EE303 - Problem Set

In the following problems, unless otherwise stated, assume $\mu_n C_{ox} = 200\,\mu\text{A/V}^2$, $\mu_p C_{ox} = 100\,\mu\text{A/V}^2$, and $V_{TH} = 0.4\,\text{V}$ for NMOS devices and $-0.4\,\text{V}$ for PMOS devices.

Problem 1

It is possible to define an "intrinsic time constant" for a MOSFET operating as a resistor:

$$\tau = R_{on} C_{GS}, \qquad (6.79)$$

where $C_{GS} = WLC_{ox}$. Obtain an expression for τ and explain what the circuit designer must do to minimize the time constant.

Problem 2

In the circuit of Fig. 6.37, M_1 serves as an electronic switch. If $V_{in} \approx 0$, determine W/L such that the circuit attenuates the signal by only 5%. Assume $V_G = 1.8\,\text{V}$ and $R_L = 100\,\Omega$.

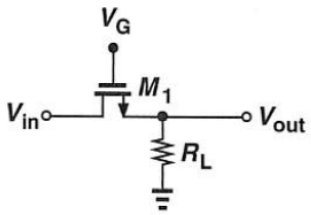


Figure 6.37

Problem 3

Determine the region of operation of M_1 in each of the circuits shown in Fig. 6.38.

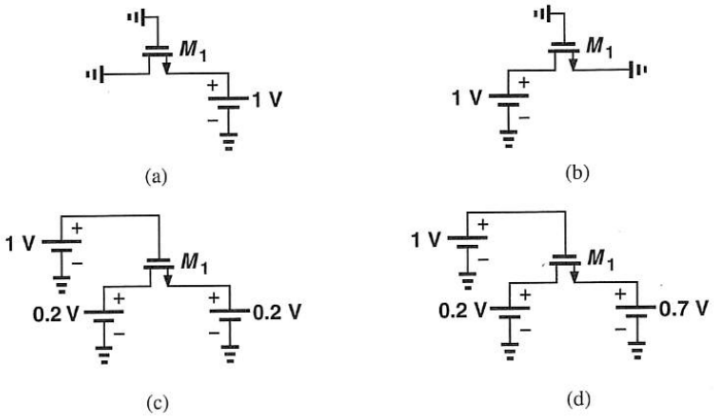


Figure 6.38

Problem 4

In the Fig. 6.42 ,what is the minimum allowable value of V_{DD} if M_1 must not enter the triode region? Assume $\lambda = 0$.

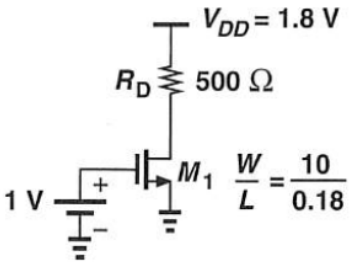


Figure 6.42

Problem 5

. Calculate the bias current of M_1 in Fig. 6.43 if $\lambda = 0$.

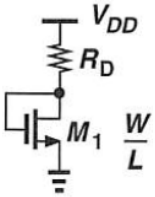
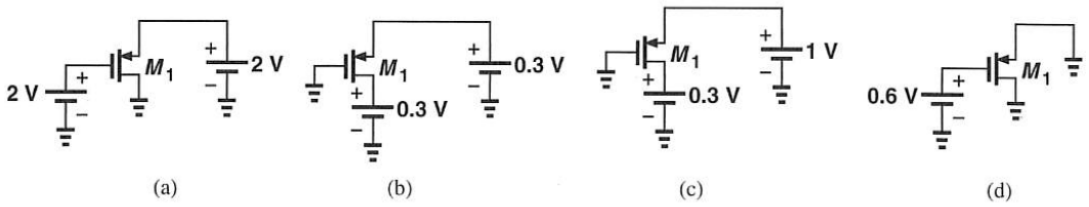


Figure 6.43

Problem 6

Determine the region of operation of M_1 in each circuit shown in Fig. 6.51.



(a) (b) (c) (d)

Figure 6.51