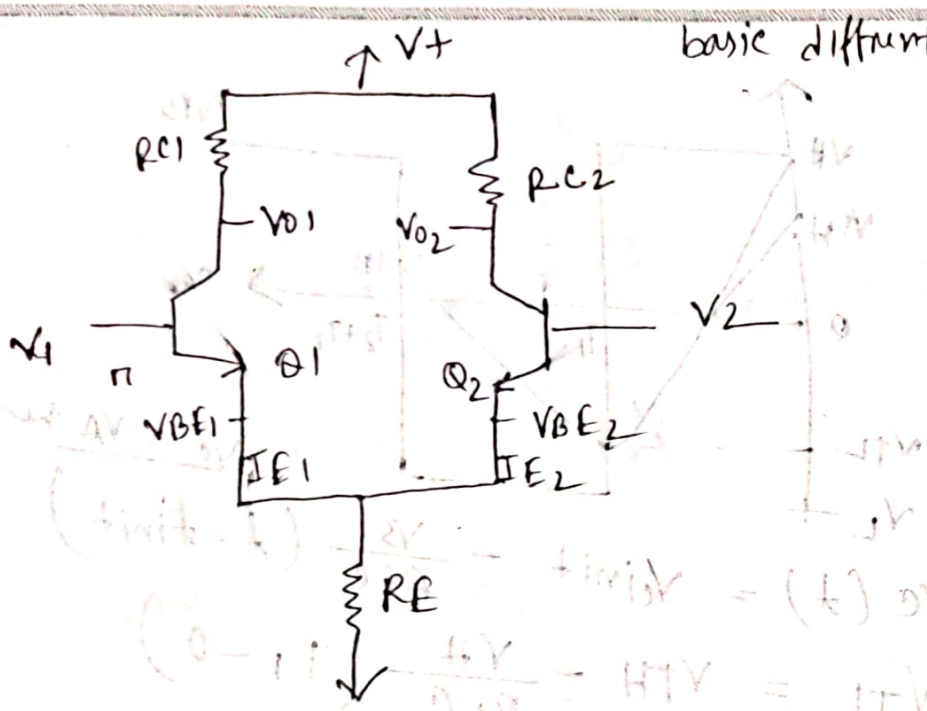
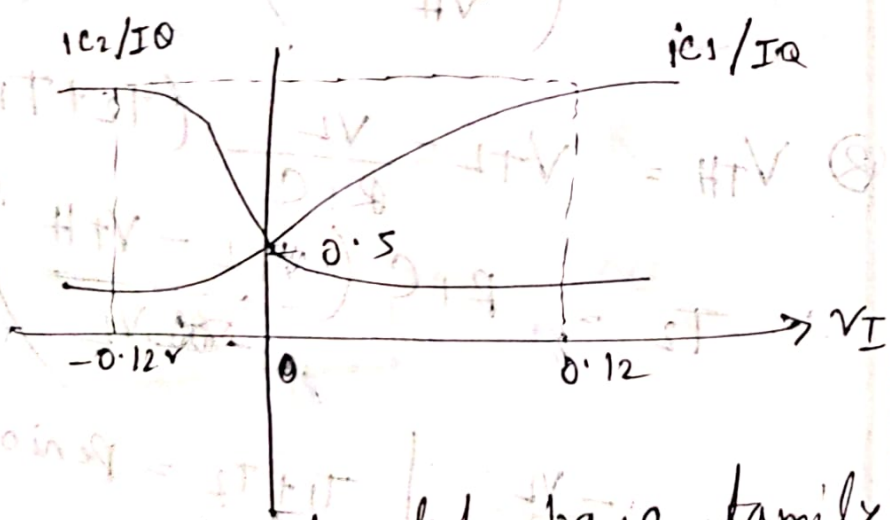
TOPIC NAME : Emitter Coupled Logic family DAY: _____

TIME : DATE : / /

basic differential amp



$V_I = V_1 - V_2$



- No saturation / unsaturated logic family
- Only f.A and cutoff

GOOD LUCK

GOOD LUCK

TOPIC NAME : _____ DAY : _____

TIME : DATE : / /

forward active :

