)} = 3V$

$V_{o(rms)} =$ ~~2.121~~ $\frac{3}{\sqrt{2}} = 2.12V.$

④ $V_{GSQ} = -I_{DQ}.R_s.$ for self bias conf^{n}.

$R_s = 4.21\ k\Omega$

⑤ $A_V = -g_m(R_D \| r_d)$ — R_s bypassed, r_d is 50k.

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

$= 1.26\ mA/V.$

$R_D = 3.389\ k\Omega$

$I_{DQ} = \frac{V_{GSQ}}{R_s} = \frac{1.87}{4.3} = 0.4348\ mA.$

⑥ Check $I_{DQ}.R_D$ is less than $V_{o(peak)}$.

$\therefore$ increasing R_D select $R_D = 10K/\frac{1}{4}W.$

Q. No.		Marks

(7) $V_{DD} = V_{R_D} + V_{DSQ} + V_{R_S}$

where $V_{R_D} = I_{DQ} \cdot R_D = 7.848V$

$\therefore V_{DD} = 14.156V \simeq 15V$

(8) $C_S = \dfrac{1}{2\pi f_L \cdot X_{CS}}$ $X_{CS} = 0.1 R_S = 430\Omega$

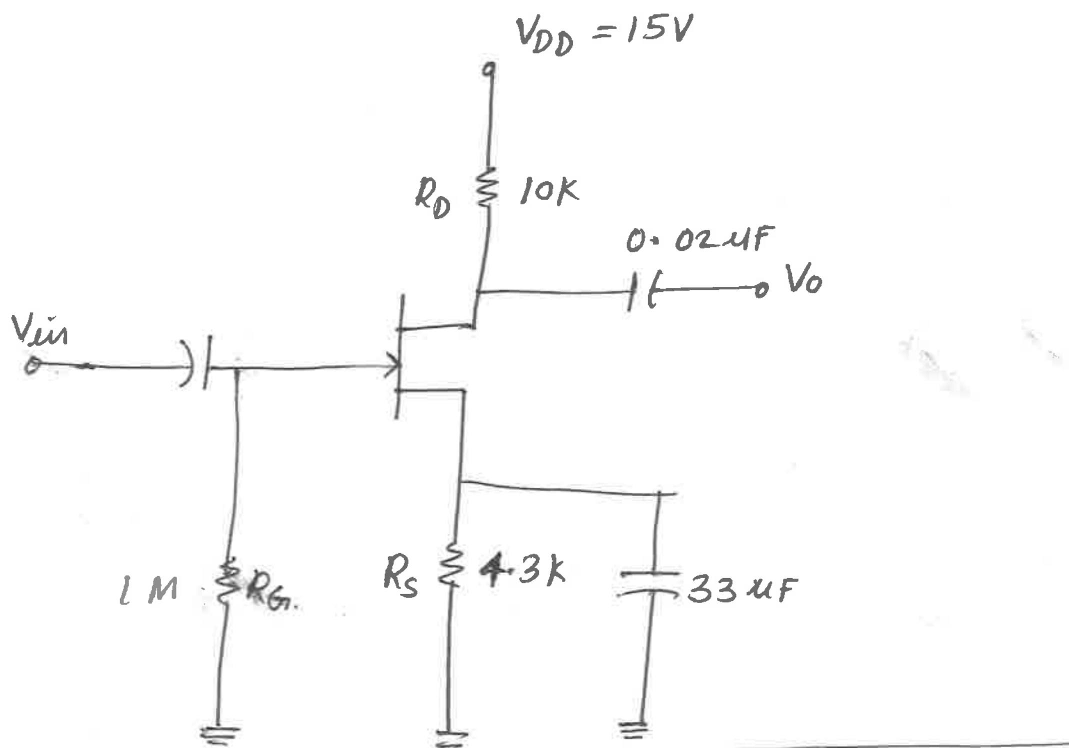
$= 33\mu F/25V.$

$C_{cin} = C_{Co} = \dfrac{1}{2\pi f_L \cdot R_i}$ $R_i = R_G = 1M\Omega$

$\therefore = 0.0106\mu F = 0.02\mu F$

Ckt diagram -

(09)



