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考試科目： 電子學

考試日期：0307，節次：1

※ 考生請注意：本試題 可 不可 使用計算機

1. Determine the current  $I_{D2}$  and the voltage  $V_O$  in the diode circuit shown in Fig. 1. Assume the turn-on voltage of  $V_\gamma=0.7V$  for each diode. (10%)

2. A Schottky TTL logic circuit is shown in Fig. 2. Assume the turn-on voltages of  $V_\gamma=0.7V$  and  $V_\gamma(SD)=0.3V$  are used for all diodes and Schottky diodes, respectively. Also, the turn-on voltage of B-E junction  $V_{BE(on)}=0.7V$  and common-emitter current gain of  $\beta=30$  are employed for all transistors. (a) Calculate the maximum fan-out for  $V_X=V_Y=3.6V$ . (b) Using the results of part (a), determine the power dissipated in this circuit for  $V_X=V_Y=3.6V$ . (22%)

3. Assume the input signal to the circuit in Fig. 3 is  $v_i = 75 \sin(120\pi t)$  V and the diode has a cut-in voltage ( $V_\gamma$ ) of 0.7 V.

(a) Calculate the average value of the output voltage  $v_o$ . (5%)

(b) If a capacitor ( $50 \mu F$ ) is added in parallel with the load resistor  $R_L$  and the ripple voltage is to be  $\leq 4$  V, determine the minimum value of  $R_L$  for the case of  $V_\gamma = 0$  V and  $V_\gamma = 0.7$  V, respectively. (10%)

4. Assume the circuit in Fig. 4 is a symmetrical circuit. Derive the ac component of the output voltage  $v_o$  for the case of  $v_{C1} = v_{C2}$  and  $v_{C1} < v_{C2}$ , respectively. (10%)

5. Plot transfer curve of the circuit in Fig. 5.

(a) Assume an ideal operational amplifier (op-amp). (4%)

(b) Assume the op-amp has a finite voltage gain (i.e.,  $A_v \neq \infty$ ). (5%)

6. A feedback amplifier is shown in the Fig. 6, neglect  $r_o$  and body effect of the MOSFET devices. The parameters of  $M_1$  and  $M_2$  :  $g_{m1} = g_{m2} = 5$  mA/V.

(a) Which topology is for this feedback amplifier? (4%)

(b) Calculate the feedback factor  $\beta$ . (5%)

(c) Find the voltage gain  $v_o/v_s$ , the input resistance  $R_{in}$ , and the output resistance  $R_{out}$ . (9%)

7. Consider the class AB Amplifier as shown in Fig. 7.

The circuit is biased with  $V_{CC} = 12$  V, and  $I_{BIAS} = 20$  mA, the load resistance  $R_L = 8 \Omega$ .

The device parameters are:  $I_{SD} = 3 \times 10^{-14}$  A for diodes, and  $I_{SQ} = 10^{-13}$  A for  $Q_N$  and  $Q_P$ ,  $\beta_n = \beta_p = 75$ .

The minimum value for diode current is to be no less than 5 mA

(a) Find the quiescent collector current  $I_{CQ}$  for  $Q_N$  and  $Q_P$ . (8%)

(b) Calculate the maximum average power delivered to the load. (8%)

(背面仍有題目,請繼續作答)

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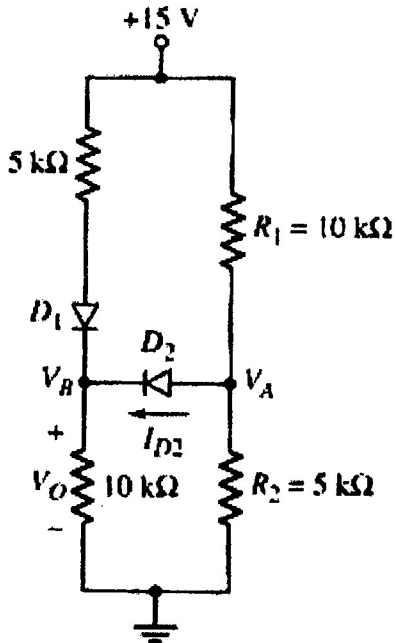


