1. Draw and explain briefly the possible load line of an enhancement-mode n-MOSFET using (a) a forward-biased diode, or (b) a reverse-biased diode, or (c) a depletion-mode n-MOSFET with $V_{GS} = 0\,V$ as the load device. (15%)
2. Calculate the small-signal input resistance R_i as shown in Fig.1. Assume $R_B = R_C = 2\,k\Omega$, $g_m = 25\,mS$, $\beta = 100$, and $r_o = \infty$. (10%)
3. As the circuit shown in Fig.2, let β=100, C_μ=2pF and f_T=400MHz. Calculate the midband gain and the upper 3-dB frequency. (12%)
4. A multiple amplifier having a first pole at 1MHz and an open-loop gain of 100dB is to be compensated for closed-loop gains as low as 20 dB by introduction of a new dominant pole. At what frequency must the new pole be placed?(3%)
5. Consider the complementary BJT class B output stage and neglect the effects of V_{BE} and V_{CEsat}. For ±10V power supplies and a 100-Ω load resistance, what is the maximum sine-wave output power available? What supply power corresponds? What is the power-conversion efficiency? For output signals of half this amplitude, find the power-conversion efficiency.(10%)
6. (a)A CMOS inverter pair is shown in Fig. 3(a). Let V_{TN}=0.8V, V_{TP}=-0.8V, and Kn=Kp. (i) If v_{O1}=0.6V, determine v_I and v_{O2}. (ii) Determine the range of v_{O2} for which both N_2 and P_2 are biased in the saturation region. (20%)
   (b)What is the function realized at Y in the CMOS circuit shown in Fig.3(b)? (5%)
7. Your answers must be as brief as possible for the following questions
   (a)List the parameters used to specify the transmission characteristics of a low-pass filter. (5%)
   (b)A filter transfer function is written as the ratio of two polynomials. The degree of its denominator is P and the degree of its numerator is R. What's the order of the filter? (5%)
   (c)For the filter in (b) to be stable, what is the relation between P and Q. (5%)
   (d)For the amplifier in Fig. 4, what's the class of its output stage? (Hint: Maybe one of class AB, A, B, C, D, E, …. etc.) (5%)
   (e)What is the function of the R and Cc in Fig. 2 ? (5%)

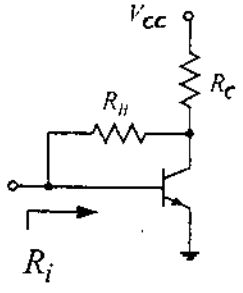

Fig. 1

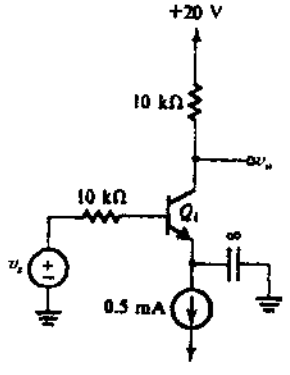

Fig. 2

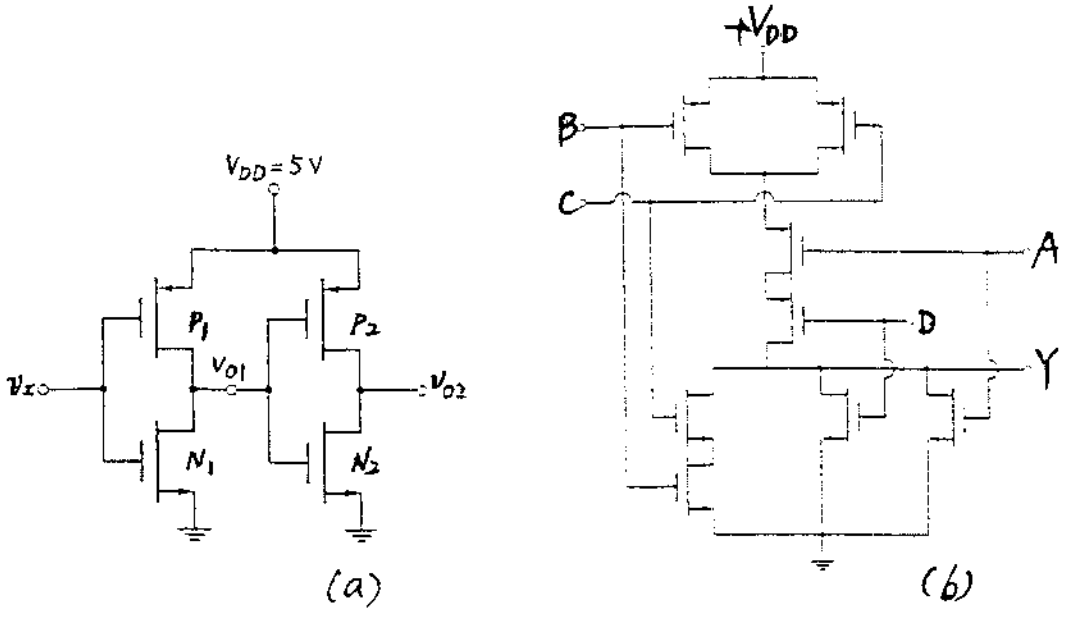
$V_{DD}=5V$
P_1
P_2
V_{O1}
V_x
V_{O2}
N_1
N_2
(a)
$+V_{DD}$
B
C
A
D
Y
(b)

Fig. 3

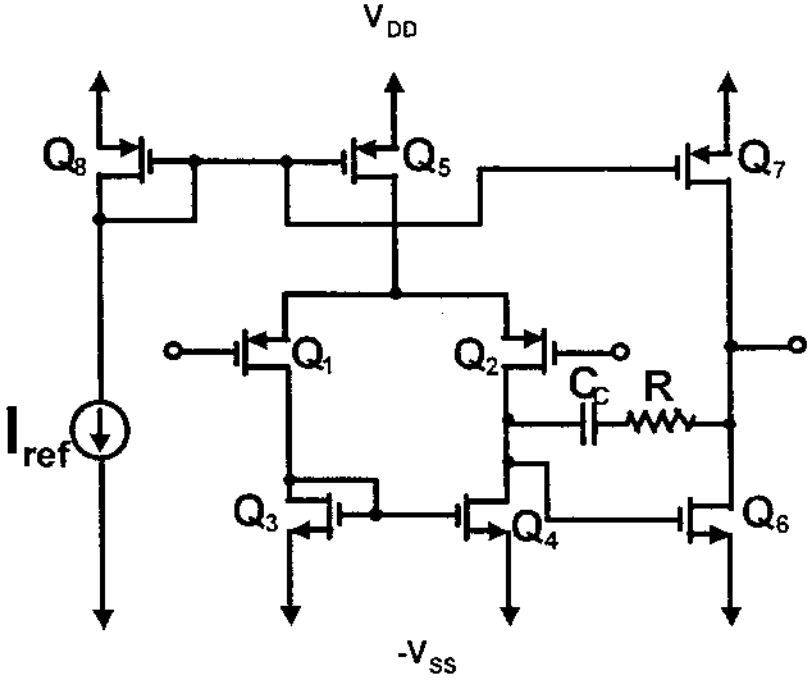
V_{DD}
Q_8
Q_5
Q_7
Q_1
Q_2
C_C
R
I_{ref}
Q_3
Q_4
Q_6
$-V_{SS}$

Fig. 4