系所組別： 微電子工程研究所，電機系甲乙丁戊組，電通所丙丁組

考試科目： 電子學

※ 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_γ=0.7V for each diode. (10%)

2. A Schottky TTL logic circuit is shown in **Fig. 2**. Assume the turn-on voltages of V_γ=0.7V and V_γ(SD)=0.3V are used for all diodes and Shottky diodes, respectively. Also, the turn-on voltage of B-E junction V_{BE}(on)=0.7V and common-emitter current gain of β= 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_γ) of 0.7 V.

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

(b) If a capacitor (50 μF) is added in parallel with the load resistor R_L and the ripple voltage is to be ≤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 $v_{G1} = v_{G2}$ and $v_{G1} \ll v_{G2}$, 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 β. (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: $I_{SD} = 3\times10^{-14} A$ 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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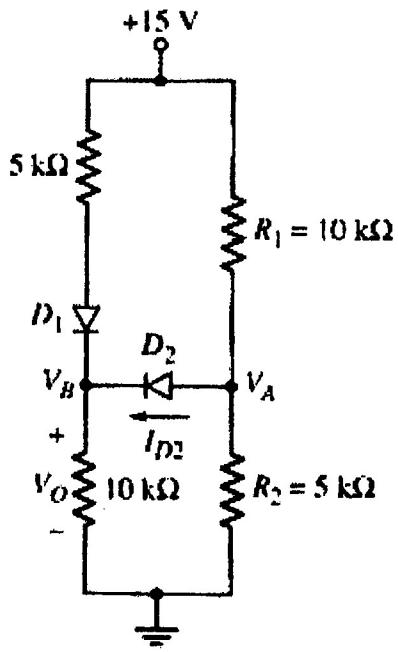

