ECE 342
Electronic Circuits

Lecture 11
Common Source Amplifiers - 3

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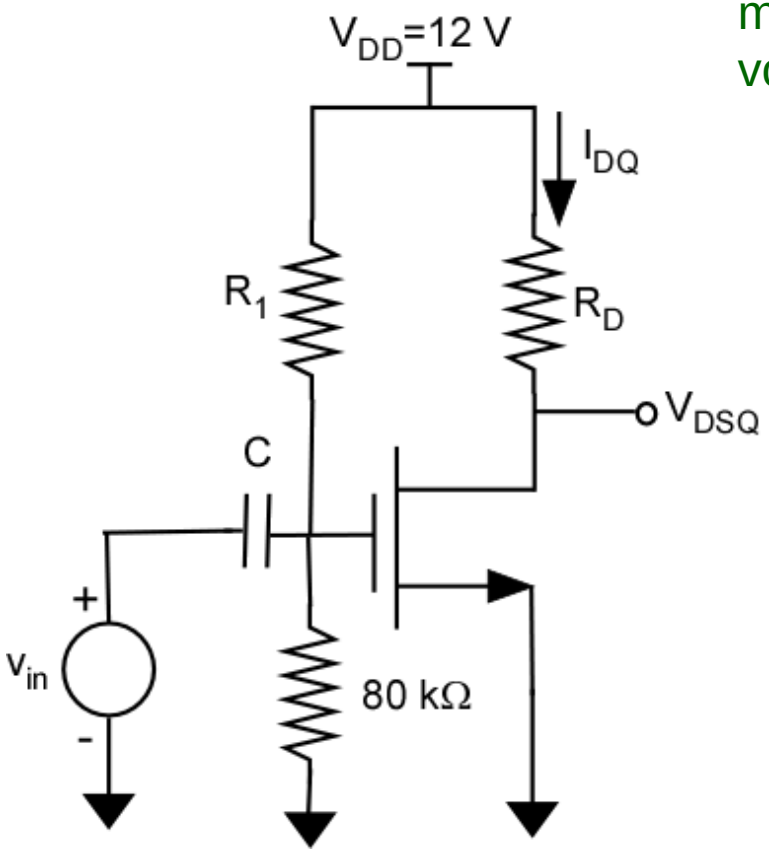
Example

In the circuit shown, V_T=1 V, λ=0, $\mu C_{ox}W/2L$=0.1 mA/V^2. Select R_D and R_1 to result in midband voltage gain of –4 and V_{DSQ}=7 V.



$$R_D = \frac{V_{DD} - V_{DSQ}}{I_{DQ}} = \frac{5}{I_{DQ}}$$

$$A_{MB} = -g_m R_D = -g_m \frac{5}{I_{DQ}}$$

$$A_{MB} = -\sqrt{4 \times 0.1 \times I_{DQ}} \times \frac{5}{I_{DQ}} = \frac{-3.162}{\sqrt{I_{DQ}}} = -4$$

Example (Cont')

$$I_{DQ} = \left(\frac{3.162}{4}\right)^2 = 0.625\,mA \Rightarrow R_D = \frac{5}{0.625} = 8\,k\Omega$$

$$0.625 = 0.1\left(V_{GS} - 1\right)^2 \; leads\; to \; \sqrt{6.25} + 1 = V_{GS} = 3.5\,V$$

$$\frac{V_{DD}R_2}{R_1 + R_2} = \frac{80}{80 + R_1} \times 12 = 3.5 \Rightarrow \frac{960}{3.5} - 80 = R_1 = 194\,k\Omega$$

$$R_D = 8\,k\Omega$$

$$R_1 = 194\,k\Omega$$