

4.42 In the circuits shown in Fig. P4.42, transistors are characterized by  $|V_t| = 2\text{ V}$ ,  $k'W/L = 1\text{ mA/V}^2$ , and  $\lambda = 0$ .

- (a) Find the labeled voltages  $V_1$  through  $V_7$ .
- (b) In each of the circuits, replace the current source with a resistor. Select the resistor value to yield a current as close to that of the current source as possible, while using resistors specified in the 1% table provided in Appendix G. Find the new values of  $V_1$  to  $V_7$ .

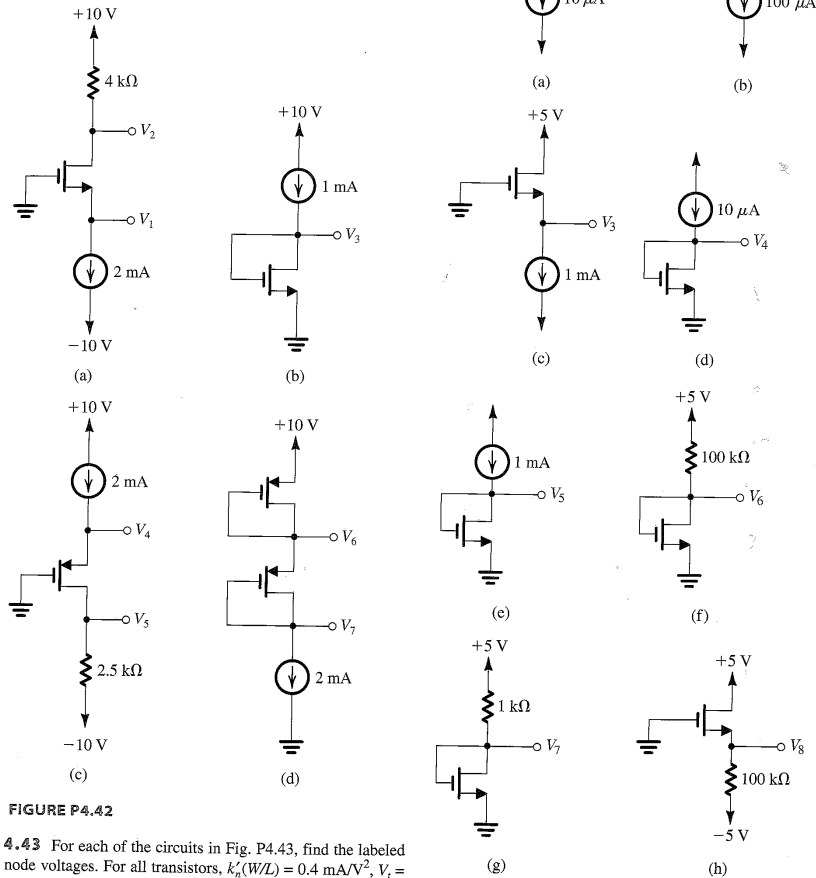


FIGURE P4.42

4.43 For each of the circuits in Fig. P4.43, find the labeled node voltages. For all transistors,  $k'_n(W/L) = 0.4\text{ mA/V}^2$ ,  $V_t = 1\text{ V}$ , and  $\lambda = 0$ .

FIGURE P4.43

4.44 For each of the circuits shown in Fig. P4.44, find the labeled node voltages. The NMOS transistors have  $V_t = 1\text{ V}$  and  $k'_n W/L = 2\text{ mA/V}^2$ . Assume  $\lambda = 0$ .

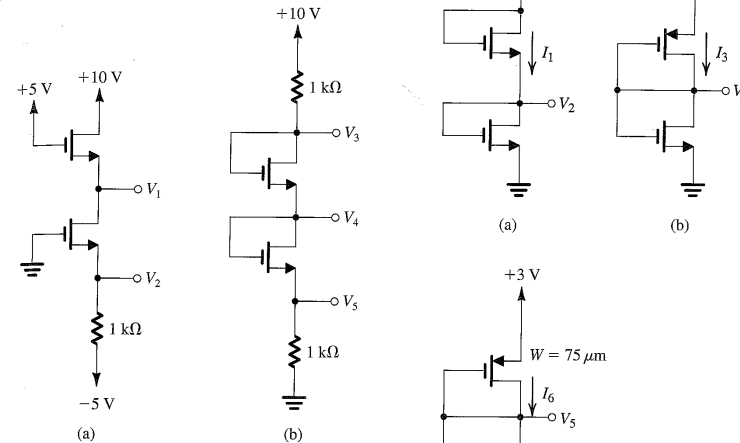


FIGURE P4.44

\*4.45 For the PMOS transistor in the circuit shown in Fig. P4.45,  $k'_p = 8\text{ }\mu\text{A/V}^2$ ,  $W/L = 25$ , and  $|V_{tp}| = 1\text{ V}$ . For  $I = 100\text{ }\mu\text{A}$ , find the voltages  $V_{SD}$  and  $V_{SG}$  for  $R = 0, 10\text{ k}\Omega, 30\text{ k}\Omega$ , and  $100\text{ k}\Omega$ . For what value of  $R$  is  $V_{SD} = V_{SG}$ ?  $V_{SD} = V_{SG}/2$ ?  $V_{SD} = V_{SG}/10$ ?

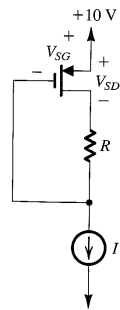


FIGURE P4.45

4.46 For the circuits in Fig. P4.46,  $\mu_n C_{ox} = 2.5\text{ }\mu_n C_{ox} = 20\text{ }\mu\text{A/V}^2$ ,  $|V_t| = 1\text{ V}$ ,  $\lambda = 0$ ,  $\gamma = 0$ ,  $L = 10\text{ }\mu\text{m}$ , and  $W = 30\text{ }\mu\text{m}$ , unless otherwise specified. Find the labeled currents and voltages.

FIGURE P4.46

\*4.47 For the devices in the circuits of Fig. P4.47,  $|V_t| = 1\text{ V}$ ,  $\lambda = 0$ ,  $\gamma = 0$ ,  $\mu_n C_{ox} = 50\text{ }\mu\text{A/V}^2$ ,  $L = 1\text{ }\mu\text{m}$ , and  $W = 10\text{ }\mu\text{m}$ . Find  $V_2$  and  $I_2$ . How do these values change if  $Q_3$  and  $Q_4$  are made to have  $W = 100\text{ }\mu\text{m}$ ?

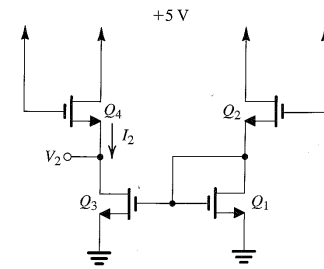


FIGURE P4.47