Evenly distribute marks throughout the problem

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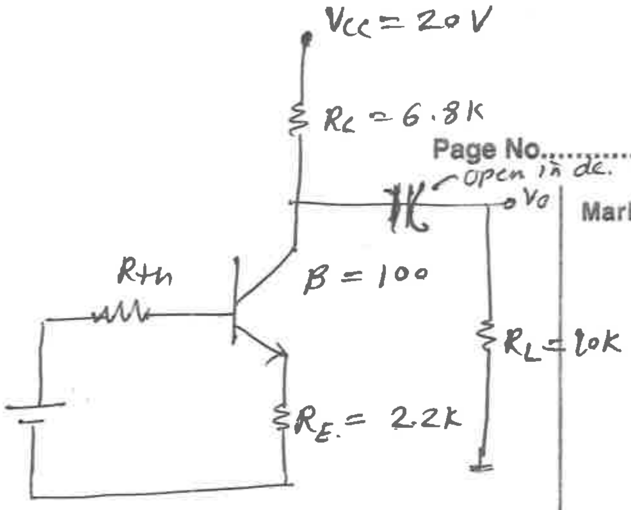
Q. No. Q-2-B

Marks



$$V_{th} = V_{cc} \frac{R_2}{R_1 + R_2}$$

$$= 20 \times \frac{56}{220+56} = 4.05V$$

$$R_{th} = \frac{R_1 R_2}{R_1 + R_2} = \frac{220K \times 56K}{220 + 56K} = 44.63K.$$

$$I_{BQ} = \frac{V_{th} - V_{BE}}{R_{th} + (1+\beta) R_E} = \frac{4.05 - 0.7}{44.63K + (101) \times 2.2K}$$

$$= 0.01255 \text{ mA.}$$

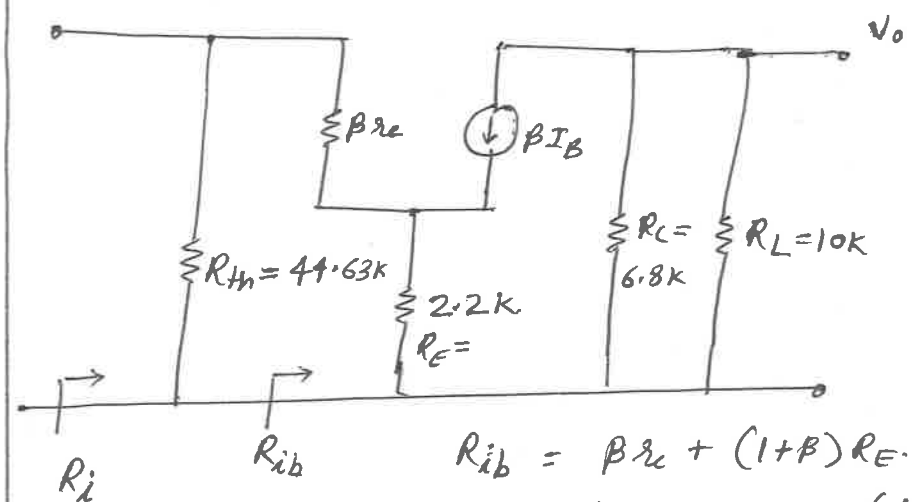
$$I_{CQ} = \beta \cdot I_{BQ} = 1.255 \text{ mA}$$

$$V_{CEQ} = V_{cc} - I_C (R_C + R_E) = 20 - 1.255mA(6.8K + 2.2K)$$

$$= 20 - 11.25 = 8.75 V$$

$$r_e = \frac{26mV}{I_{CQ}} = \frac{26mV}{1.255mA} = 20.71\Omega$$

ac equivalent :-



$$R_{ib} = \beta r_e + (1+\beta) R_E.$$

$$= 100 \times 20.71 + (101 \times 2.2K) = 224.27K$$

$$R_i = R_{th} \parallel R_{ib}.$$

$$= 44.63K \parallel 224.27K$$

$$= 37.17K.$$

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$$|A_V| = \frac{(R_C || R_L)}{R_E}$$

$$= \frac{6.8 || 10K}{2.2K} = \text{~~[illegible]~~}$$

$$R_o = (R_C || R_L) = (6.8K || 10K) = \frac{6.8K \times 10K}{6.8K + 10K}$$

$$= \frac{68K}{16.8K} = \underline{\underline{4.04K}}$$

Q-3-A.

EMOSFET — DMOSFET symbol — (1)

constructional diffuence — (1)

Drain characteristics - sketches, explanation — (4)

transfer characteristics - sketches. explanation - (4)

Q-3-B. (1) Self bias circuit -

$$V_{GSQ} = - I_{DQ} \cdot R_S.$$

(2) V_{GSQ} can be found out analytically or graphically.