① $V_{BE} = 0.7\ V$

frw biased pn junction

$V_B > V_E$

② $I = I_S \exp\left(n \frac{V_{BE}}{V_T}\right)$, $n = 1$

$V_T = 25.9\ mV$ @ 300K

$I_B \approx 0$ as $i_C, i_E >>$

$i_E = i_C + i_B$ ($i_B \to 0$)

③ $i_E = i_C$

TOPIC NAME : _____ DAY : _____

TIME : DATE : / /

$$I_{E1} = I_S \exp\left(\frac{V_{BE1}}{V_T}\right)$$

$$I_{E2} = I_S \exp\left(\frac{V_{BE2}}{V_T}\right)$$

$$\frac{I_{E1}}{I_{E2}} = \frac{I_S e^{V_{BE1}/V_T}}{I_S e^{V_{BE2}/V_T}}$$

$$= e^{\frac{V_{BE1} - V_{BE2}}{V_T}}$$

if $I_{E1} = 100 I_{E2}$

$$\frac{100 I_{E2}}{I_{E2}} = e^{\frac{V_{BE1} - V_{BE2}}{V_T}}$$

$$V_T \ln(100) = V_{BE1} - V_{BE2}$$

$$\rightarrow V_{BE1} - V_{BE2} = 0.12 V_T$$

GOOD LUCK

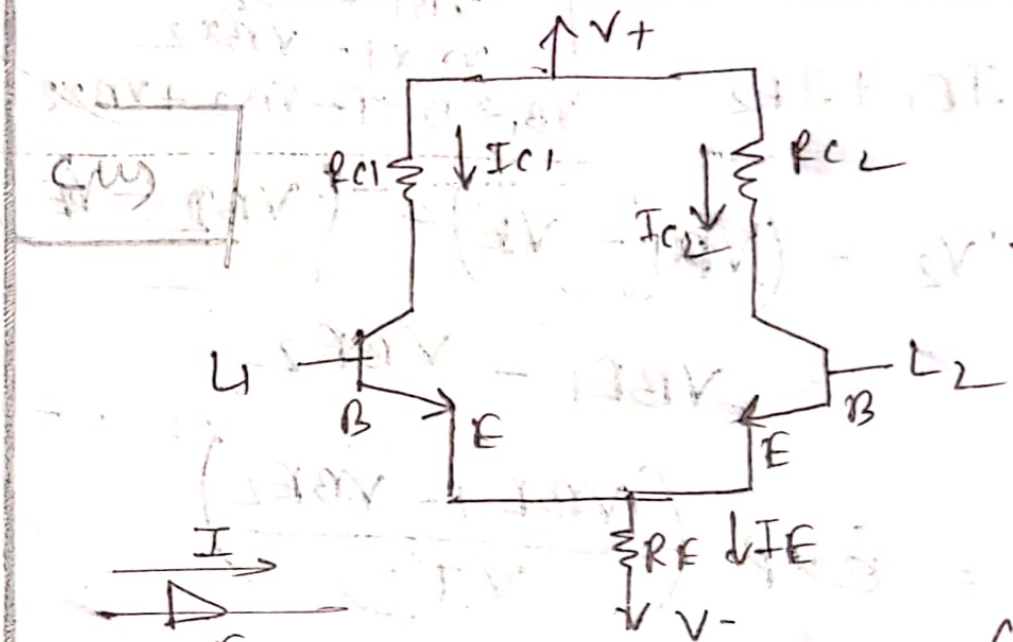
GOOD LUCK

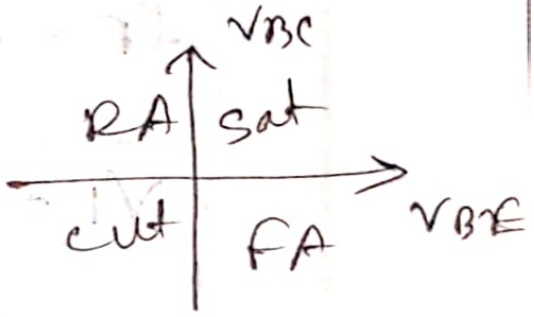
TOPIC NAME : ECL logic family

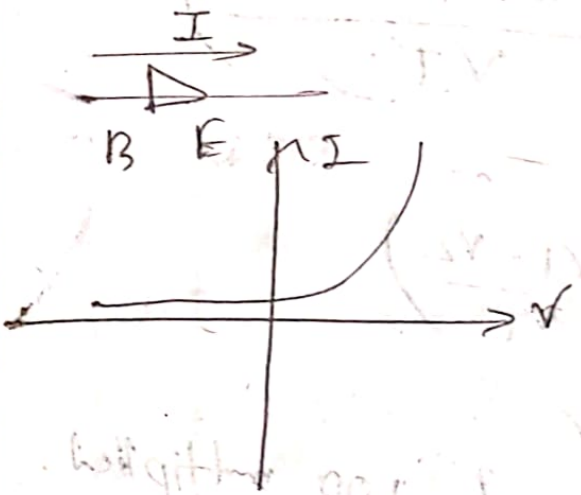
DAY :

TIME :

