Due in the "EE 105 box" near 125 Cory Hall by 5pm on Friday 10/26/2012.

Read Chapter 7 and Section 11.1 in B. Razavi: Fundamentals of Microelectronics

Use the following parameters in all problems, unless otherwise specified:

Device	Parameter values
BJT	$I_s = 1\,\text{fA}$, $\beta = 100$, and $V_A = 100\,\text{V}$
NMOS	$\lvert V_{TH}\rvert = 400\,\text{mV}$, $\mu_n C_{ox} = 200\,\mu\text{A/V}^2$, $\lambda = 0.02\,\text{V}^{-1}$, $\gamma = 0\,\text{V}$.
PMOS	$\lvert V_{TH}\rvert = 400\,\text{mV}$, $\mu_p C_{ox} = \mathbf{100}\,\mu\text{A/V}^2$, $\lambda = 0.02\,\text{V}^{-1}$, $\gamma = 0\,\text{V}$.

Unless otherwise specified, assume room temperature and $V_t = 25\,\text{mV}$.

1. Do the Exercise after Example 7.6 in B. Razavi: Fundamentals of Microelectronics. If $r_{01} = r_{02} = r_o$ and $R_L = r_o/10$, calculate the ratio of the gain a_v without and a_{vL} and with R_L present in the circuit. What do you conclude about driving resistors with CS or CE stages?

2. Do the Exercise after Example 7.7 in B. Razavi: Fundamentals of Microelectronics.

3. Repeat Example 7.9 in B. Razavi: Fundamentals of Microelectronics after replacing M_2 with a diode-connected PMOS transistor. Note: "diode connected" means tying the gate and drain of the transistor together.

4. Do the Exercise after Example 7.13 in B. Razavi: Fundamentals of Microelectronics.

5. Do the Exercise after Example 7.16 in B. Razavi: Fundamentals of Microelectronics.

6. Do the Exercise after Example 7.17 in B. Razavi: Fundamentals of Microelectronics.

7. Do Problem 7.14 in B. Razavi: Fundamentals of Microelectronics.

8. Do Problem 7.20 in B. Razavi: Fundamentals of Microelectronics.

9. Do Problem 7.71 in B. Razavi: Fundamentals of Microelectronics.

10. Do the Exercise after Example 11.7 in B. Razavi: Fundamentals of Microelectronics.

11. Do the Exercise after Example 11.8 in B. Razavi: Fundamentals of Microelectronics.

12. Do the Exercise after Example 11.10 in B. Razavi: Fundamentals of Microelectronics.

13. Do the Exercise after Example 11.11 in B. Razavi: Fundamentals of Microelectronics.

14. Do Problem 11.1 in B. Razavi: Fundamentals of Microelectronics.

15. Do Problem 11.2 in B. Razavi: Fundamentals of Microelectronics.

16. Do Problem 11.6 in B. Razavi: Fundamentals of Microelectronics. Plot both the magnitude and phase versus frequency (log axis). You may either use a "piece-wise linear approximation" or use a program (xcell, matlab, spice, ...) for the plots.

    In piece-wise linear approximations the magnitude consists of straight lines with slope $n \times 20\,\mathrm{dB/dec}$ joined at the pole and zero frequencies. The phase response also consists of straight lines spanning 90 degrees over two decades (45 degrees each above and below the pole or zero which contributes the shift. Consult your EE40 notes or office hours if you forgot how to do this.