

本試題是否可以使用計算機: 可使用, 不可使用 (請命題老師勾選)

- The characteristics for transistors Q_1 and Q_2 , used in the circuit shown in Fig. 1, are given in Figs. 2 and 3, respectively. Determine V_{DS1} and V_{DS2} . (13%)
- A TTL NAND gate with a totem-pole output is shown in Fig. 4. If all transistors are identical and the related parameters of transistor and diode are:
 $V_{BE(\text{cut-in})}=0.5\text{V}$, $V_{BE(\text{on})}=0.7\text{V}$, $V_{BE(\text{sat})}=0.8\text{V}$, $V_{CE(\text{sat})}=0.2\text{V}$, $V_{DO(\text{cut-in})}=0.6\text{V}$, $V_{DO(\text{on})}=0.7\text{V}$. Please determine the average static power dissipation $P_{(\text{av})}$ and dynamic power dissipation $P_{(\text{dyn})}$ of this gate. (20%)

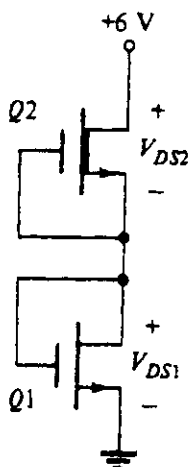


Fig. 1

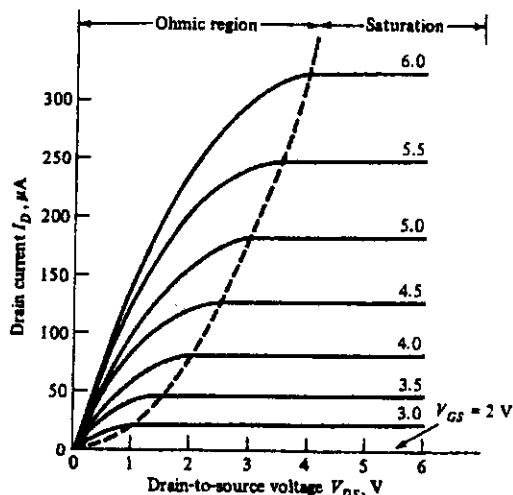


Fig. 2

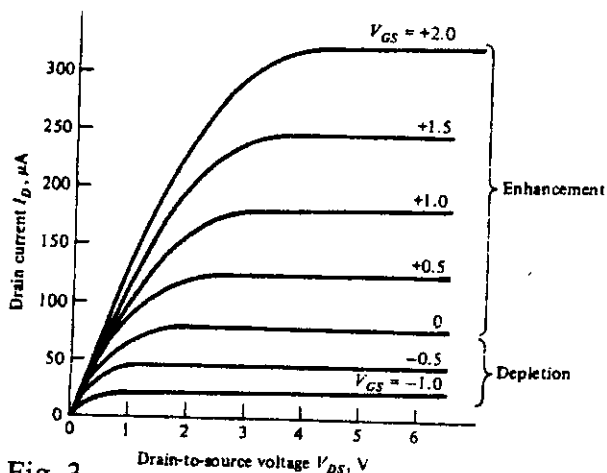


Fig. 3

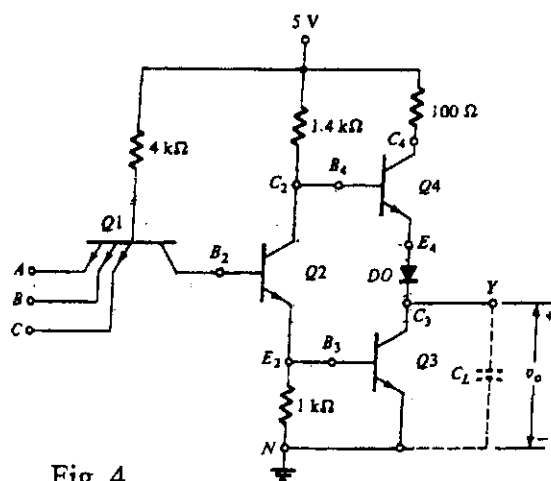


Fig. 4

- Please answer briefly for the following questions.
 - For class A, B, and AB amplifiers, which one has the maximum possible power conversion efficiency? Explain the condition that the maximum efficiency can be

(背面仍有題目, 請繼續作答)

本試題是否可以使用計算機: 可使用, 不可使用 (請命題老師勾選)

obtained in the amplifier. (3%)

- (b) List the four basic feedback topologies for amplifiers, which topology is desirable for the design of a current amplifier. (3%)
- (c) What is the function of CC in the CMOS op-amp circuit as shown in the attached Fig. 5? (3%)