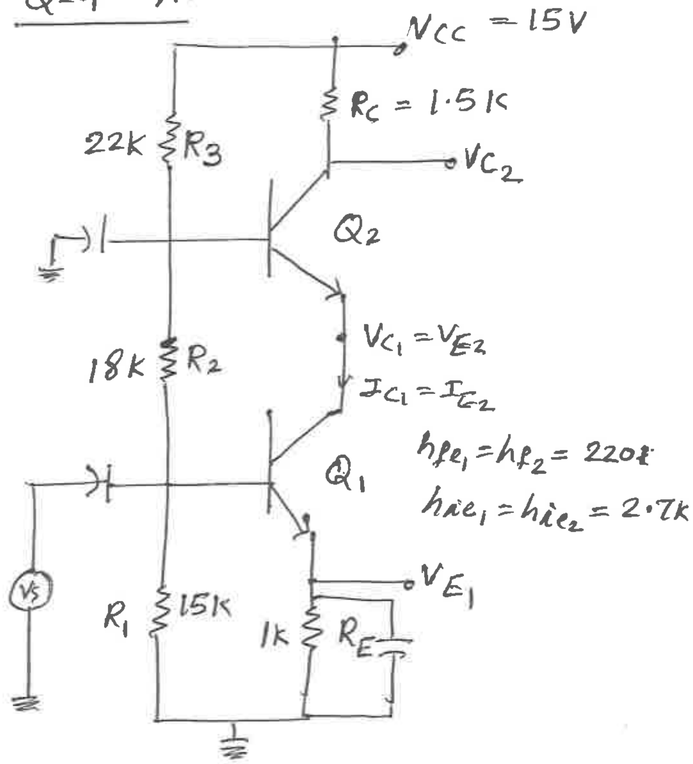
$V_{GSQ} = -0.924V.$ $I_{DQ} = +3.85\ mA$