Fig. 1

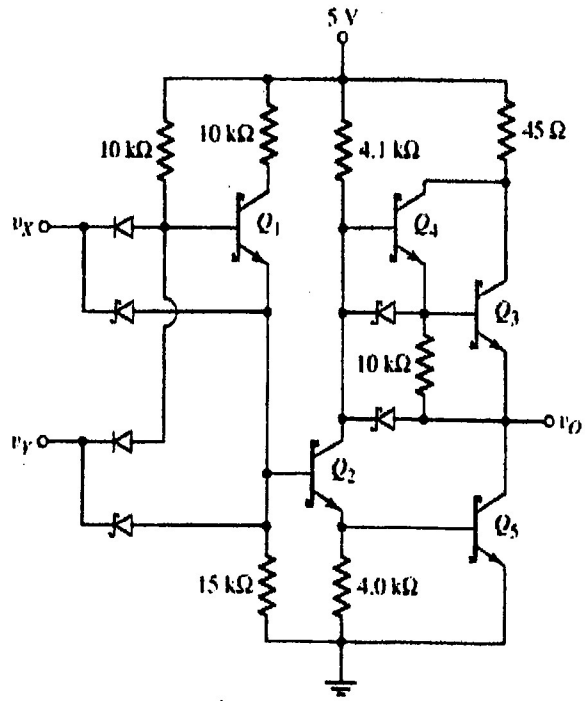

Fig. 2

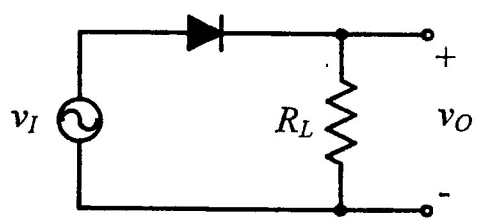

Fig. 3

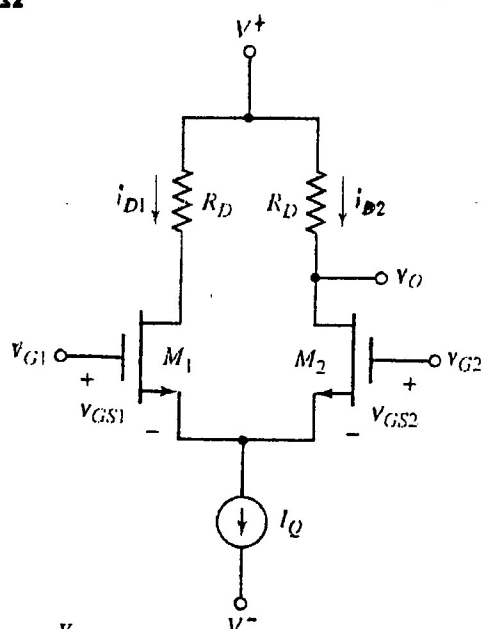

Fig. 4

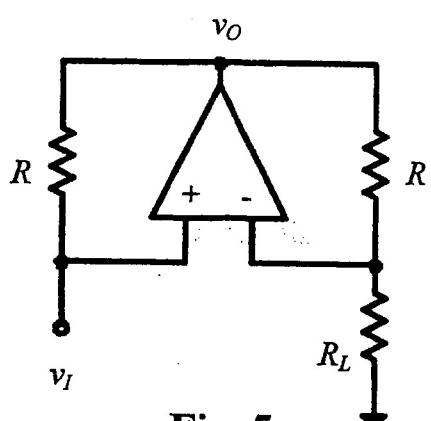

Fig. 5

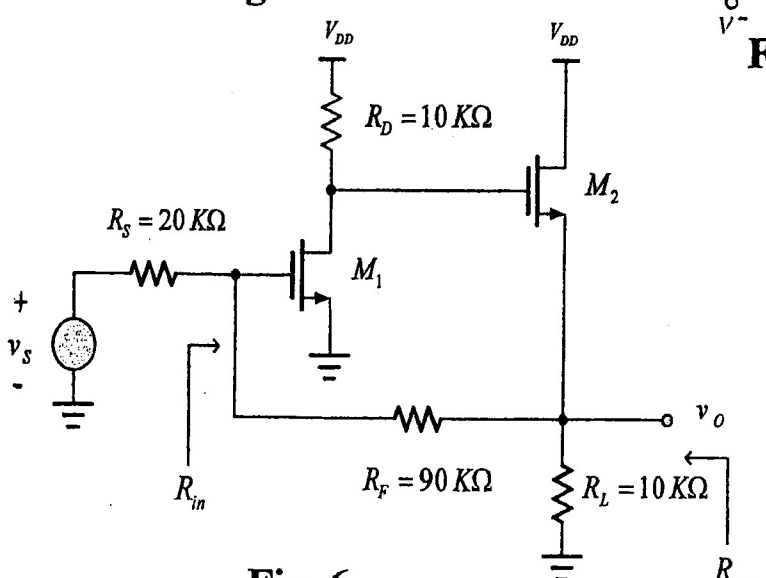

Fig. 6

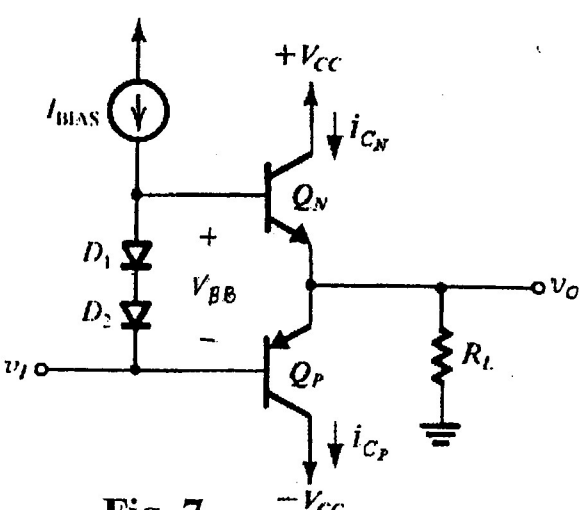

Fig. 7