Student Name: ID: 8ᵗʰ Oct, 2024
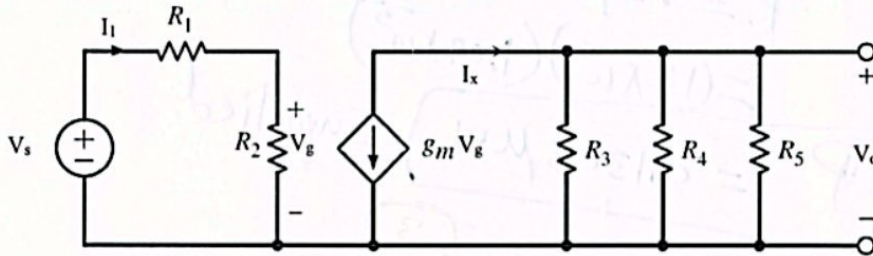
Problem 1: For the circuit shown is a FET common-source amplifier or BJT common-emitter amplifier.

If $R_1 = 100\ \Omega$, $R_2 = 1k\Omega$, $g_m = 0.04S$, $R_3 = 50k\Omega$, and $R_4 = R_5 = 10\ k\Omega$, and $V_s = 12V$, then use Kirchhoff's laws and Ohm's law and series/parallel reduction to:

A) Find V_o, and I_x

B) Calculate the power of the V_s source, state whether it is supplied or absorbed!
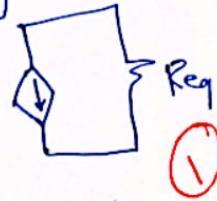

To find I_1

$$-V_s + R_1 I_1 + R_2 I_1 = 0$$

$$-12 \times 10^{-3} + 100 I_1 + 1000 I_1 = 0$$

$$I_1 = \frac{12 \times 10^{-3}}{1.1K} = 1.09 \times 10^{-5}\,A \quad ③$$

$$V_g = I_1 R_2 = 1.09 \times 10^{-5}(1K) = \boxed{0.0109V}$$

$$I_x = -g_m V_g$$

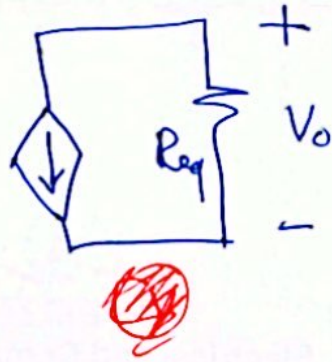$$I_x = -0.04(0.0109) = \boxed{-4.36 \times 10^{-4}\,A}$$

$$\frac{1}{R_{eq}} = \frac{1}{R_3} + \frac{1}{R_4} + \frac{1}{R_5} \implies R_{eq} = 4.545k$$

$$V_o = (-g_m V_g) R_{eq}$$

$$= (-4.36 \times 10^{-4}) 4545k$$

$$V_0 = (-g_m V_g) R_{eq}$$

$$= (-4.36 \times 10^{-4}) 4545k$$

$$\boxed{V_0 = -1.98 \, V} \quad \textcircled{3}$$

B) Power Supplied by V_s

$$P = V I_1$$

$$= (12 \times 10^{-3})(1.09 \times 10^{-5})$$

$$\boxed{P = 0.1308 \, \mu W} \quad \text{Supplied}$$

$$\textcircled{3}$$