

EE 320

Intro to Electronics

4/10/13

Lecture 20

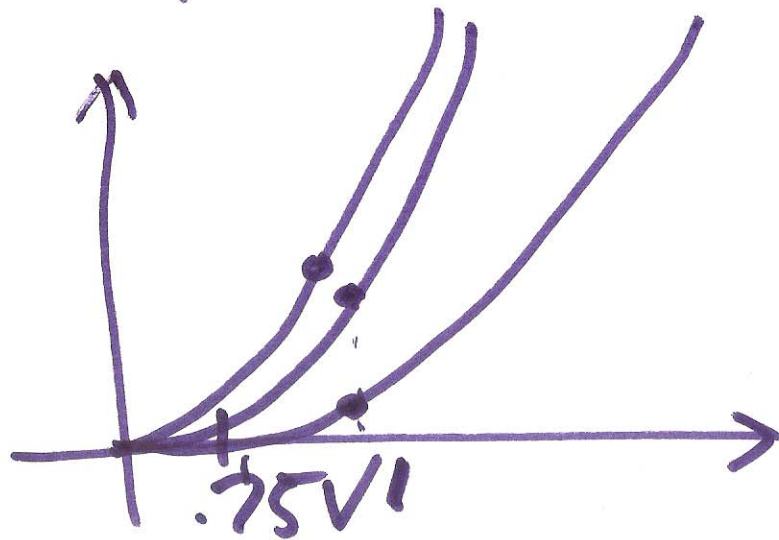
VN3306

$V_{THN} = 2V$

$I_D = 0.2A$

@ $V_{GS} = 4$

SSM



$W = 100\mu$

$L = 1\mu$

$$0.2A = \frac{K_P}{2} \cdot \frac{W}{L} (4-2)^2$$

$$I_D = \frac{K_P}{2} \frac{W}{L} (V_{GS} - V_{THN})^2$$

$$0.2 = \frac{K_P}{2} \cdot 100 \cdot 4$$

$$\frac{10^{-2}}{10^{-2}} \cdot \frac{10^{-1}}{10^{-2}} = \frac{0.1}{100} = K_P = 1mA/V^2$$

$$V_{TO} = -3.5 \text{ V}$$

$$I_D = 150 \text{ } \mu\text{A}$$

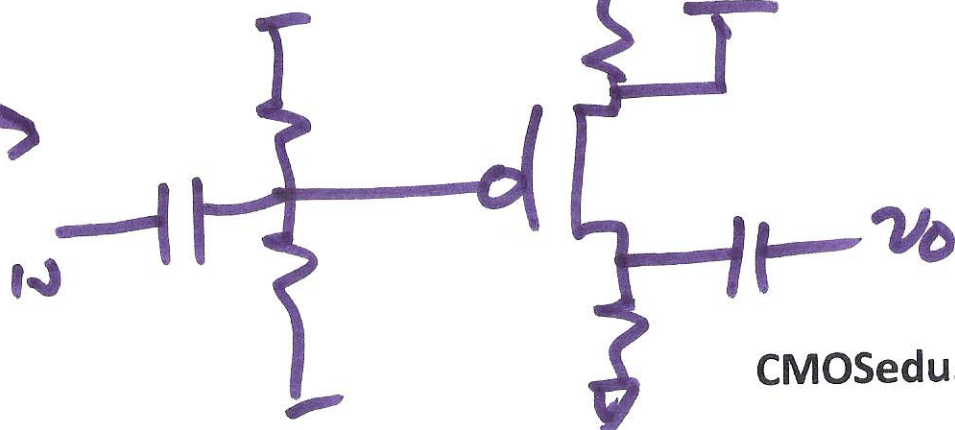
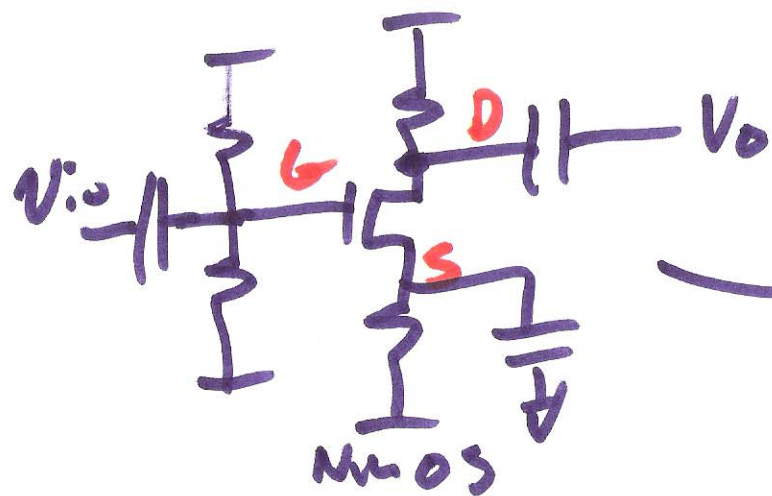
$$V_{GS} = -5$$

