PROBLEM SET #5

Issued: Friday, September 27, 2019

Due: Friday, October 4, 2019 at 12:00 noon via **Gradescope**.

1. Sedra & Smith, Problem 3.25

2. Sedra & Smith, Problem 3.26

3. Given a *pn* junction with doping $N_A = 10^{17}$ cm^{-3}, $N_D = 10^{16}$ cm^{-3}, cross-sectional area, $A = 200$ μm^2, $n_i = 1.5 \times 10^{10}$cm^{-3}, diffusion lengths $L_p = 4$ μm & $L_n = 12$ μm, and diffusion constants $D_p = 8$ cm^2/s & $D_n = 20$ cm^2/s, find I_S. If a forward voltage $V = 800$ mV is applied across this junction, what is the resulting forward current?

4. Sedra & Smith, Problem 4.37

5. Sedra & Smith, Problem 4.43

6. Sedra & Smith, Problem 5.23

7. Sedra & Smith, Problem 5.27

For problems 8 and 9 below, use the parameters in Table PS5.1 as needed.

PARAMETER	NMOS VALUE	PMOS VALUE	UNIT
V_{t0}	0.75	-0.75	V
γ	0.75	0.5	$\sqrt{V}$
$2\phi_f$	0.6	0.6	V
K'	25	10	μA/V^2

Table PS5.1

8. Identify the source, drain, gate and bulk terminals, and find the current I in the transistors in Figure PS5.1. Assume $V_{tn} = 0.75$ V.
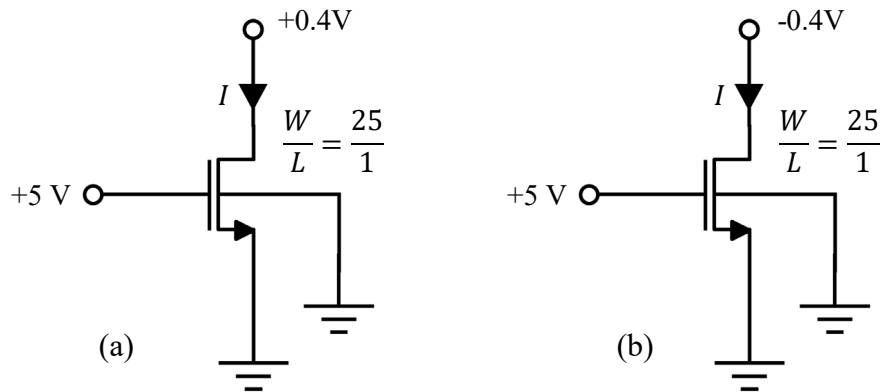

Figure PS5.1

9. Consider transistors operating in their linear regions for the questions below.

   (a) What is the W/L ratio required for an NMOS transistor to have an on-resistance of 2 kΩ when $V_{GS} = 5$ V and $V_{SB} = 0$ V?

   (b) Repeat for a PMOS transistor with $V_{GS} = -5$ V and $V_{SB} = -3$ V.

10. Sedra & Smith, Problem 5.24