國立中央大學八十六學年度碩士班研究生入學試題卷

1. For the collector-coupled flip-flop as shown in Figure 1. Assume transistor Q_1 is the same as Q_2, $V_{cc} = 10\ V$, $R_c = 1\ K\Omega$ and $R_B = 20\ K\Omega$, The test condition for a flip-flop is "do two stable states exist, in each of which at least one transistor is not active?" to estimate the required minimum β of transistor. (20分)

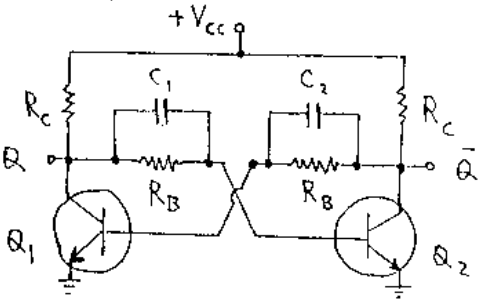

Figure 1.

2. For the FET amplifier as shown in Figure 2. Assume $R_1 = 20K$, $R_2 = 80K$ $R_o = 10K$, $R_D = 10\ K$ and $g_m = 4 \times 10^{-3}$ mhos, To find the gain without and with feedback. (20分)

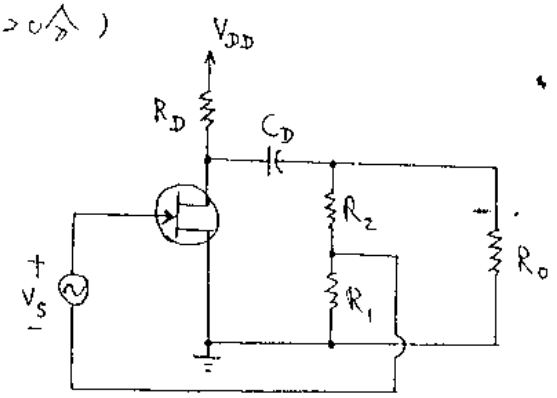

Figure 2.

3. A FET common-source amplifier has $R_{in} = 2\ k\Omega$, $g_m = 4\ mA/V$, $r_o = 100\ k\Omega$ $R_D = 10\ K\Omega$, $C_{gs} = 2pF$, and $C_{gd} = 0.5pF$, The amplifier is fed from a voltage source with an internal resistance of 500 $K\Omega$ and is connected to a 10 $k\Omega$ load. Find:
   (a) the overall midband gain A_M (10分)
   (b) the dominant high frequency pole using the Miller approximation. (10分)

4. (a) Given the circuit of Fig 4 (a) with $\alpha_o = 0.9$ and $I_{EO} = I_{CO} = 1 \times 10^{-5} A$ find the critical emitter current that just saturates the transister. (10分)
   (b) From the typical output CE characteristics curves of a

TIS 100 transistor shown in Fig. 4(b) determine the dc value of β (i.e h_{FE}) and dynamic Value of β (i.e h_{fe}) at an $I_B = 1.5\times10^{-4}$ A and a $V_{CE} = 6$ V. (10分)

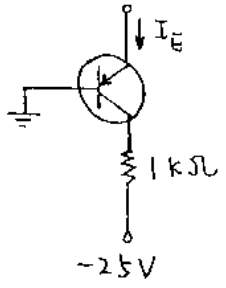

Figure 4 (a)

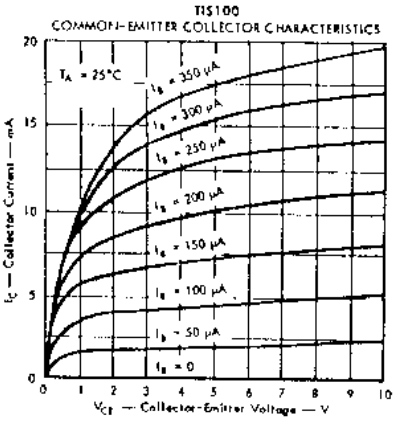

Figure 4(b)

5. An op amp with an open-loop voltage gain of 80 dB and poles at 10^5, 10^6, and 2×10^6 Hz is to be compensated to be stable for unity β. Assume that the op amp incorporates an μ-amplifier equivalent to that in Fig. 5, which $C_1 = 150$ pF, $C_2 = 5$ pF, and $g_m = 40$ mA/V, and that f_{P1} is caused by input circuit and f_{P2} by the output circuit of this amplifier. Find the required value of the compensating Miller Capacitance C_f and the new frequency of the output pole. (20分)

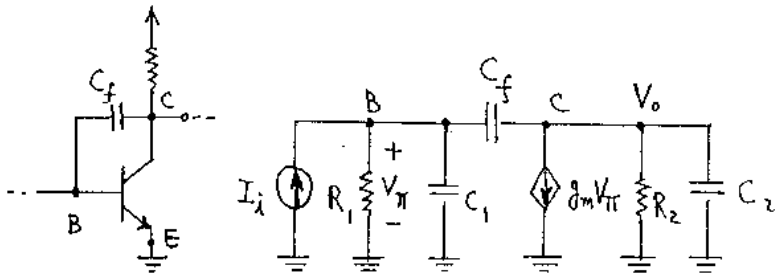

Figure 5