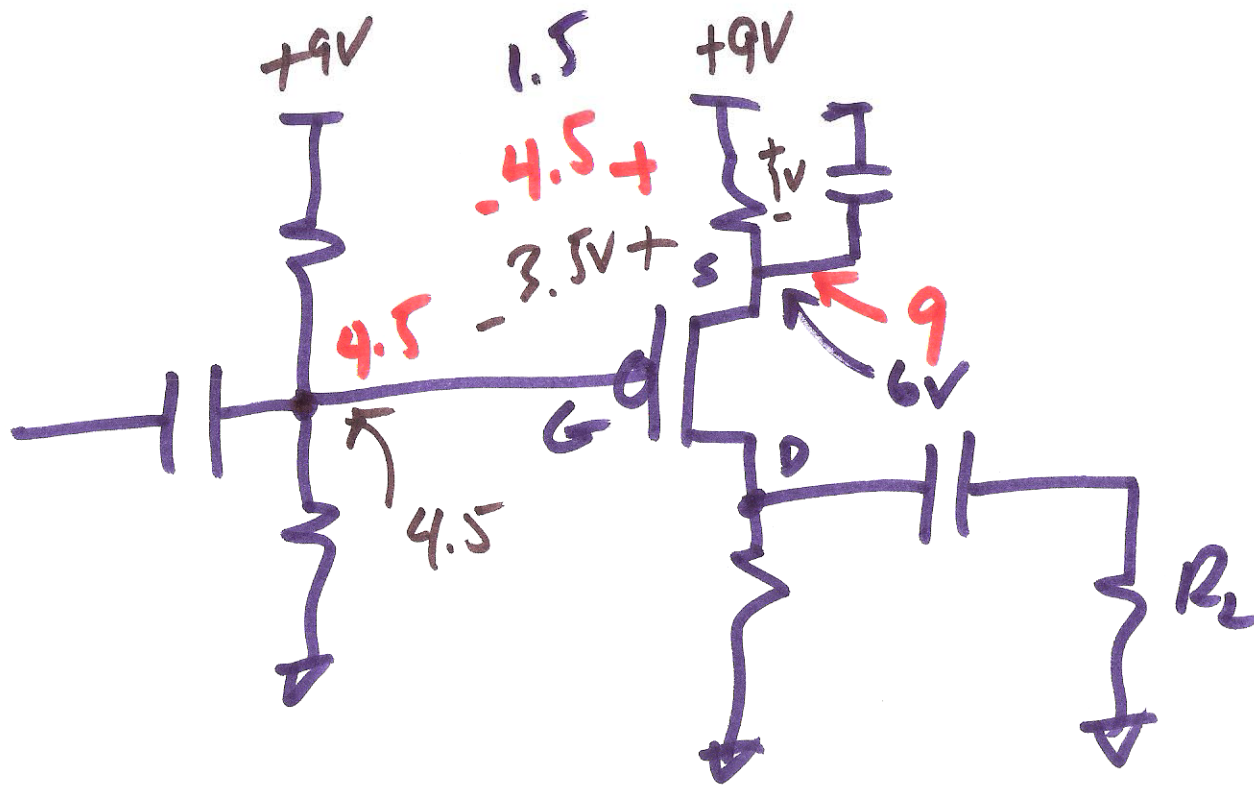
$$W = L = 10 \mu\text{m}$$

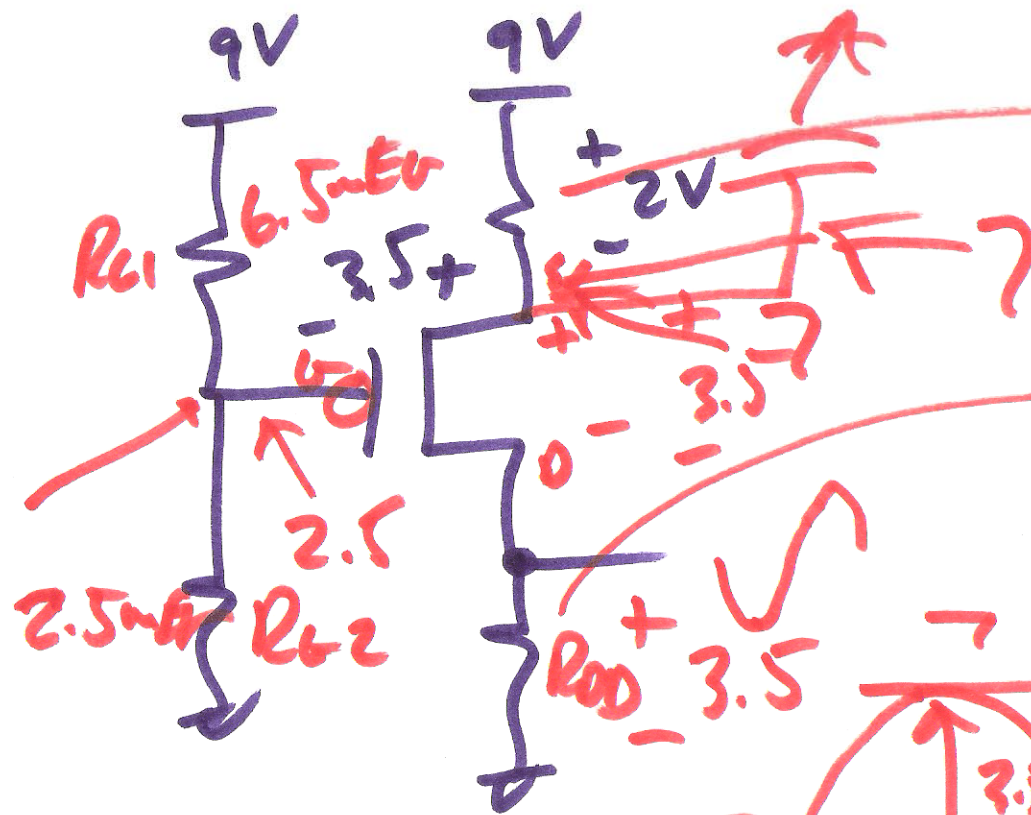
$$150 \text{ } \mu\text{A} = \frac{K_P}{2} \cdot \frac{10}{10} (5 - 3.5)^2$$

$$300 \text{ } \mu\text{A} = K_P (2.25) \text{ V}^2$$

$$K_P = \frac{300 \text{ } \mu\text{A}}{2.25 \text{ V}^2} = 133 \text{ } \mu\text{A/V}^2$$