DATE : 19 / 8 / 23







$$I = I_S \, e^{\left(\frac{n V_{BE}}{V_T}\right)}$$

$V_T = 0.0259\ V$

Any PN junction

if $V_1 > V_2$: $n = 1$

① $I_{E1} = I_S \exp\left(\frac{V_{BE_1}}{V_T}\right) \approx I_{C1}$

② $I_{E2} = I_S \exp\left(\frac{V_{BE_2}}{V_T}\right) \approx I_{C2}$

In FA : $I_C, I_E > 0$

$I_C, I_E >> I_B \rightarrow$ negligible

$I_E = I_C + \cancel{I_B}^{\,0}$

TOPIC NAME: _____ DAY: _____

TIME: DATE: / /

$I_E = I_{E1} + I_{E2}$

$V_{B1} - V_{B2}$

$V_{BE1} - V_{BE2}$

$V_{B1} - V_{BE1} - V_{B2} + V_{BE2}$

$V_1 - V_2 = (V_{B1} - V_E) - (V_{B2} - V_E)$

$= V_{BE1} - V_{BE2}$

$$\frac{I_{E1}}{I_{E2}} = \exp\left(\frac{V_{BE1} - V_{BE2}}{V_T}\right)$$

W.K.T, $I_{E1} = 100\, I_{E2}$

$$\Rightarrow 100 = \exp\left(\frac{V_1 - V_2}{V_T}\right)$$

$\Rightarrow V_1 - V_2 = 0.12\ V$

For 0.12 V diff current 100 multiplied.

In this case:

