E E 311

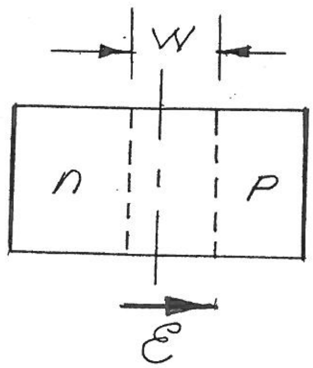
EXAM 2 (100pts)

October 11, 2013

Name ______________

ID ______________

(8pts) 2. The pn junction shown has a depletion width, W, which extends unevenly into the n and p materials.

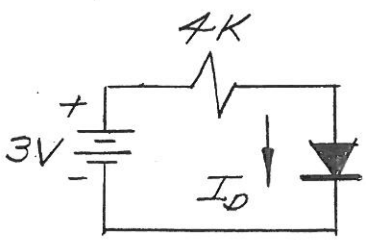


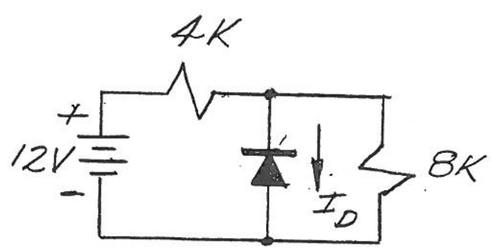
a) Which material is most heavily doped? (n or p) (3pts)

b) Which net impurity concentration is largest? (N_D or N_A) (2pts)

c) On the diagram above, indicate the direction of the built-in electric field, E. (3pts)

(10pts) 3. The diode in the circuits below has a forward voltage drop of $0.6V$ and a breakdown voltage of $4V$. Estimate the current through the diode, I_D.





$I_D =$ 0.6mA

(a)

(4pts)

$I_D =$ 1.5mA

(b)

(6pts)

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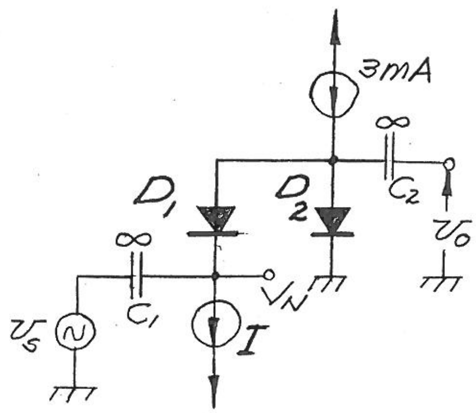
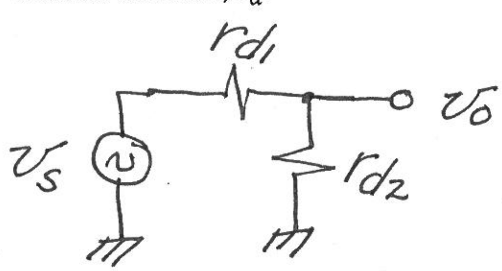
(20pts) 4. For the attenuator circuit shown, assume C_1 and C_2 to be very large (∞) coupling capacitors. Assume D_1 and D_2 are identical diodes.

a) Determine the value of the dc voltage, V_N when $I = 1mA$.



$V_N =$ 17.3mV (7pts)

b) Draw the small-signal equivalent circuit, replacing the diodes with their small signal resistive model, r_d. (6pts)



c) Determine the value of v_O/v_S when $I = 1mA$.

$v_O/v_S =$ 1/3 (7pts)

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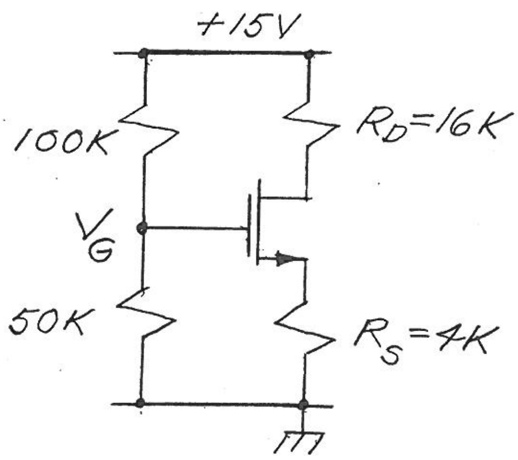
(20pts) 5. For the circuit below let $k_n' \frac{W}{L} = 0.25mA/V^2$, $V_t = 1V$ and $\lambda = 0$.
Determine V_G, I_D, V_{GS} and V_{DS}.



V_G = 5V (4pts)

V_{GS} = 3V (8pts)

I_D = 0.5mA (4pts)

V_{DS} = 5V (4pts)

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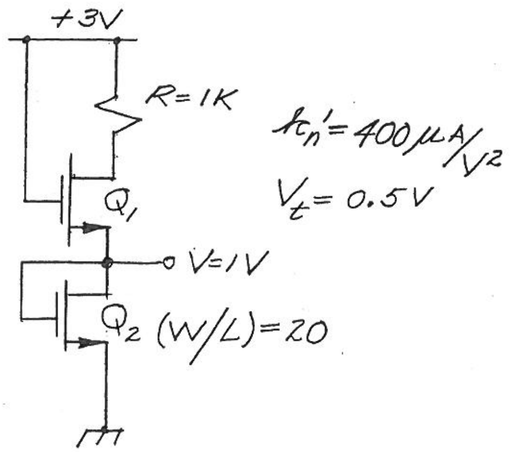
(20pts) 6. a) For the circuit shown, determine the value of the drain current, I_D, for $V = 1V$.



I_D = 1mA (4pts)

b) Determine V_{GS1} and V_{DS1} for transistor Q_1.

V_{GS_1} = 2V (2pts)

V_{DS_1} = 1.0V (3pts)

c) Does Q_1 operate in the {saturation, triode} region? (3pts)

d) Determine the required aspect ratio, $(W/L)_1$, for transistor Q_1.

$(W/L)_1$= 2.5 (8pts)