(3) $V_{DSQ} = V_{DD} - I_D(R_D + R_S)$

$= \underline{1.45V}$

Q. No. | Marks

Q-4-A



$I_{C_1} = I_{C_2} = I_{E_1} = I_{E_2}$

$V_{B_1} = R_1 \cdot \dfrac{V_{CC}}{R_1 + R_2 + R_3}$

$= 15V \times \dfrac{15k}{15k + 18k + 22k}$

$= 4.09V$

$I_{E_1} = \dfrac{V_{E_1}}{R_E} = \dfrac{3.39}{1K}$

$= 3.39 mA.$

$V_{E_1} = V_{B_1} - V_{BE1}$

$= 4.09 - 0.7V = 3.39V$

$r_e = \dfrac{26 mV}{I_E}$

$= \dfrac{26 mV}{3.39 mA} = 7.66 \Omega$

$V_{B2} = V_{CC} \cdot \dfrac{R_1 + R_2}{R_1 + R_2 + R_3}$

$= 9V$

$V_{E2} = V_{B2} - V_{BE2}.$

$= 9 - 0.7 = 8.3V.$

$V_{C2} = V_{CC} - I_{C2} \cdot R_C.$

$= 15 - (3.39 \times 1.5K)$

$= 9.915V.$

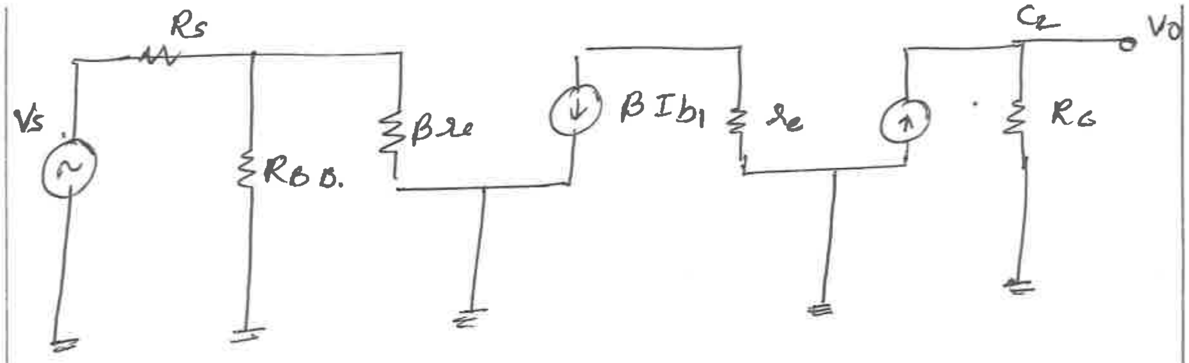
$V_{CE_1} = V_{C_1} - V_{E_1}$

$= 8.3 - 3.39 = 4.91V.$

$V_{CE2} = V_{C2} - V_{E2}$

$= 9.915 - 8.3 = 1.615V.$

Q. No. Marks



$R_{BB} = R_1 \parallel R_2$

$= \frac{R_1 R_2}{R_1 + R_2} = \frac{15K \times 18K}{15K + 18K}$

$= 8.18K.$

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

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

$= 8.18K \parallel (220 \times 7.66)$

$= 8.18K \parallel 1.68K.$

$= 1K.$

$Z_o = R_C = 1.5K.$

$A_{V2} = \frac{R_C}{r_e} = \frac{1.5K.}{7.66\Omega} = 195.82$

$A_{V1} = \underline{\underline{-1}}$

$A_{V(T)} = \frac{-R_C}{r_e.} = -195.82$

Q-4-B

CG amplifier.

ckt diagram - (1)

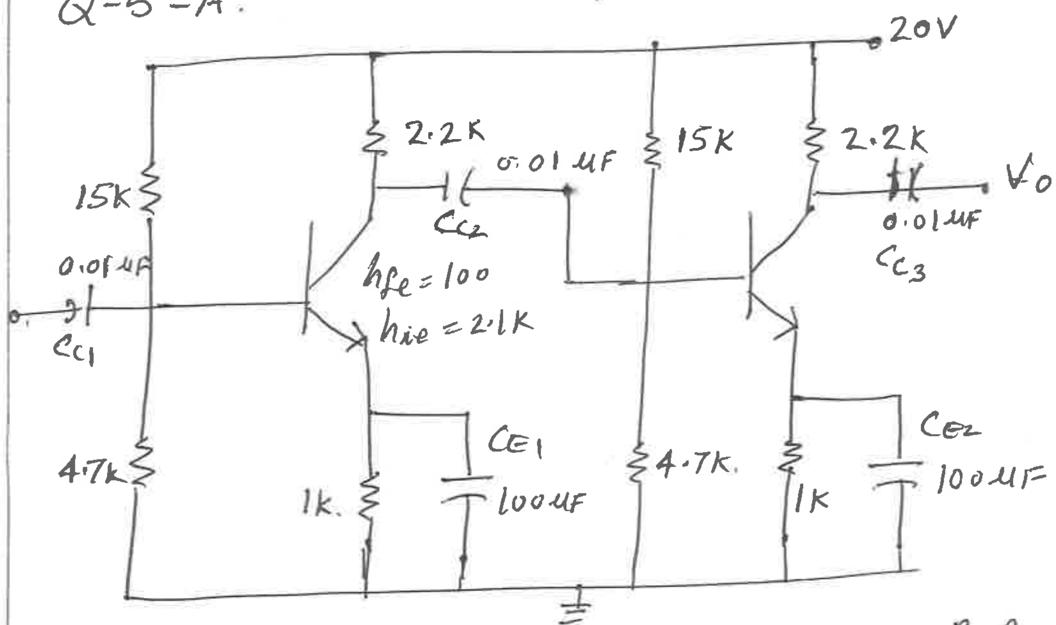
ac equivalent circuit - (1)

Z_i - (3) A_V - (3)

Z_o - (2)

Q. No. | Marks

Q-5-A.



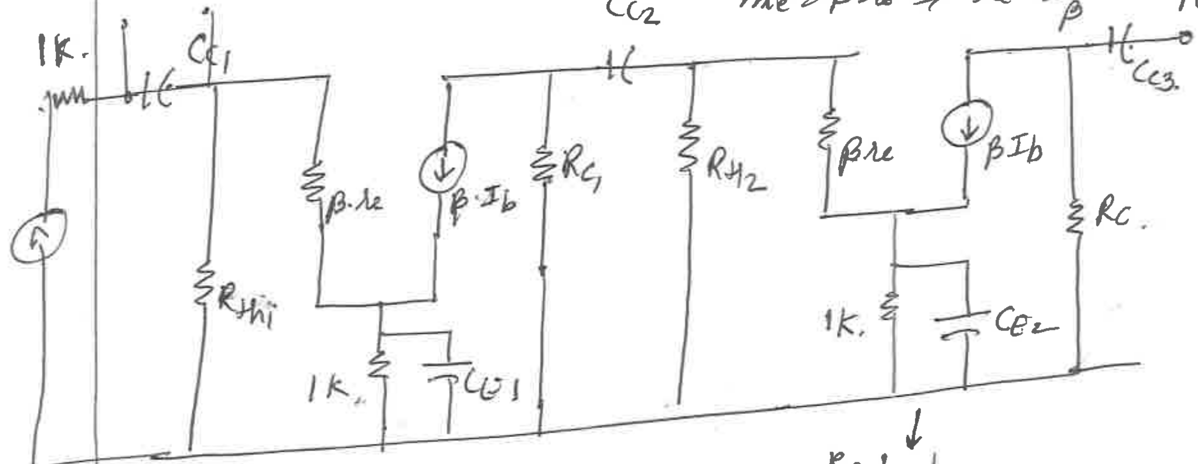
~~$f_{LCC1} = \frac{1}{2\pi X_{CC1} \cdot C_{C1}}$~~