$I_E \approx I_{E1}$

if $V_1 > V_2$: V_1 FA

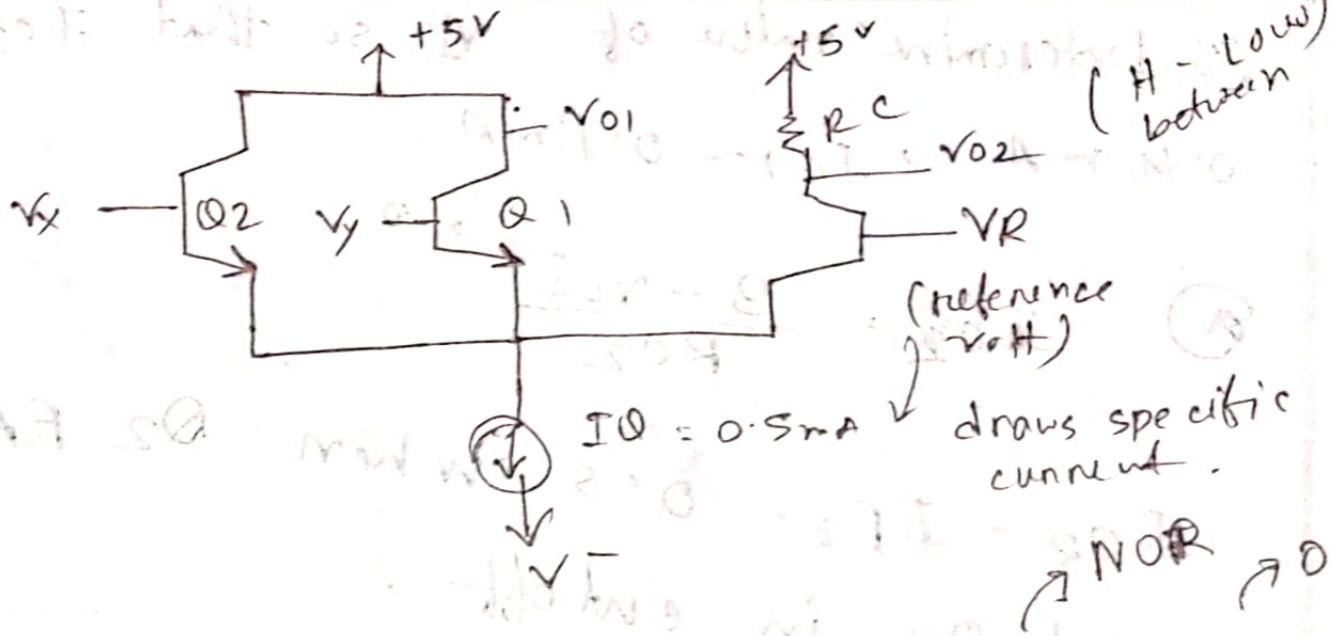
$V_1 = V_2 = 5$: FA $V_1 - V_2 = 0$: cutoff both

GOOD LUCK

GOOD LUCK

TOPIC NAME : _____ DAY : _____

TIME : DATE : / /



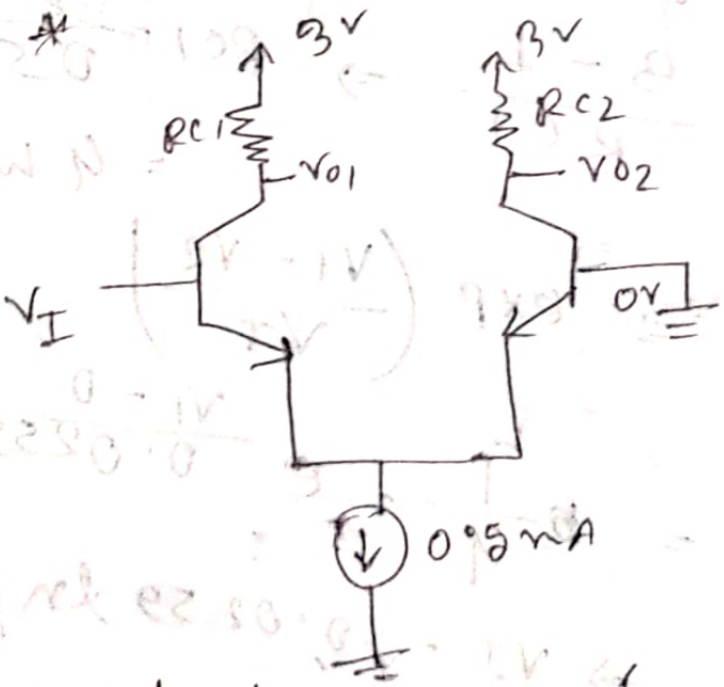
(H - Low) between

(reference voH)

draws specific current.

NOR OR

VX	VY	Q1	Q2	OR	VO1	VO2
L	L	C/O	C/O	FA	H	L
L	H	FA	C/O	C/O	L	L
H	L	C/O	F/A	C/O	L	L
H	H	F/A	F/A	C/O	L	H



(a) Determine value of R_{C2} such that the min value of $V_{O2} = 0V$.

(b) value of R_{C1} such that $V_{O1} = 1V$ when $V_I = 1V$.

