

# 國立嘉義大學 107 學年度 電機工程學系碩士班招生考試試題

## 科目：電子學

(注意事項：1. 可使用計算機。 2. 依次序作答。)

- Using the fact that a silicon diode has  $I_S = 10^{-15}$  A at 26.5°C and that  $I_S$  increases by 25% per 1°C rise in temperature, find the value of  $I_S$  at 200°C. (5%)
- Assuming an ideal diode, consider the battery charging circuit in Fig. 1 with  $V_m = 20$  V,  $R = 10 \Omega$  and  $V_B = 14$  V.
  - Find the percentage of each cycle in which the diode is in on state. (10%)
  - Find the peak current. (5%)

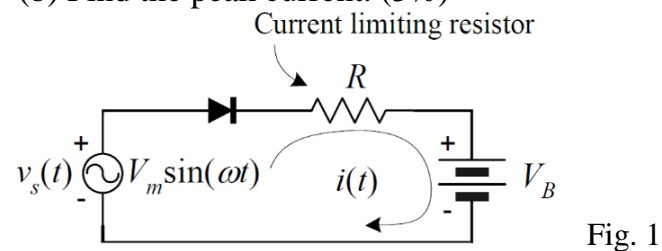


Fig. 1

- The transistor in the circuit of Fig. 2 has a very high  $\beta$ . Assume  $V_{BE} = 0.7$  V.
  - For  $V_B = +2$  V, find  $V_E$  and  $V_C$ . (5%)
  - For  $V_B = +1$  V, find  $V_E$  and  $V_C$ . (5%)
  - For  $V_B = 0$  V, find  $V_E$  and  $V_C$ . (5%)

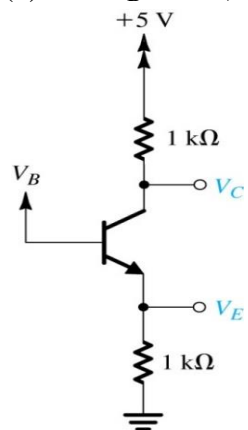


Fig. 2

- An enhancement NMOS transistor is connected in the bias circuit of Fig. 3 with  $V_G = 4$  V and  $R_S = 1$  k $\Omega$ . The transistor has  $V_t = 2$  V and  $k'_n(W/L) = 2$  mA/V<sup>2</sup>.
  - What bias current " $I_D$ " results? (10%)
  - If a transistor for which  $k'_n(W/L)$  is 50% higher is used, what is the resulting current " $I_D$ "? (10%)

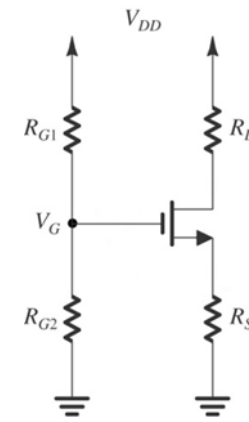


Fig. 3

- The NMOS transistors in the circuit of Fig. 4 have  $V_t = 1$  V,  $\mu_n C_{ox} = 120 \mu\text{A}/\text{V}^2$ ,  $\lambda = 0$ , and  $L_1 = L_2 = 1 \mu\text{m}$ . Find required values to obtain the voltage and current values indicated.
  - Find the required value of gate width " $W_1$ " for  $Q_1$ . (10%)
  - Find the required value of gate width " $W_2$ " for  $Q_2$ . (10%)
  - Find the value of " $R$ ". (5%)

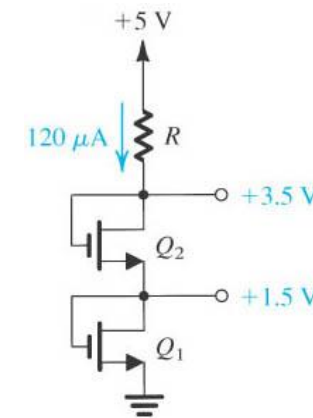


Fig. 4

- Determine the current  $i_o$  for the circuit shown in Fig. 5. (10%)

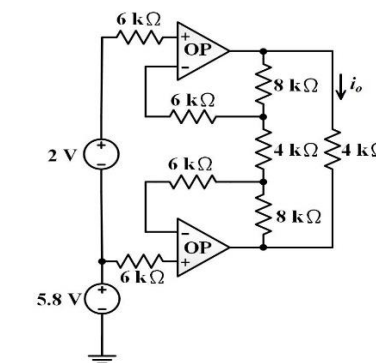


Fig. 5

- Determine the voltage  $v_o$  for this circuit shown in Fig. 6. (10%)

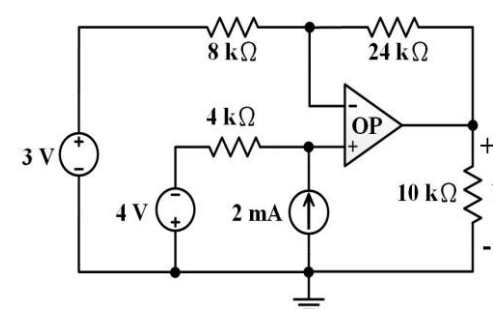


Fig. 6