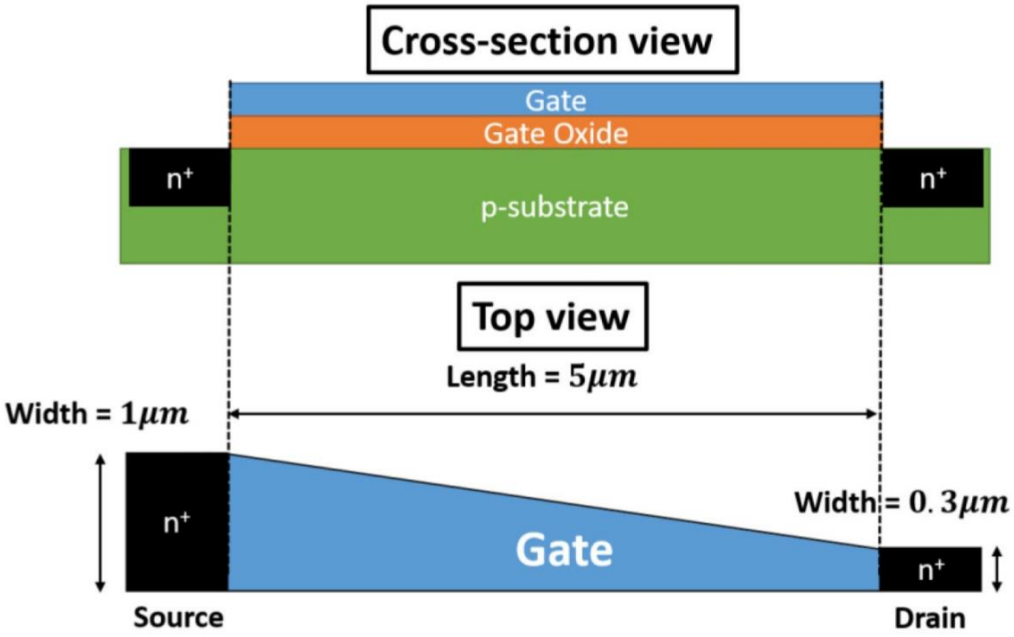
PROBLEM SET #7

Issued: Friday, October 9, 2020

Due: Friday, October 16, 2020 at 12:00 noon via **Gradescope**.

1. The cross-section and top-view of an NMOS transistor are shown below. The length of the channel is $5\mu m$. The width of the channel changes linearly from $1\mu m$ at the source to $0.3\mu m$ at the drain. Derive the expression for the device current when operating in the **linear region** as a function of μ_n, C_{ox}, V_{GS}, V_{DS} and V_{TH}. Assume λ=0.



2. Sedra & Smith, Problem 6.15

3. Indicate the region of operation for a npn transitor biased as follows:

(a) $V_{BE} = 0.7V,\ V_{BC} = 0.7V$

(b) $V_{BE} = 0.7V,\ V_{BC} = -2V$

(c) $V_{BE} = -0.7V,\ V_{BC} = -2V$

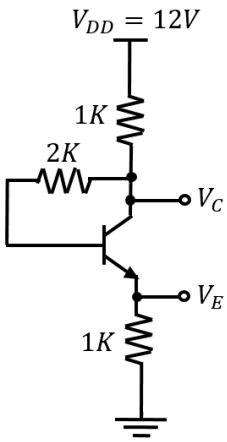
(d) $V_{BE} = -1V,\ V_{BC} = -2V$

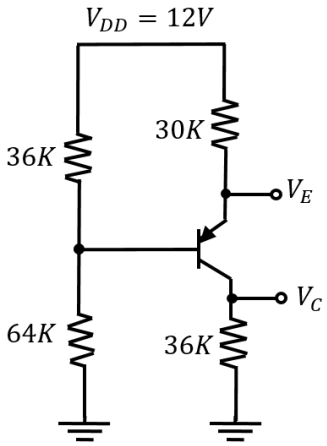
(e) $V_{BE} = -1V,\ V_{BC} = 0.7V$

4. Sedra & Smith, Problem 6.51

5. Sedra & Smith, Problem 6.59

6. Find the transistor operating points, V_C and V_E in the following circuits. $\beta = 60, V_{BE} = 0.7V$


$V_{DD} = 12V$
$1K$
$2K$
V_C
V_E
$1K$


$V_{DD} = 12V$
$30K$
$36K$
V_E
V_C
$64K$
$36K$