QP. 24600

T 555

Q. No. | Marks

EDC-1 Solution

Que 1 (a) Apply KVL to circuit

$$10 - V_D - I_D(1K) = 0 \quad \text{——— (1)}$$

for I_{Dmax} let $V_D = 0$

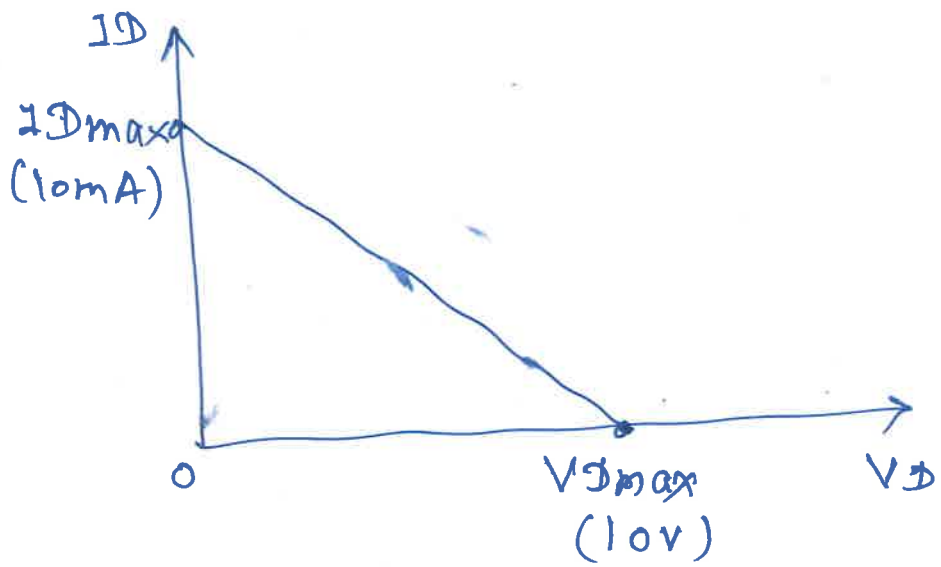
$\therefore 10 - 0 - I_{Dmax}(1K) = 0$

$\therefore I_{Dmax} = \frac{10}{1K} = 10mA$

for V_{Dmax}, let $I_D = 0$

$\therefore 10 - V_{Dmax} - 0 = 0$

$\therefore V_{Dmax} = 10\,V$



Q. No. | Marks

Que 2 b)

$$V_{th} = \frac{R_2 V_{CC}}{R_1 + R_2} = 3\ V$$

$$R_{th} = R_1 \| R_2 = 12.95\ K\Omega$$

$$I_{BQ} = \frac{V_{th} - V_{BE}}{R_{th} + (1+\beta) R_E} = \frac{3 - 0.7}{12.95\ K + (101 \times 1.2\ K)}$$

$$= 17.15\ \mu A.$$

$$\therefore I_{CQ} = \beta I_{BQ} = 1.71\ mA$$

$$r_{\pi} = \frac{V_T \beta}{I_{CQ}} = \frac{26\ mV \times 100}{1.71\ mA} = 1.516\ K\Omega$$

$$g_m = \frac{I_{CQ}}{V_T} = 65.96\ mA/V$$

let $r_o = \infty$

$$R_i = r_{\pi} = 1.516\ k\Omega$$

$$R_i' = R_{th} \| R_i = 1.35\ k\Omega$$

$$A_V = \frac{-g_m V_{\pi} R_C}{V_{\pi}} = -g_m R_C = -257.20$$

$$R_o = \infty$$

$$R_o' = R_C = 3.9\ K\Omega$$

Av with RL, $A_V = -g_m (R_C \| R_L) = -185$

$$A_I = -\beta = -100$$

Q. No. | Marks

Que 3 a)

$$K = \frac{I_{D(ON)}}{[V_{GS(ON)} - V_{GS(th)}]^2}$$

$$= 0.55 \text{ mA/V}^2$$

$$V_{GS} = 9.7 - 0.75 I_{DQ}$$

$$I_{DQ} = K [V_{GS} - V_{GS\,th}]^2$$

Solving

$$I_{DQ} = 4.96 \text{ mA}$$

V_{DSQ}

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

$$= 24 - 4.96 \text{ mA} (2.2K + 0.75K)$$

$$V_{DSQ} = 9.36 \text{ V}$$

Que 4 b)

$$I_B = 32.11 \mu A$$

$$I_C = \beta I_B = 3.21 \text{ mA}$$

$$V_{CE} = V_{CC} - I_C (R_C + R_E)$$

$$V_{CE} = 10.33 \text{ V}$$

$$V_C = 13.58 \text{ V}$$

$$V_E = 3.24 \text{ V}$$

Q. No. | Marks

Que 6 a) From DC Analysis.

$$V_{GSQ} = V_G - I_D R_S$$

$$V_{GSQ} = 6 - 1.2\, I_{DQ}$$

$$I_{DQ} = k(V_{GSQ} - V_T)^2$$

Solving

$$I_{DQ} = 1.11\ mA$$

$$\therefore V_{GSQ} = 4.66\ V.$$

$$\therefore g_m = 2k(V_{GSQ} - V_T)$$

$$= 1.33\ mA/V$$

AC Analysis :

$$R_i = R_1 \| R_2 = 8\ M\Omega$$

$$A_v = -g_m (r_d \| R_D)$$

$$A_v = -4.05$$

$$R_o = r_d \| R_o$$

$$R_o = 3.04\ K\Omega$$