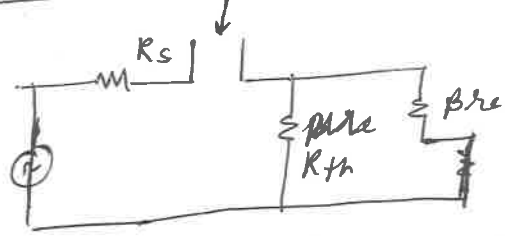
$R_{th_1} = R_{th_2} = \frac{R_1 R_2}{R_1 + R_2} = \cdot$

$= 3.57K$

a.c. equivalent :-

$h_{ie} = \beta \cdot r_e \Rightarrow r_e = \frac{h_{ie}}{\beta} = \frac{2.1K}{100} = 21\ \Omega$





$f_{LCC1} = \frac{1}{2\pi X_{CC1} \cdot C_{C1}}$

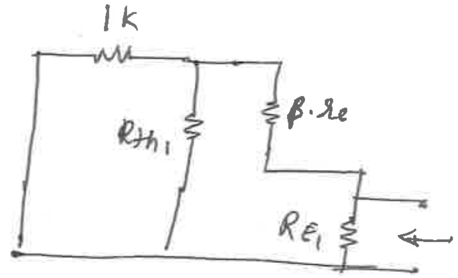
$X_{CC1} = (R_{th} \| \beta r_e) + R_s.$

$=$

$X_{CC1} =$

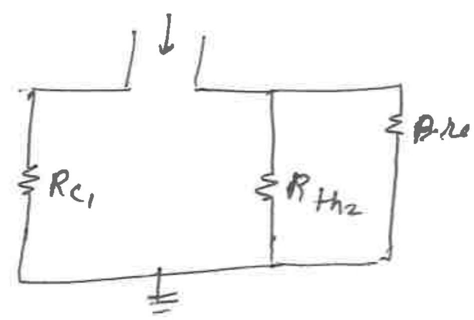
Q. No. | Marks

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



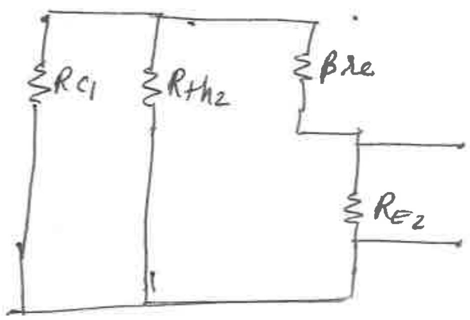
$$X_{CE_1} = \left\{ \frac{(1k \,||\, R_{th_1}) + \beta \cdot r_e}{1+\beta} \right\} || R_{E_1}$$

$$f_{L_{C_{C2}}} = \frac{1}{2\pi R_{C_{C2}} \cdot C_{C_2}}$$



$$X_{C_{C2}} = (R_{th_2} \,||\, \beta \cdot r_e) + R_{C_1}$$

$$R_{CE_2} = \frac{1}{2\pi X_{CE_2} \cdot C_{E_2}}$$



$$X_{CE_2} = \left[\frac{(R_{C_1} \,||\, R_{th_2}) + \beta r_e}{1+\beta} \right] || R_{E_2}$$

$$R_{C_{C3}} = \frac{1}{2\pi X_{C_{C3}} \cdot C_{C_3}} \qquad X_{C_{C3}} = R_C.$$

Lower cut-off frequency is the highest frequency amonst fire calculated.

Page No............

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Q-6 -

A BJT as a switch -

2 different modes of operation &
equivalent circuits to be written.

B Reason for considering voltage divider biasing
most useful - (01), ckt. diagram - (1)
Derivation of S - (2)
formula for S = (1)

C. Zero temperature drift -

D. Clipper.

Series clipper one type to be explained
shunt clipper, one type to be explained.
Concept of biased clipper to be explained.
waveforms are essential

E. Basic diagrams of CE ampr, CS ampr - (2)
High frequency model. - (3)