(2) (1)

Triode

$$I_{DS} = K\left[(V_{GS} - V_T) - \frac{1}{2}V_{DS}\right]V_{DS}$$

$$\Rightarrow I_{DS} = 0.7\left[(5 - 1.7) - \frac{1}{2}V_O\right]V_O$$

$V_o = 20 - I_{DS} \times 0.27$

$\Rightarrow V_o = 20 - 0.27 \times 0.7 \times \left[3.3 - \frac{1}{2} V_o\right] V_o$

$\Rightarrow V_o = 20 - 0.6237 V_o + 0.0945 V_o^2$

$\Rightarrow 0.0945 V_o^2 - 1.6237 V_o + 20 = 0$

$\Rightarrow V_o = (8.59 - 11.74i)\ V$

or

$(8.59 + 11.74i)\ V$

$= 14.547 \angle -0.93\ V$

$\therefore |V_{DS}| = 14.547 V$

(b)

V_{DS} is greater than $V_{GS} - V_t$

$\therefore$ Not in Triode

Q

(i) + (ii)

$V_i = 15\ V$

$$I_{DS} = \frac{0.7[15 - 1.7]^2}{2}$$

$$= 61.9115\ mA$$

$$V_o = 20 - (61.9115 \times 0.27)$$

$$= 3.2838$$

$$= V_{DS}$$

(ii)

$$V_{GS} - V_T = 15 - 1.7$$

$$= 13.3$$

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

$\therefore$ Assumption Wrong