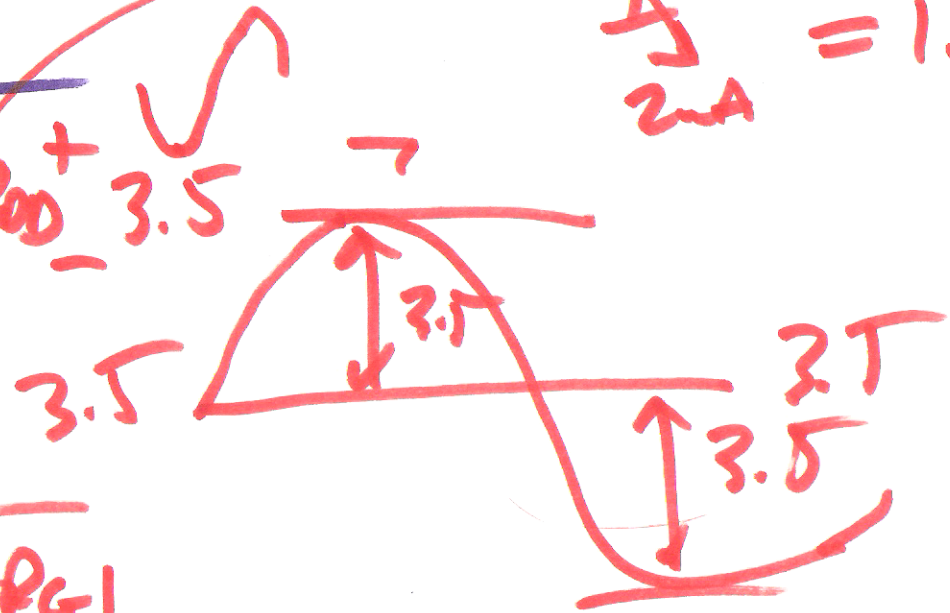




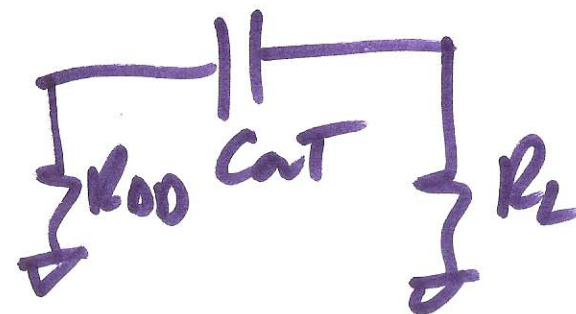
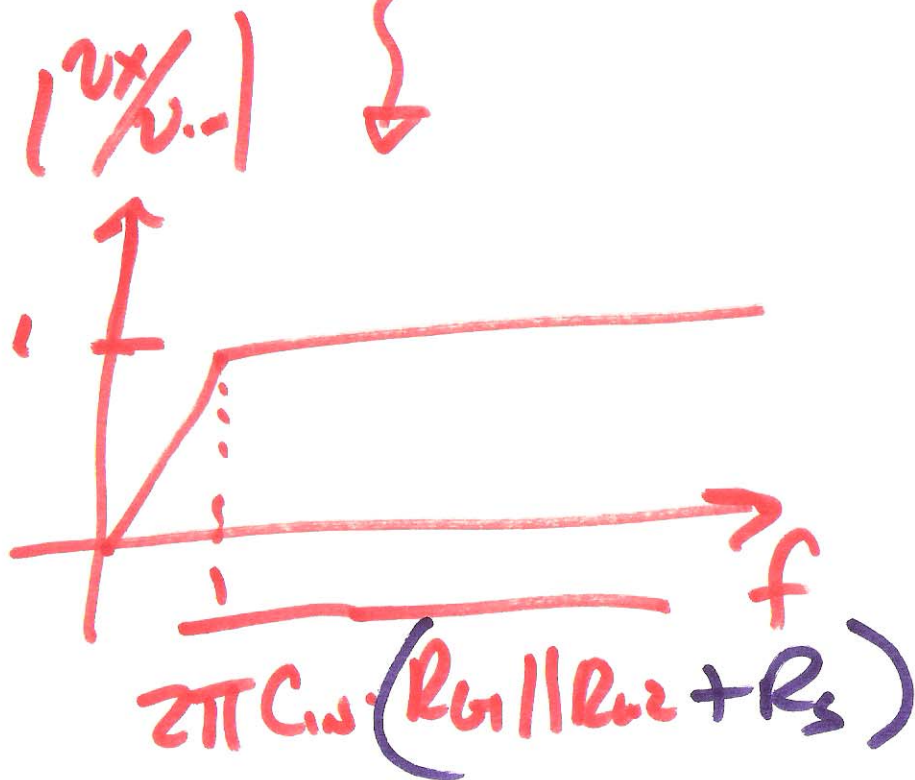
