逢甲大學100學年度碩士班招生考試試題 編號：074 科目代碼：333

科目	電子學	適用系所	電子工程學系固態電子組	時間	100分鐘

※請務必在答案卷作答區內作答。

1. For a Si semiconductor, please briefly describe the (a) Quasi Fermi level (b) effective density of state in conduction band or valence band (c) Degenerate semiconductor (10%)

2. For a PN junction, if the $N_A << N_D$, please (a) draw the minority carrier distribution in a forward bias, (b) draw the energy band diagram in the reverse bias with V_R voltage, pleaes label the Fermi level position and the built in voltage. (10%)

3. Assuming the op amp is ideal shown in **Fig. 1**, if we want to implant a current amplifier with a gain i_L/i_I =30, (a) find the required value of R, (b) if R_L = 1 KΩ, and the op amp operates in an ideal manner that is v_O in the range ±15V, find the rang of i_I, (c) if the amplied is fed with a current source i_S=1mA and source resistance of 10 KΩ, find the i_L (12%)

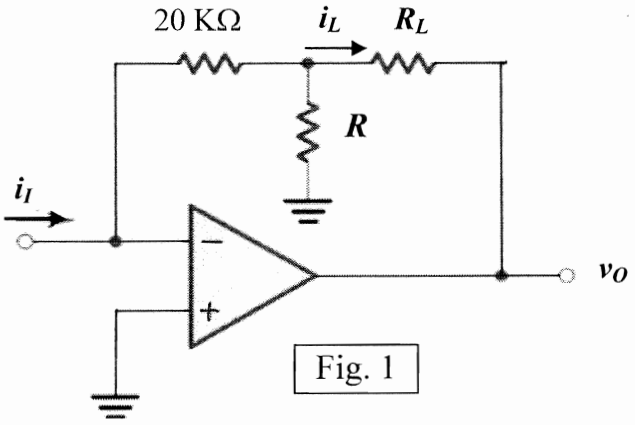

Fig. 1

4. The CS stage MOS amplifier shown in **Fig. 2**, V_t =1V, $K_n'(W/L)$= 2 mA/V^2,
   (a) Please find the dc bias value of V_{GS} and I_D (4%)
   (b) if V_A =50V, find g_m and r_o (4%)
   (c) Find R_{in}, R_{out} and overall voltage gain $G_V = v_o/v_{sig}$ (10 %)

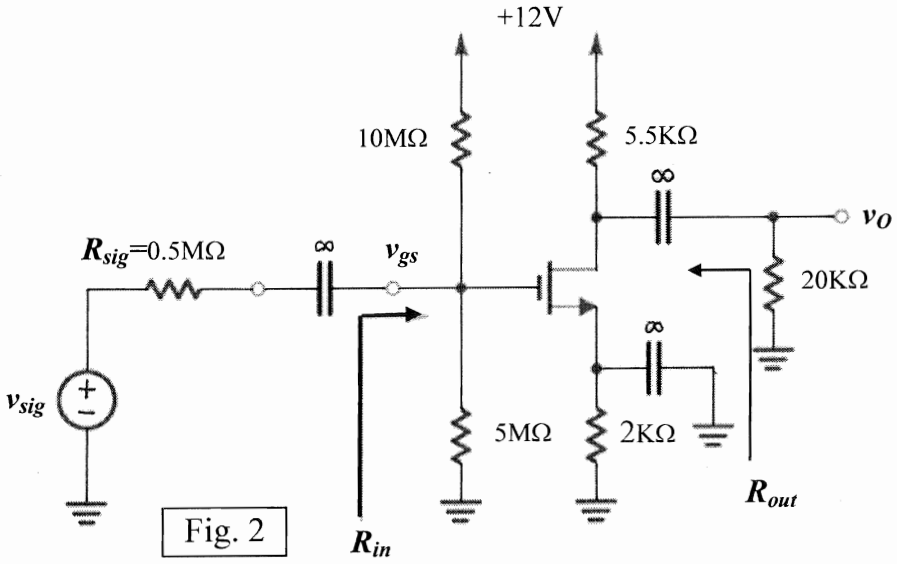

Fig. 2

5. Consider the circuit shown in **Fig. 3**. Let $\beta = 100$, $C_\mu = 1.5\,\text{pF}$, and $f_T = 500\,\text{MHz}$ for the BJT. By neglecting r_x and r_o, calculate the midband gain A_M and the 3-dB frequency f_H. (10%)

