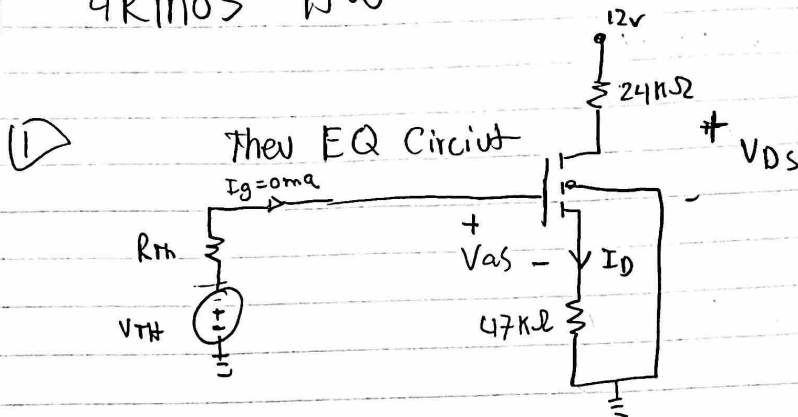


4RMOS HW



$$V_{th} = \frac{200}{200+430} \times 12 = \underline{V_{th} = 3.8 \text{ V}} \quad R_{th} = \frac{200 \times 430}{200+430} = \underline{136.5 \text{ k}\Omega}$$

$$V_{gs} = 3.8 - 47 I_D$$

$$V_{TD} = 1 \text{ V}$$

$$W/L = 5/1$$

$$\mu_{n\text{cose}} = 0.2 \text{ mA/V}^2$$

$$k_n = \mu_{n\text{cose}} (W/L) = 0.2 \times 5 = 1 \text{ mA/V}^2$$

Sat Region: $V_{gs} > V_{TD} = 3.8 - 47 I_D$

$$\underline{I_D < 0.0595 \text{ mA}}$$

$$I_D = \frac{k_n}{2} (V_{gs} - V_{TD})^2 = 2 I_D = (3.8 - 47 I_D)^2$$

$$I_D = 0.0527 \text{ mA}, \quad 0.0074 \text{ mA}$$

$$I_D < 0.0595 \text{ mA} \quad \text{so} \quad \underline{I_D = 0.0527 \text{ mA}}$$

$$V_{gs} = 3.8 - (47)(0.0527)$$

$$\underline{V_{gs} = 1.3231 \text{ V}}$$

$$KVL: 12 - 24I_D - V_{DS} - 47I_D = 0$$

$$V_{DS} = 8.253 V$$

$$(b) \quad w/L = 15/1$$

$$k_n = 0.2 \times 15 = 3 \text{ mA/V}^2$$

$$\text{So, } I_D = \frac{3}{2} (3.8 - 47I_D)^2$$

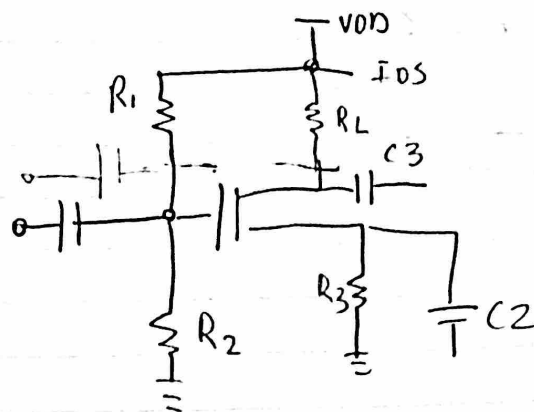
$$I_D = 0.0555 \text{ mA}, \quad 0.0639 \text{ mA}$$

$$I_D = \text{---} \uparrow$$

$$V_{DS} = 12 - 71I_D = 12 - (71)(0.0555)$$

$$V_{DS} = 8.0595 V$$

2

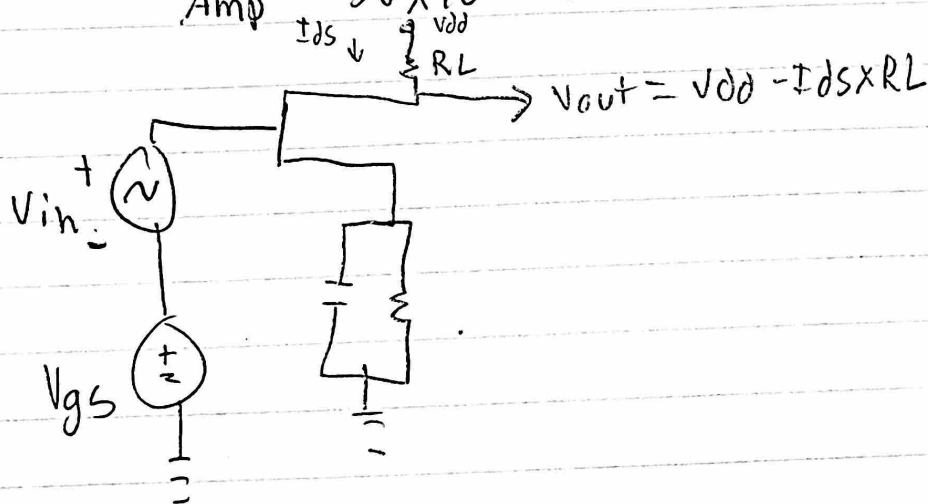


$R_1 // R_2$ EA input resistance

Voltage Gain $A_v = \frac{\Delta V_{out}}{\Delta V_{gs}} = \frac{\Delta I_{DS} \times R_L}{\Delta V_{gs}}$

Swing Max $V_{in} = \Delta V_{gs} = 3V$

Amp $3V \times 10 = 330V$



(c) $R_1 // R_2 = R_{in} = 110 \text{ k}\Omega$

$$Load \Rightarrow R_L = \frac{V_{DS}}{I_{DS}} = \frac{V_{DD}}{2 \times I_{DS}}$$

$$R_S = \frac{V_S}{I_{DS}}$$

Simplified Circuit