Neglect base current

TOPIC NAME : _____ DAY : _____

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© Determine value of V_I so that $I_{C_2} = 0.4\ mA$, $I_{C_1} = 0.1\ mA$.

(a) $I_{C_2} = \dfrac{3 - V_{O2}}{R_{C_2}}$ → 0

V_{O2}

$I_{C_2} = I_{E_2} = 0.5$ when Q_2 FA and Q_1 in cut-off.

Max drop when I_{C_2} = all current

(b) $0.5 = \dfrac{3}{R_{C_2}} \Rightarrow R_{C_2} = \dfrac{3}{0.5} = 6\ k\Omega$

(b) $Q_1 \rightarrow$ FA, $Q_2 \rightarrow$ C/O

$I_{C_1} = 0.5 = \dfrac{3 - 1}{R_{C_1}} \rightarrow R_{C_1} = \dfrac{2}{0.5}$

$= 4\ k\Omega$

(c) $\dfrac{I_{E_1} = I_{C_1}}{I_{E_2} = I_{C_2}} = \exp\left(\dfrac{V_1 - V_2}{V_T}\right)$

$\Rightarrow \dfrac{0.1}{0.4} = \dfrac{1}{4} = e^{\frac{V_1 - 0}{0.0259}}$

$\Rightarrow V_I = 0.0259 \ln(1/4)$

GOOD LUCK

GOOD LUCK

TOPIC NAME : _____ DAY : _____

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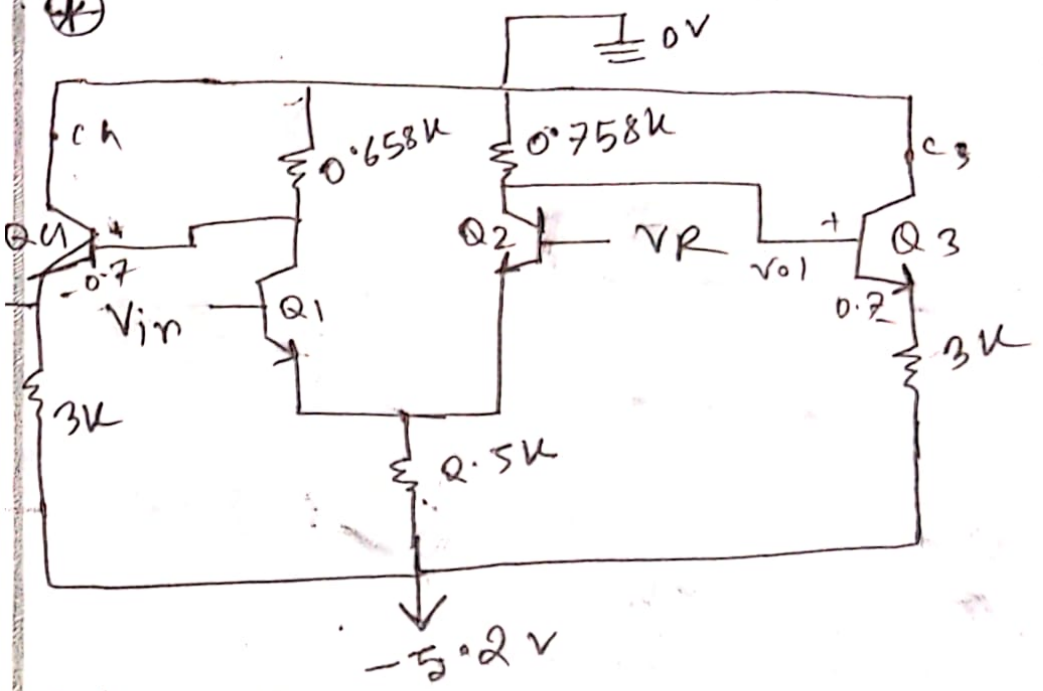
(*)



$C_4 > B_3, B_4$
C_3

$V_{BC} < 0$

$V_{BE} = +pos$

(a)

Vin logic low [much smaller voltage VR]

Vin	VR	Q1	Q2	Vo1	Vo2
L					