CSE350 (Quiz:1)

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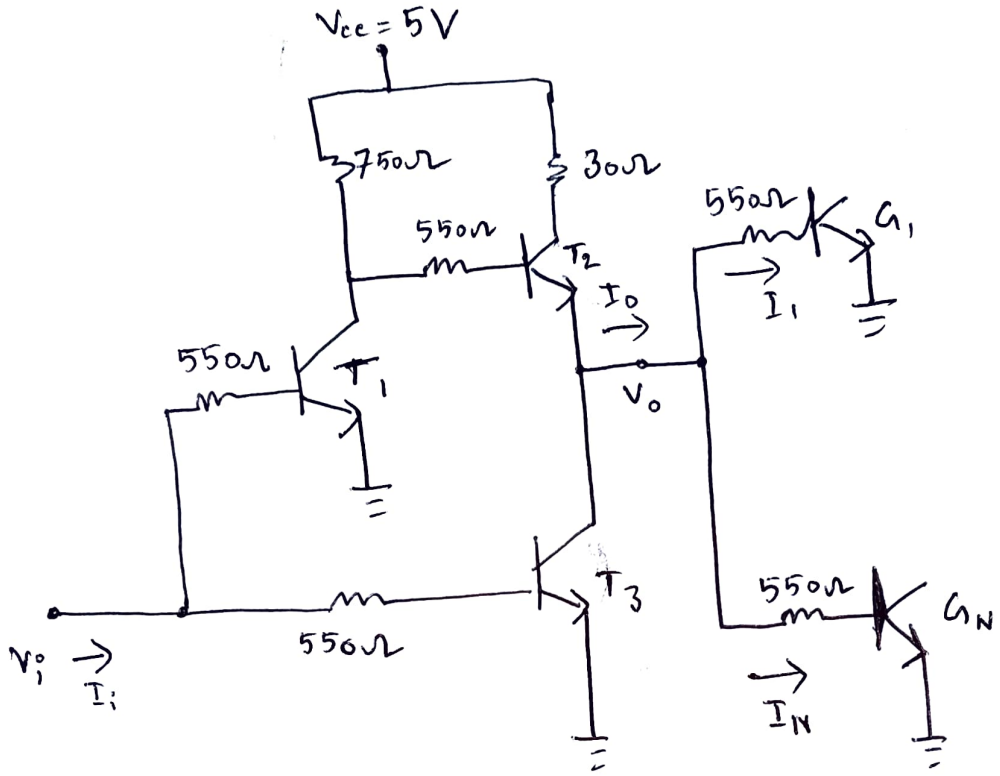
Section: 12



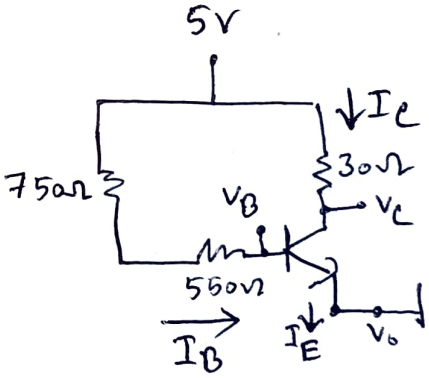
Here, ~~Vcc~~

for case: 1,

$V_i = 0V$

So, $T_1, T_3 \rightarrow$ Cut off

$T_2 \rightarrow$ Forward active



T_2 is in forward active because,

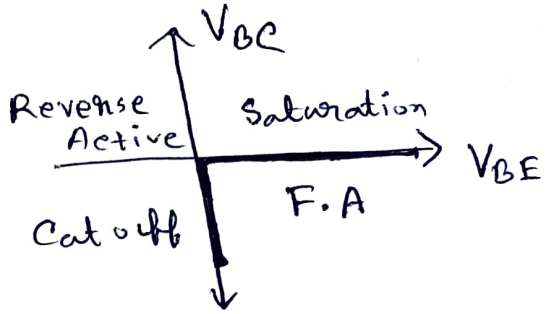
We can see, The collector voltage of T_2 is very small. So, the collector voltage is almost 5V. On the other hand, V_B is significantly lower than V_C.

So, we can state that,

$V_C > V_B$

$\Rightarrow V_B - V_C < 0$

$\Rightarrow V_{BC} < 0$



And,

$V_{BE} \geq 0.5$

So, T_2 transistor is in forward active mode.

So, we know,

$I_C = \beta_F I_B$

$= 30 I_B$

$I_C = \alpha I_E$

$= \frac{\beta}{1+\beta} I_E$

$= \frac{30}{1+30} I_E$

$= \frac{30}{31} I_E$

KCL,

$I_E = I_B + I_C$

$= I_B + 30 I_B$

$= I_B (30+1)$

$= 31 I_B$

We also know,

$V_{BE} = 0.7$

$\Rightarrow V_B - V_E = 0.7$

$\Rightarrow V_B = V_o + 0.7 \quad [V_E = V_o]$

Now,

$I_B = \frac{5 - V_o - 0.7}{1.3 \times 10^3}$

$= \frac{4.3 - V_o}{1.3 \times 10^3}$

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Now,
The output of driver circuit is low,

So, V_o = $3.3 = V_{OH}$

So, Max current supply = $31 \times \frac{4.3 - 3.3}{1.3}$

= 23.85.

Individual demand load current,

$I_1 = \frac{3.3 - 0.8}{0.55}$ = 4.545

∴ Maximum fanout =

$= \frac{23.85}{4.545} = 5.25$

Case: 2

$V_i = 5V$

So, T_1, T_3 → Saturation

$V_o = 0.2V$

$V_B (T_2) \approx 0.2V$

$V_E (T_2) \approx 0.2V$

$V_{BE} (T_2) = 0V < 0.5V$

T_2 → cut off

So, G_1; G_2 --- G_N in cutoff

demand current = 0

Maximum fanout = $\frac{0}{0}$ = ∞

Any number of fanout is valid.

Maximum fanout = ~~21~~ 5

(b)

If the input is 0.2V and 2 load circuits connected to the driven, the total power dissipation will be in the diver:

if input is 0.2V.

then T_1, T_3 will be in catoff

T_2 " " " forward active

So, the, $V_o = V_{OH} = 3.3$

So, $I_B = \frac{4.3 - 3.3}{1.3} = 0.769$ mA

$I_C = \beta_o I_B = 23.077$ mA

$I_E = \beta_1 I_B = 23.839$ mA

So, power dissipation : $\Delta V I_E$

$= (0.2 - 0)\, 23.839$ mA

$= 4.77$ mW.

(Ans)