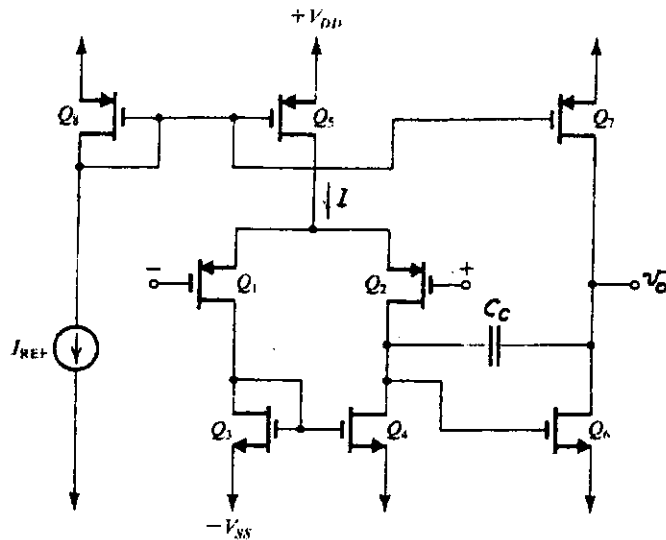


Fig. 5

4. Use the feedback method to analyze the circuit shown in the Fig. 6, Find
- (a) what is the feedback configuration of this circuit? (3%)
- (b) the feedback factor β and the voltage gain v_o/v_s (6%)
- (c) the input resistance R_{in} and the output resistance R_{out} . (6%)

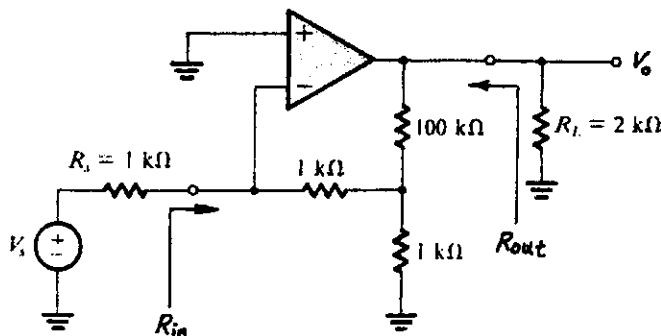


Fig. 6

The op-amp has open-loop gain $\mu = 10^4$ v/v, $R_{id} = 100$ k Ω , $r_o = 1$ k Ω .

5. For the circuit shown in Fig. 7, assume the diode voltage drop is 0.7V.
- (a) Show the analysis of this circuit that the oscillation can be obtained. (5%)
- (b) Find the frequency of oscillation, and the amplitude of the output sine wave in peak-to-peak value. (5%)

本試題是否可以使用計算機: 可使用, 不可使用 (請命題老師勾選)

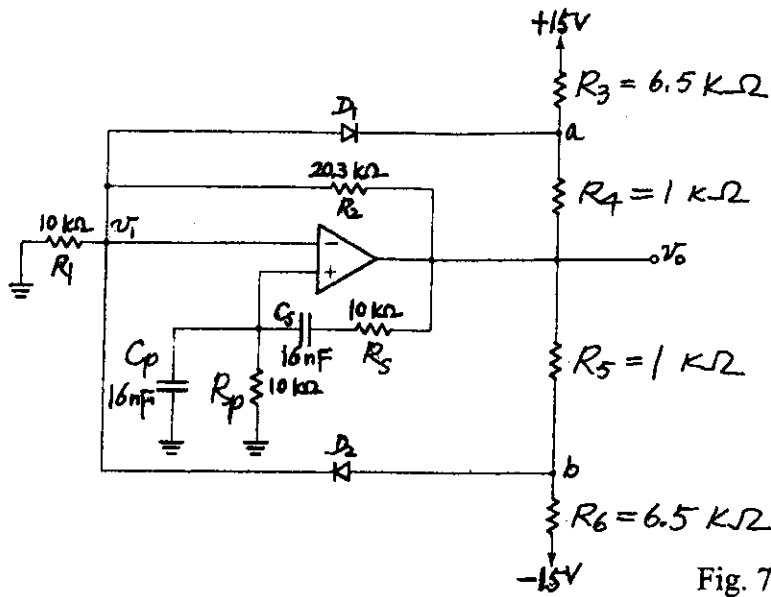


Fig. 7

6. Please answer or explain briefly the following questions.
- The reason why transistors could act as transfer resistances. (5%)
 - The bias condition for a transistor to operate as a linear amplifier. (5%)
 - For a CMOS inverter with matched MOSFETs having threshold voltage $V_t=1\text{ V}$, find the noise margin if $V_{DD}=5\text{ V}$. (5%)
 - What is the small-signal resistance of a diode biased to operate at a dc current I_D . (Assume the diode follows $i_D = I_o(\exp(\frac{v_D}{V_T}) - 1)$.) (5%)
7. (a) Draw the load line of D_2 for the circuit shown in Fig. 8. Assume that D_1 and D_2 are matched diodes and $V_A=4V_t$, where V_t is the cut-in voltage of the diode. (10%)
- (b) State one of the possible methods to double the current I ? (3%)

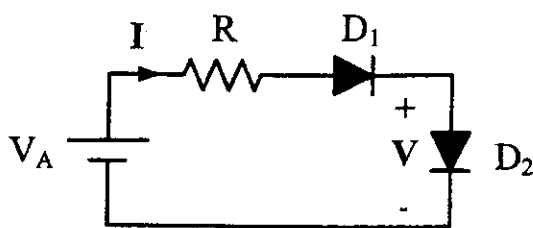


Fig. 8