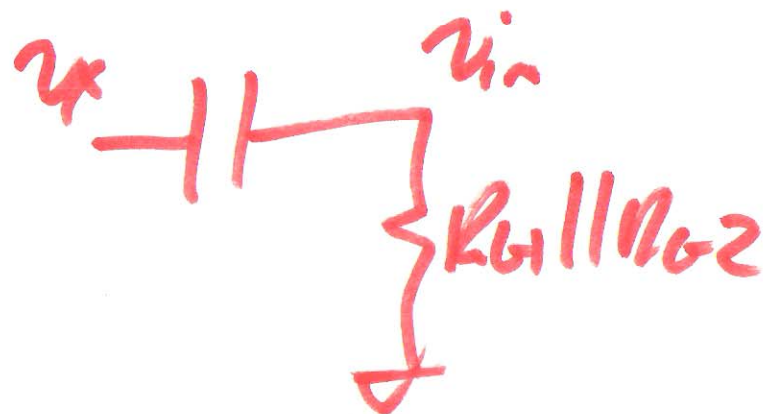
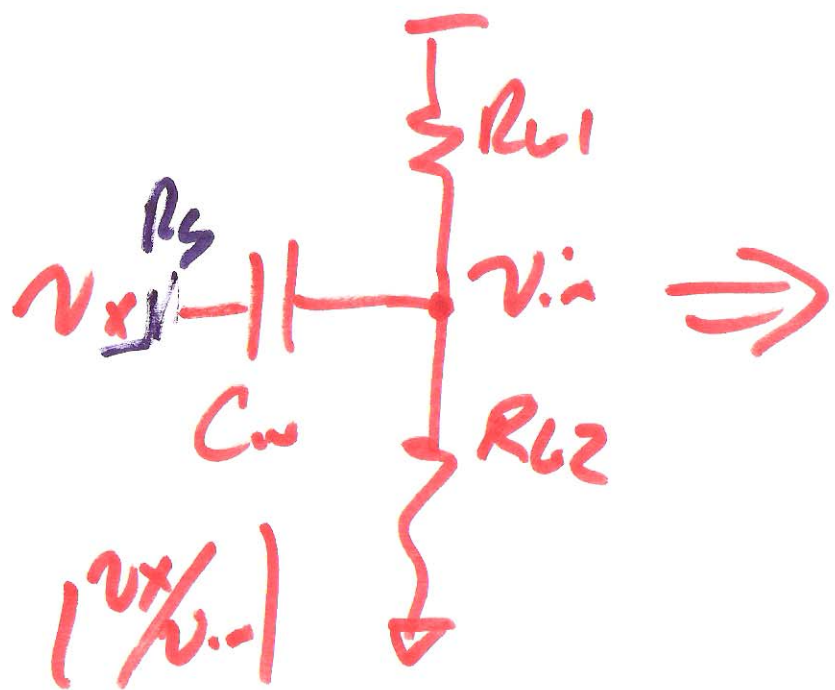
$$R_{SS} = \frac{2}{I_{2mA}} = 1k$$

