1. (a) A CMOS inverter pair is shown in Fig. 1(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. 1(b)? (5%)

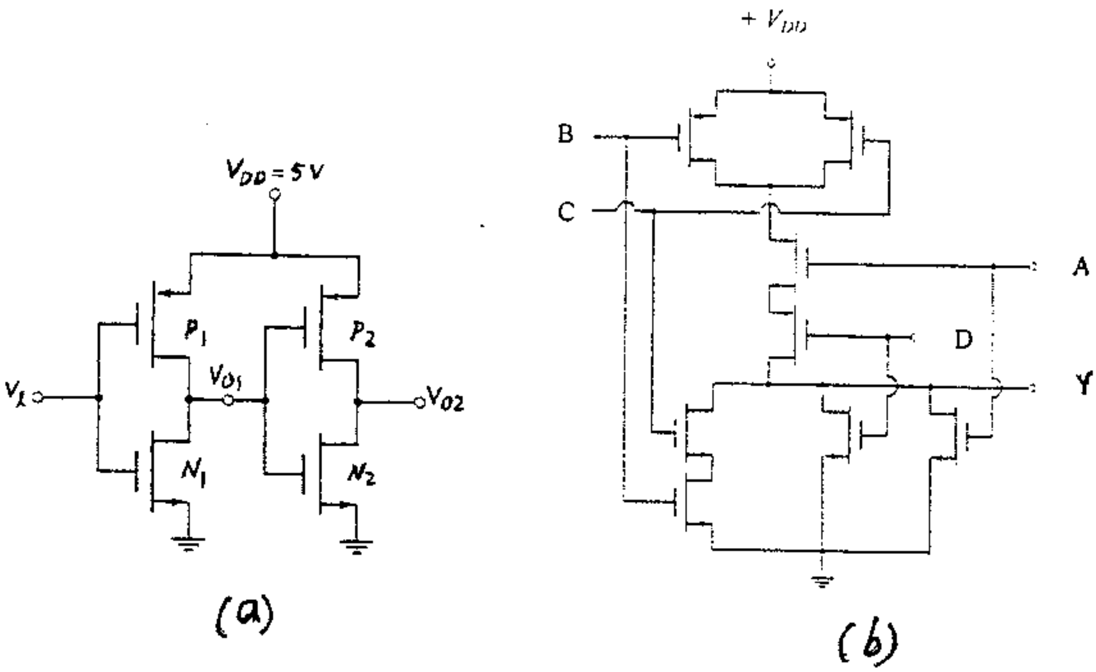

Fig. 1

2. 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%)
   (b) For the filter in (b) to be stable, what is the relation between P and Q. (5%)
   (c) For the amplifier in Fig. 2, what's the class of its output stage? (Hint: Maybe one of class AB, A, B, C, D, E, …, etc.) (5%)
   (d) What is the function of the R and Cc in Fig. 2 ? (5%)

3. 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%)

4. 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%)

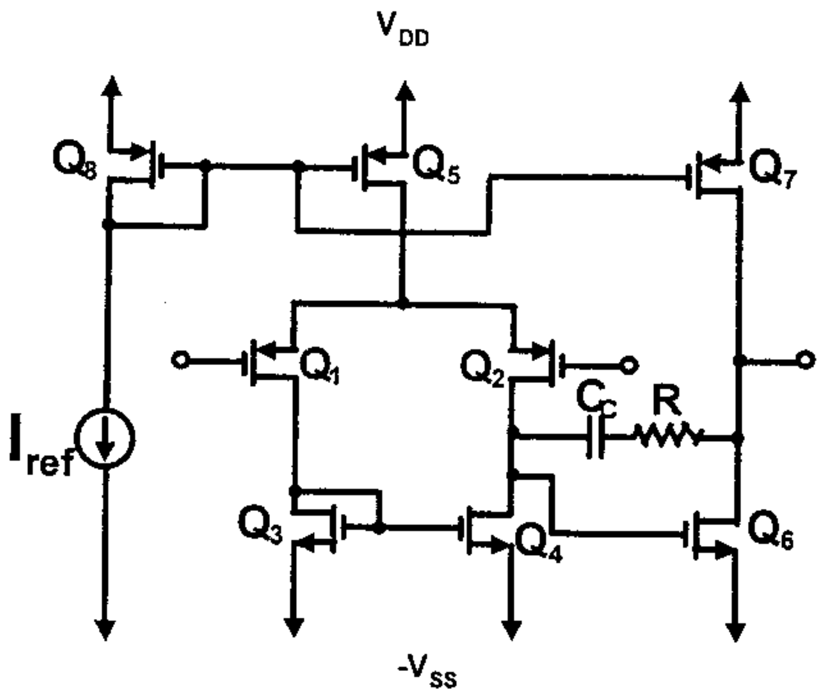

Fig2

5. As the circuit shown in Fig.3, let β=100, C_μ=2pF and f_T=400MHz. Calculate the midband gain and the upper 3-dB frequency. (12%)
6. 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%)
7. Calculate the small-signal input resistance R_i as shown in Fig. 4. Assume $R_B = R_C = 2\ k\Omega$，$g_m = 25\ mS$、$\beta = 100$，and $r_o = \infty$。(10%)

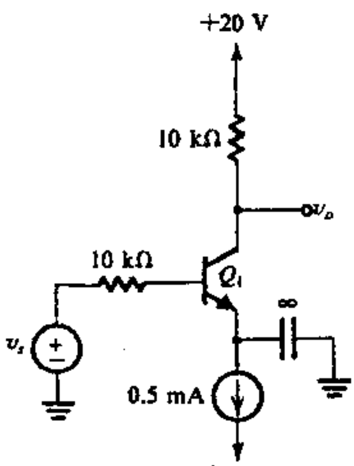

Fig.3

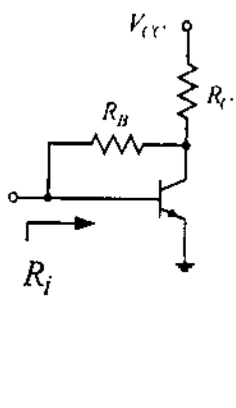

Fig.4