

Home work - 7

$$i_D = K_n [2(V_{GS} - V_{TN}) V_{DS} - V_{DS}^2]$$

$$= 0.3 [2(2 - 0.5) V_0 - V_0^2]$$

$$i_D = \frac{V_{DD} - V_0}{R_D}$$

for, $V_{in} = 2V$

$$\frac{V_{DD} - V_0}{R_D} = 0.3 [2(2 - 0.5) V_0 - V_0^2]$$

$$\Rightarrow \frac{2.5 - V_0}{20} = 0.3 (3V_0 - V_0^2)$$

$$\Rightarrow 2.5 - V_0 = 18V_0 - 6V_0^2$$

$$\Rightarrow 6V_0^2 - 19V_0 + 2.5 = 0$$

$$x_1 = \frac{19 + \sqrt{301}}{12}$$

$$= 3.0291$$

$$x_2 = 0.13755$$

$$V_{DS} = V_0 = 0.13755$$

$$V_{GS} - V_T = 2 - 0.5$$

$$V_{DS} < V_{GS} - V_T = 1.5$$

(Triode)

assumption correct

B Jon,

$$V_I = 0.3V$$

$$I_D = K_n \left[2(V_{GS} - V_{TN}) V_{DS} - V_{DS}^2 \right]$$
$$= 0.3 \left[2(0.3 - 0.5) V_0 - V_0^2 \right]$$

$$I_D = \frac{V_{DD} - V_0}{R_D} = \frac{2.5 - V_0}{20}$$

$$\Rightarrow \frac{2.5 - V_0}{20} = 0.3 \left[2(0.3 - 0.5) V_0 - V_0^2 \right]$$

$$\Rightarrow 2.5 - V_0 = 6(-0.4V_0 - V_0^2)$$

$$\Rightarrow 2.5 - V_0 = -1.2V_0 - 6V_0^2$$

$$\Rightarrow 2.5 + 0.2V_0 + 6V_0^2 = 0$$

$$x_1 = -\frac{1}{60} + 0.64V \quad x_2 = -\frac{1}{60} - 0.652$$

$$\boxed{= 0.6233V} \quad \boxed{= -0.6686V}$$

$$V_{DS} = V_0 = -0.6233$$

$$V_{GS} - V_T = 0.3 - 0.5$$
$$= -0.2$$

(triode)

$$V_{DS} < V_{GS} - V_T$$

$$-0.6686 < -0.2$$

assumption

correct

assumption wrong