$$\frac{3.5}{I_{2mA}} = R_{OD} = 1.75k$$

$$2.5 = 9 \cdot \frac{R_{G2}}{R_{G2} + R_{G1}}$$



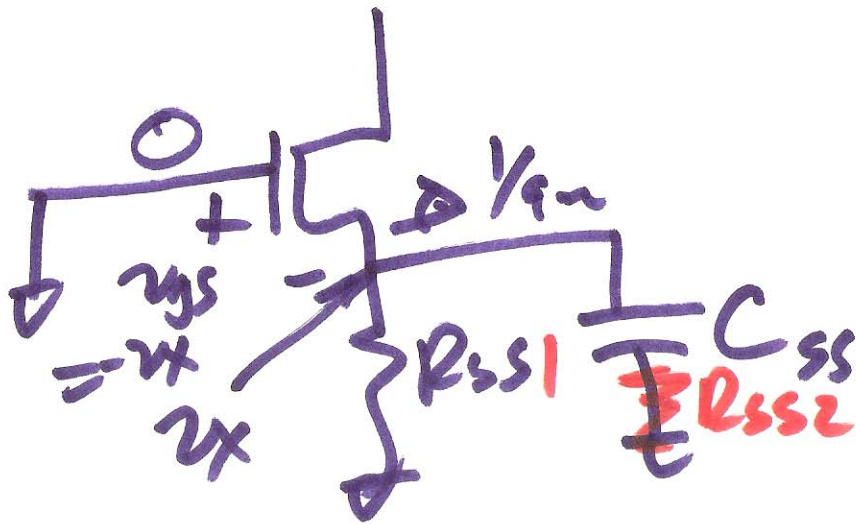
$$I_D = \frac{K_P}{2} \frac{W}{L} (V_{GS} - V_{thn})^2$$



$$f_{3dB} = \frac{1}{2\pi C_{AT} (R_{00} + R_L)}$$

5)

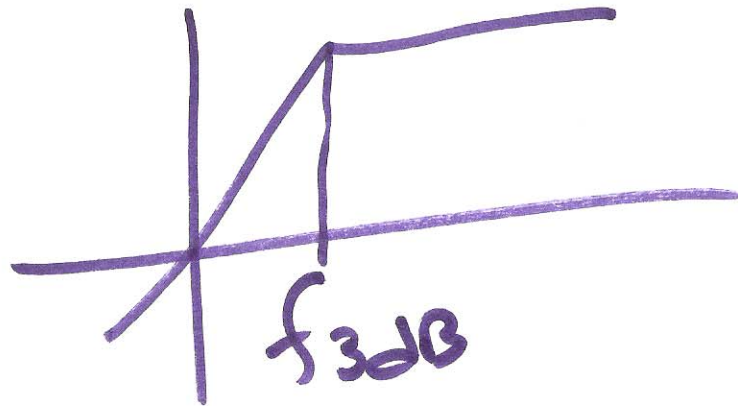
$$f_{3dB} = \frac{1}{2\pi C_{ss} \cdot \left(\frac{1}{g_m} \parallel R_{ss1} + R_{ss2} \right)}$$



$$f_{3dB} = \frac{1}{2\pi \frac{1}{g_m} \parallel R_{ss} \cdot C_{ss}}$$

$$\approx \frac{1}{2\pi \cdot \frac{1}{g_m} \cdot C_{ss}}$$

$$= \frac{g_m}{2\pi C_{ss}}$$



$$A_v = -g_m R_{o0} \mid R_L = \infty$$

$$= -0.027 \cdot 1.75k = -47$$

$$1.75k \parallel 10k$$

$$A_v \mid_{\text{with } R_L} = -g_m R_{L \parallel R_{o0}}$$

with $R_{SS} = 40k$

$$= -g_m \frac{R_{L \parallel R_{o0}}}{1 + R_{SS} \parallel R_{SS2}}$$

$\approx -1k$