PROBLEM SET #7

Issued: Friday, October 18, 2019

Due: Friday, October 25, 2019, at 12:00 noon via Gradescope.

1. What collector current is required for a bipolar transistor to achieve a transconductance of 25 mS?
2. What is the collector bias current, I_C which yields $r_\pi = 5$ kΩ for a bipolar transistor with $\beta = 125$? What are the approximate values of g_m and r_o if $V_A = 100$ V?
3. A circuit requires the use of a transistor with a transconductance of 250 mS. A bipolar transistor with $\beta_{DC} = 100$ and a MOSFET with $K_n = 25$ mA/V^2 are available. Which transistor would be preferred and why?
4. Sedra & Smith, Problem 7.92
5. Sedra & Smith, Problem 7.94
6. The circuit in Figure PS7.1 below illustrates a simple biasing method where a large feedback resistor, R_G connects the drain and gate of an NMOS transistor. If $V_{DD} = 3$ V, $k_n' = 25$ μA/V^2, $V_{tn} = 0.7$ V, and $R_G = 1$ MΩ, design the circuit below to have a bias current I_D of 500 μA. Pick a standard 5% resistor value for R_D, and find the actual current I_D and the drain voltage V_D.

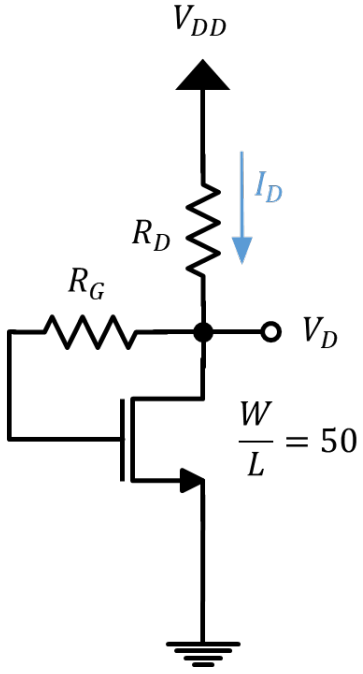

Figure PS7.1

7. Sedra & Smith, Problem 7.108

8. Sedra & Smith, Problem 7.24

9. Sedra & Smith, Problem 7.33