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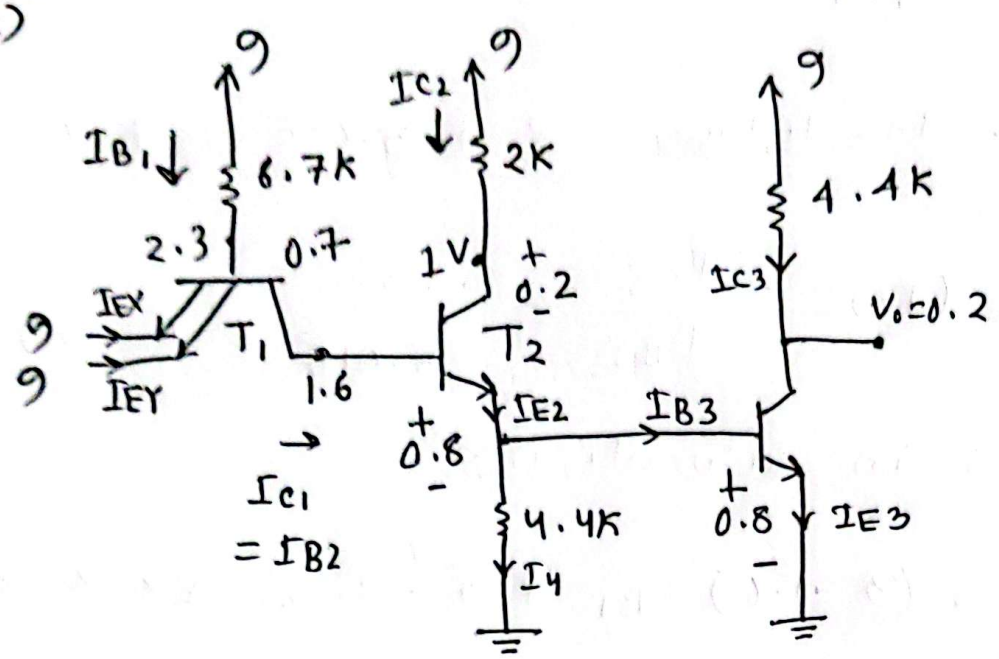
Section: 13

CSE 350
Assignment 02

Assignment 2

(1)



$V_{BE}(sat) = 0.8\ V$

$V_{CE}(sat) = 0.2\ V$

$V_{BC}(RA) = 0.7\ V$

$\beta_F = 30$

$\beta_R = 0.1$

$$I_{B1} = \frac{9 - 2.3}{6.7} = 1\ mA$$

$$\beta_R = \frac{I_{EX}}{I_{B1}}$$

$$\therefore I_{EX} = I_{EY} = 1 \times 0.1 = 0.1\ mA$$

$$I_{C1} = I_{B2} = I_{EX} + I_{EY} + I_{B1} = 0.1 + 0.1 + 1 = 1.2\ mA$$

$$I_{C2} = \frac{9 - 1}{2} = 4\ mA$$

$$I_{E2} = I_{C2} + I_{B2}$$

$$= 4 + 1.2 = 5.2\ mA$$

$$\beta_{forced} = \frac{4}{1.2} = 3.33\ mA < \beta_F$$

$\therefore T_2$ is in saturation.

$$I_A = \frac{0.8 - 0}{4.4} = 0.18\ mA$$

$$I_{B3} = I_{E2} - I_A = 5.2 - 0.18 = 5.018\ mA$$

$$I_{C3} = \frac{9-0.2}{4.4} = 2 \text{ mA}$$

$$I_{E3} = I_{C3} + I_{B3} = 2 + 5.018 = 7.018 \text{ mA}$$

$$\beta_{force}(T_3) = \frac{I_{C3}}{I_{B3}} = \frac{2}{5.018} = 0.398 < \beta_F$$

T_3 is in saturation.

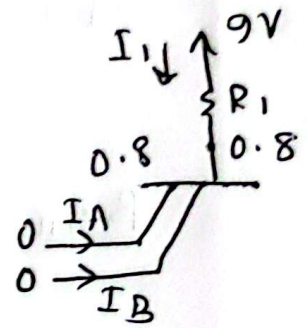
$$P_{dis} = (9-1.6) I_{B1} + (9-2.3) I_{EX} \times 2$$
$$+ (1.6-0.8) I_{B2} + (9-0.8) I_{C2}$$
$$+ (0.8-0) I_4 + (9-0) I_{C3} + (0.8-0) I_{B3}$$

$$= 64.6584 \text{ mW}$$

(2)

$P_{dis} = 1.23$ mW

When both inputs are low (0,0), T_1 saturation mode; T_2, T_3 cutoff mode.



$$I_1 = \frac{9-0.8}{R_1}$$

$$I_A = I_B = \frac{I_1}{2} = \frac{9-0.8}{2R_1}$$

$$P_{dis} = (9-0.8) I_1 + (0.8-0) I_A \times 2$$

$$\Rightarrow 1.23 = \frac{(9-0.8)(9-0.8)}{R_1} + \frac{0.8(9-0.8)\times 2}{2R_1}$$

$$\therefore R_1 = 60 \text{K}\Omega$$