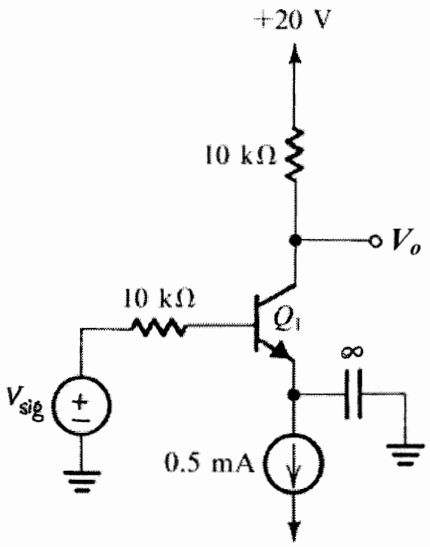

Fig. 3

6. The BJTs in the Darlington follower of **Fig. 4** have $\beta = 100$. If the follower is fed with a source having a 10 kΩ resistance and is loaded with 1 kΩ, find the input resistance and the output resistance. (10%)

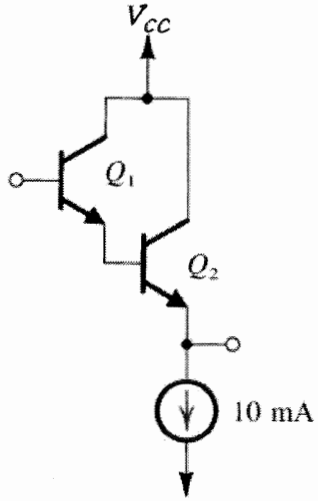

Fig. 4

7. For the differential amplifier shown in **Fig. 5**, all BJTs have $V_{BE} = 0.7\,\text{V}$ at $I_C = 1\,\text{mA}$ and β is very large. (a) If Q_1 is off, determine v_O. (3%) (b) If Q_2 is off, determine v_O. (3%) (c) Find v_I for Q_1 conducting 99% of I. (4%) (d) Find the small-signal voltage gain. (5%)

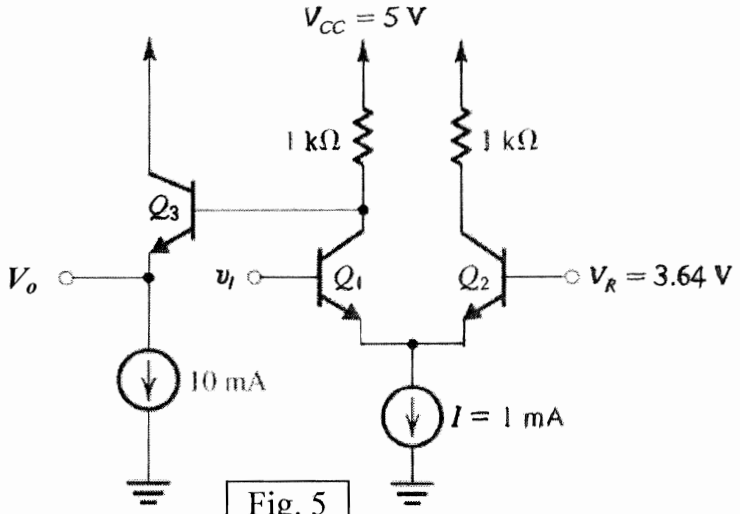

Fig. 5

8. The shunt-series feedback amplifier circuit shown in **Fig. 6** has $R_D = 10\,\text{k}\Omega$, $R_S = 20\,\text{k}\Omega$, and $R_F = 80\,\text{k}\Omega$. Assume that $g_{m1} = g_{m2} = 10\,\text{mA/V}$ and no body effect. (a) Find $A_f = I_o / I_s$ and R_{in} by neglecting r_o. (10%) (b) Find R_{out} by using $r_{o2} = 40\,\text{k}\Omega$. (5%)

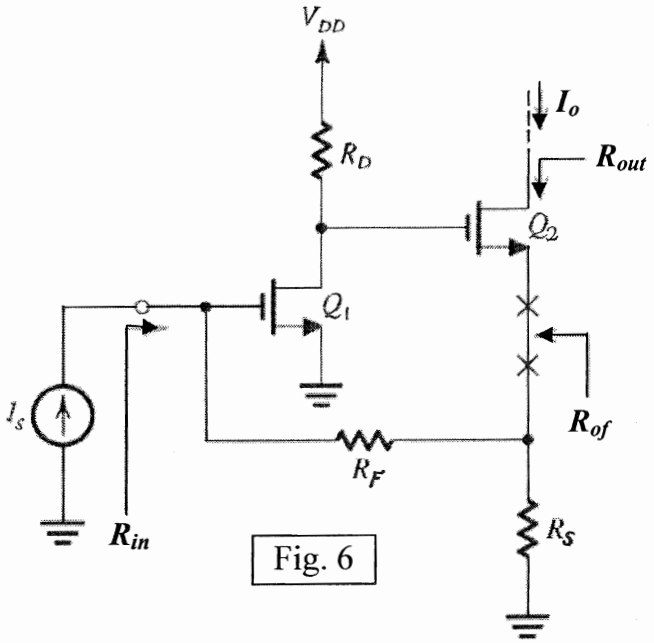

Fig. 6