Fig. 1

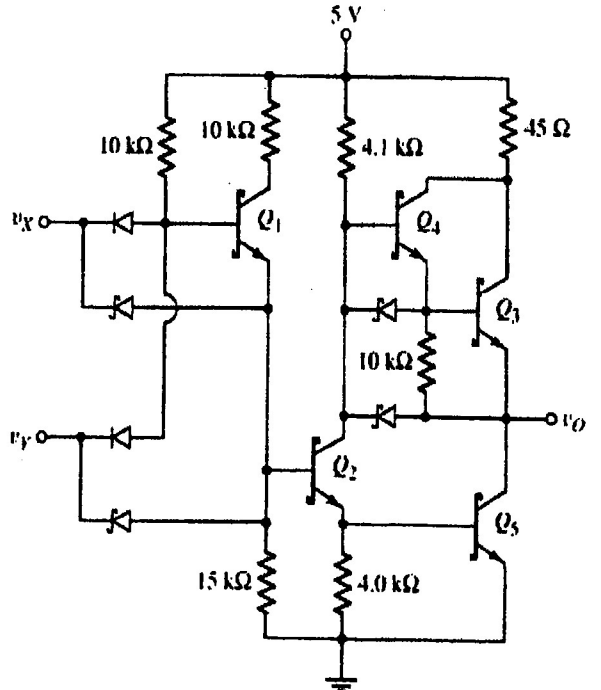


Fig. 2

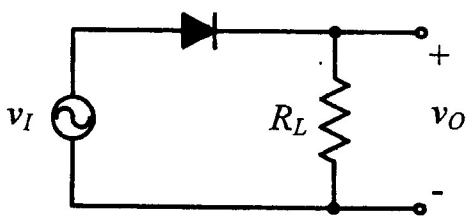


Fig. 3

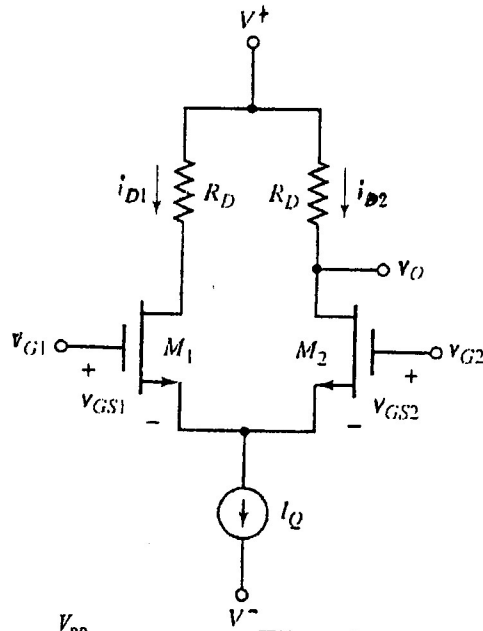


Fig. 4

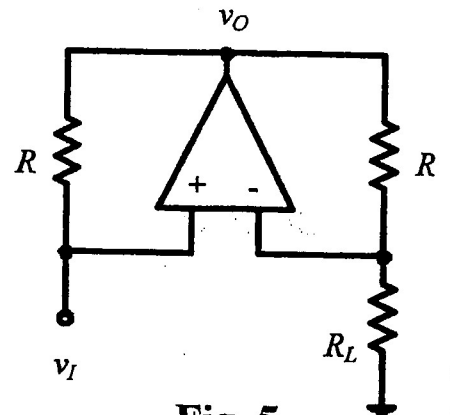


Fig. 5

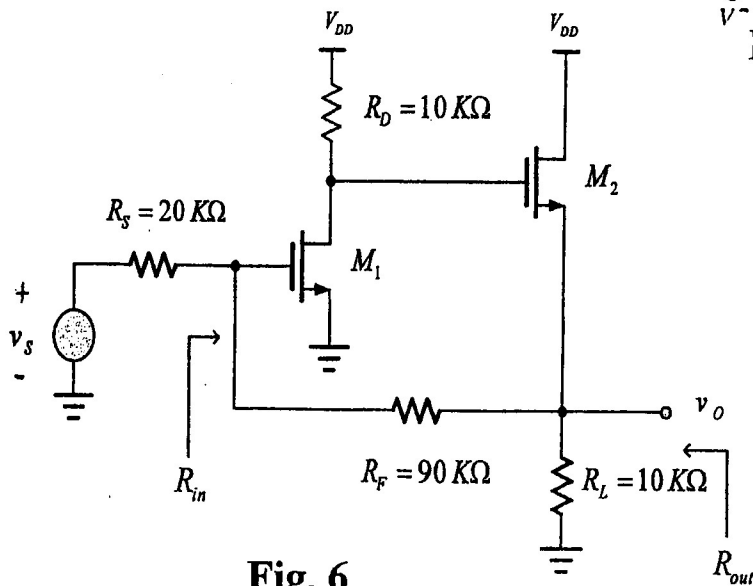


Fig. 6

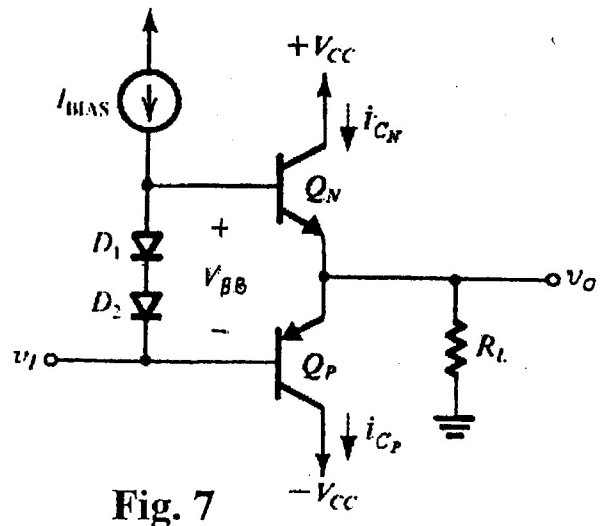


Fig. 7