逢甲大學100學年度碩士班招生考試試題 編號：078 科目代碼：335

科目	電子學	適用系所	通訊工程學系	時間	100分鐘

※請務必在答案卷作答區內作答。 共 2 頁第 1 頁

1. The circuit in figure 1 utilizes an ideal op amp. (a) Find I_1, I_2, I_3, and V_x. (4 %) (b) If V_o is not to be lower than -13 V, find the maximum allowed value for R_L. (5 %) (c) If R_L is varied in the range 100 Ω to 1 kΩ, what is the corresponding change in V_o? (3 %)

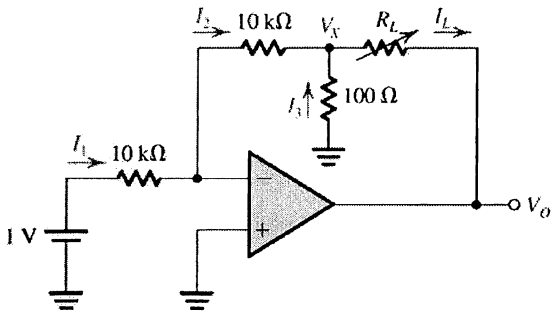

Fig. 1

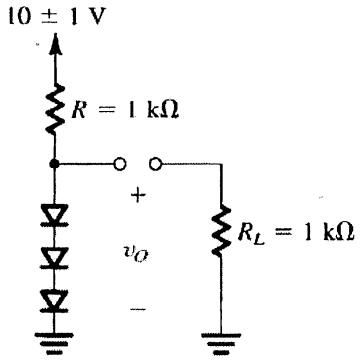

Fig. 2

2. Refer the Fig. 2, a string of three diodes is used to provide a constant voltage of about 2.1 V. We want to calculate output voltage and the percentage change in this regulated voltage caused by (a) a ± 10% change in the power-supply voltage. (6 %) (b) The connection of a 1-kΩ load resistance. Assume n = 2. (6 %)

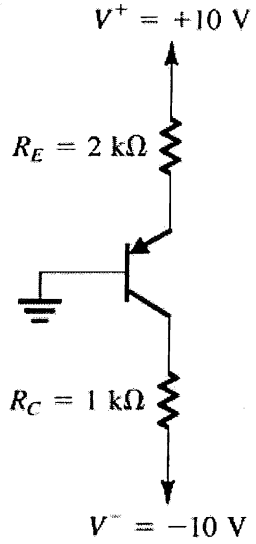

Fig. 3

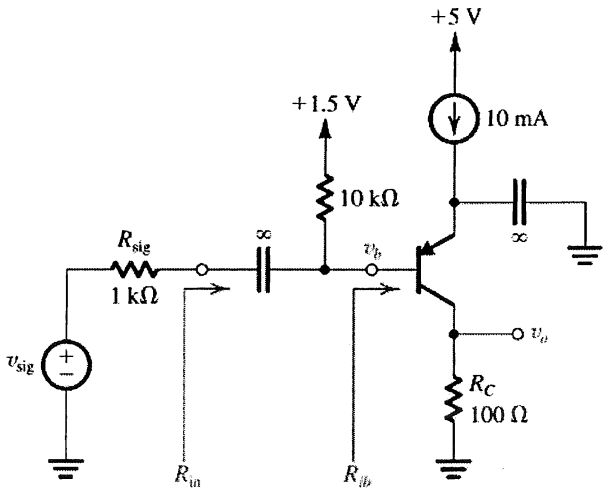

Fig. 4

3. Refer to Fig. 3, we wish to analyze this circuit to determine (a) The voltages at all nodes. (4 %) (b) The currents through all branches. (4 %)
4. In the circuit shown in Fig. 4, the transistor has a β of 200. (a) To determine the DC voltages and currents of the circuit (also find g_m and r_π). (8 %) (b) Find the input resistances R_{ib} and R_{in} and the overall voltage gain (v_o/v_{sig}). (4 %) (c) For an output signal of ± 0.4 V, what values of v_{sig} and v_b are required? (6 %)

* For NMOS transistors:

In the saturation region: $$i_D = \frac{1}{2}\mu_n c_{ox}(\frac{W}{L})(v_{GS} - V_{TH})^2(1 + \lambda v_{DS})$$

In the triode region: $$i_D = \frac{1}{2}\mu_n c_{ox}(\frac{W}{L})[2(v_{GS} - V_{TH})v_{DS} - v_{DS}^2]$$

5. The circuit shown in Fig. 5 is an AC circuit of an amplifier, if $g_{m1} = g_{m2} = g_{m3} = 20$ mA / V, $r_{o1} = r_{o2} = r_{o3} = 200$ kΩ, please find the voltage gain v_{out} / v_{in} and the output impedance R_{out}. (15%)
6. For the circuit shown in Fig. 6, if $\lambda = 0$, $(W / L) = 600$, $\mu_n C_{OX} = 200\ \mu A / V^2$, $V_{TH} = 0.4$ V. Find (a) DC voltage V_{GS}. (5%) (b) R_{in}, R_{out}, and v_{out} / v_{in}. (15%)
7. Calculate the differential voltage gain of the circuits shown in Fig. 7. Assume perfect symmetry and $g_{m1} = g_{m2} = g_{m3} = g_{m4} = 50$ mA / V, $r_{o1} = r_{o2} = r_{o3} = r_{o4} = 20$ kΩ, $R_{SS} = 100$ kΩ, V_{GG} and I_{SS} are constant voltage and current sources. (15%)

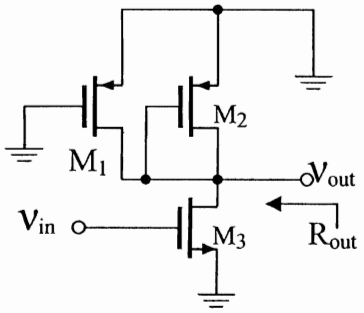

Fig. 5

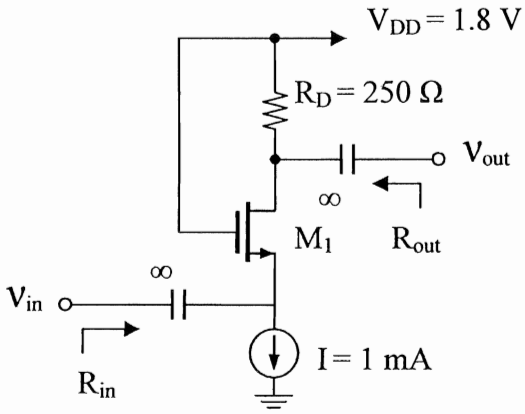

Fig. 6

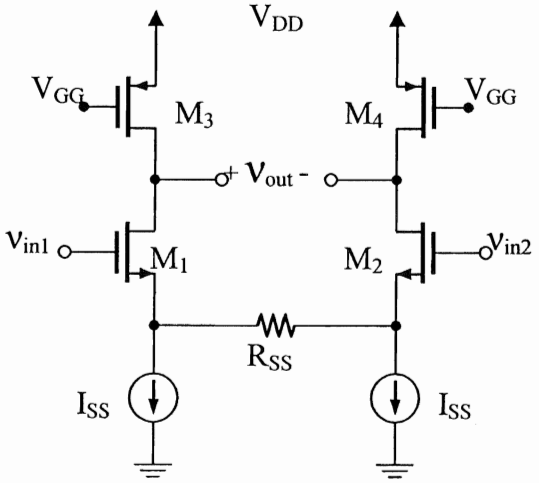

Fig. 7