EMTR 1030 – Electronics

Assignment 4

Due: 8:00pm, Tuesday, March 24

Problem 5.14

5.14 Consider an *n*-channel MOSFET with $t_{ox} = 4$ nm, $\mu_n = 450$ cm^2/V · s, $V_t = 0.5$ V, and $W/L = 10$. Find the drain current in the following cases:

(a) $v_{GS} = 1.8$ V and $v_{DS} = 1$V

(b) $v_{GS} = 0.7$ V and $v_{DS} = 1.5$ V

(c) $v_{GS} = 1.8$ V and $v_{DS} = 0.1$ V

(d) $v_{GS} = v_{DS} = 1.8$ V

Problem 5.17

5.17 A particular MOSFET for which $V_{tn} = 0.4$ V and $k_n'(W/L) = 2$ mA/V^2 is to be operated in the saturation region. If i_D is to be 50 μA, find the required v_{GS} and the minimum required v_{DS}. Repeat for $i_D = 200$ μA.

Problem 5.21

5.21 For an NMOS transistor, for which $V_t = 0.5$ V, operating with v_{GS} in the range of 1.0 V to 1.8 V, what is the largest value of v_{DS} for which the channel remains continuous?

Problem 5.44

5.44 The NMOS transistor in the circuit of Fig. P5.43 has $V_t = 0.4$ V and $k_n = 4$mA/V^2. The voltages at the source and the drain are measured and found to be −0.55 V and +0.1 V, respectively. What current I_D is flowing, and what must the values of R_D and R_S be? What is the largest value for R_D for which I_D remains unchanged?

Problem 5.46

5.46 The transistor in the circuit of Fig. P5.46 has $k_n' = 0.5$ mA/V^2, $V_t = 0.4$ V, and $\lambda = 0$. Show that operation at the edge of saturation is obtained when the following condition is satisfied:

$$\left(\frac{W}{L}\right)R_D = 2.5\ \text{k}\Omega$$

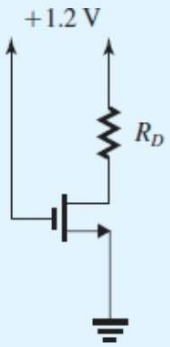

Figure P5.46

Problem 5.53

5.53 The MOSFET in Fig. P5.53 has $V_t = 0.4$ V, $k_n' = 500$ μA/V^2, and $\lambda = 0$. Find the required values of W/L and R so that when $V_I = V_{DD} = +1.3$ V, $r_{DS} = 50\ \Omega$ and $V_O = 50$ mV.

v **Show Answer**

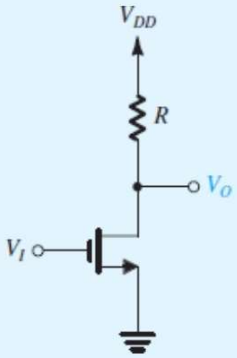

Figure P5.53