Homework for Chapter 4

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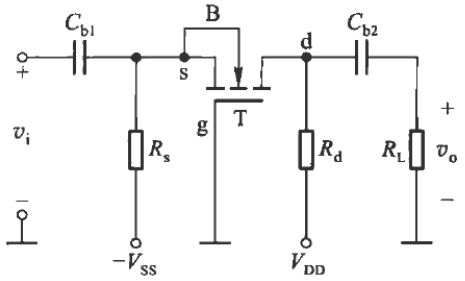
4.5.6 共栅极放大电路如图题 4.5.6 所示。电路参数为 $V_{DD}=V_{SS}=5$ V，$R_s=10$ kΩ，$R_d=5$ kΩ，$R_L=5$ kΩ。场效应管参数 $K_n=3$ mA/V^2，$V_{TN}=1$ V，$\lambda=0$。(1) 计算静态工作点 Q；(2) 求 g_m；(3) 求 $A_v=v_o/v_i$。



图题 4.5.6

Problem 1

$$I_{DQ} = K_n \left(V_{GSQ} - V_{TN}\right)^2$$

$$-V_{GSQ} - I_{DQ} R_S = -V_{SS}$$

The two possible solution for I_{DQ} are:

$$I_{DQ} = 0.438 \text{ mA}$$

or

$$I_{DQ} = 0.365 \text{ mA}$$

Noted that if $I_{DQ} = 0.438$ mA, $V_{GSQ} = 0.62$ V $< V_{TN}$. So that this solution is invalid. $I_{DQ} = 0.365$ mA when $V_{GSQ} = 1.35$ V

Problem 2

$$g_m = 2K_n \left(V_{GSQ} - V_{TN}\right) = 2.1 \text{ mA/V}$$

Problem 3

$$A_v = g_m \cdot \frac{R_d R_L}{R_d + R_L} = 5.25$$