Microelectronic Circuits I (Quiz 2)

date: 2009/12/18 (Fri)

time: 14:20~15:10

1. (50%) Consider an n-channel MOSFET with t_{ox}=20nm, μ_n=650cm^2/V*s, V_t=0.8V, and W/L=10. Find the drain current in the following cases:
   (a) v_{GS}=5V and v_{DS}=1V　4.18 mA
   (b) v_{GS}=2V and v_{DS}=1.2V　0.87 mA
   (c) v_{GS}=5V and v_{DS}=0.2V　0.919 mA
   (d) v_{GS}=v_{DS}=5V　9.887 mA

2. (50%) Figure blow shows a discrete-circuit CS amplifier employing the classical biasing scheme studied in Section 4.5. The input signal v_{sig} is coupled to the gate through a very large capacitor (shown as infinite). The transistor source is connected to ground at signal frequencies via a very large capacitor (shown as infinite). The output voltage signal that develops at the drain is coupled to a load resistance via a very large capacitor (shown as infinite).
   (a) If the transistor has V_t=1V, and k_n'W/L=2mA/V^2, verify that the bias circuit establishes V_{GS}=2V, I_D=1mA, and V_D=+7.5V. That is , assume these values, and verify that they are consistent with the values of the circuit components and the device parameters..
   (b) Find g_m and r_O if V_A=100V.　2mA/V , 100kΩ
   (c) Draw a complete small-signal equivalent circuit for the amplifier assuming all capacitors behave as short circuit at signal frequencies.
   (d) Find R_{in}, v_{gs}/v_{sig}, v_O/v_{gs}, and v_O/v_{sig}.
   3.33　0.97　8.2　7.95