

(請注意!! 答題務必按題號順序)

1. Why NAND gate is preferably used in CMOS logic circuits as compared with NOR one for the consideration of package density? (10%)
2. Latch is employed in the peripheral circuit of random access memory (RAM) as a sense amplifier. Please briefly explain the operation theory. (15%)
3. The switched-capacitor filter is shown in Fig. 3. What is the function of it? Please find the equivalent input impedance Z_{in} between IN and VG. (15%)

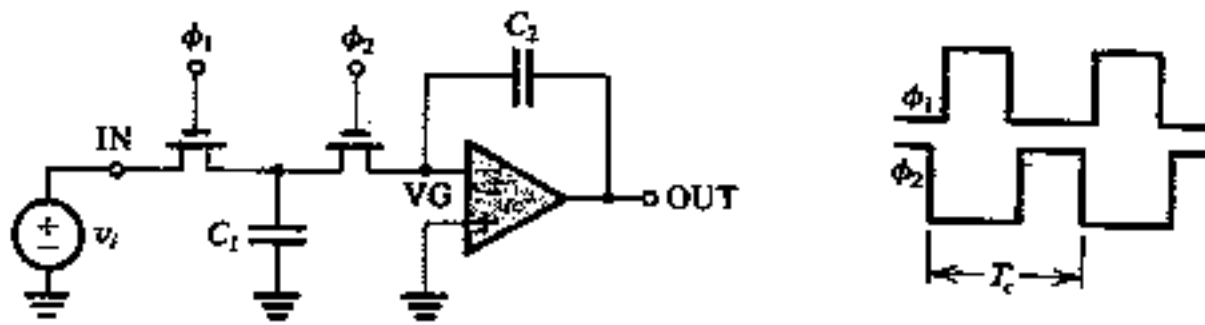


Fig. 3

4. The cascode circuits implemented with BJT and MOS are shown in Fig.4. Please find the output resistance R_o for both and show which one is proper for achieving high R_o . For all devices, assume necessary parameters like g_m , r_o , β , ... etc. (15%)

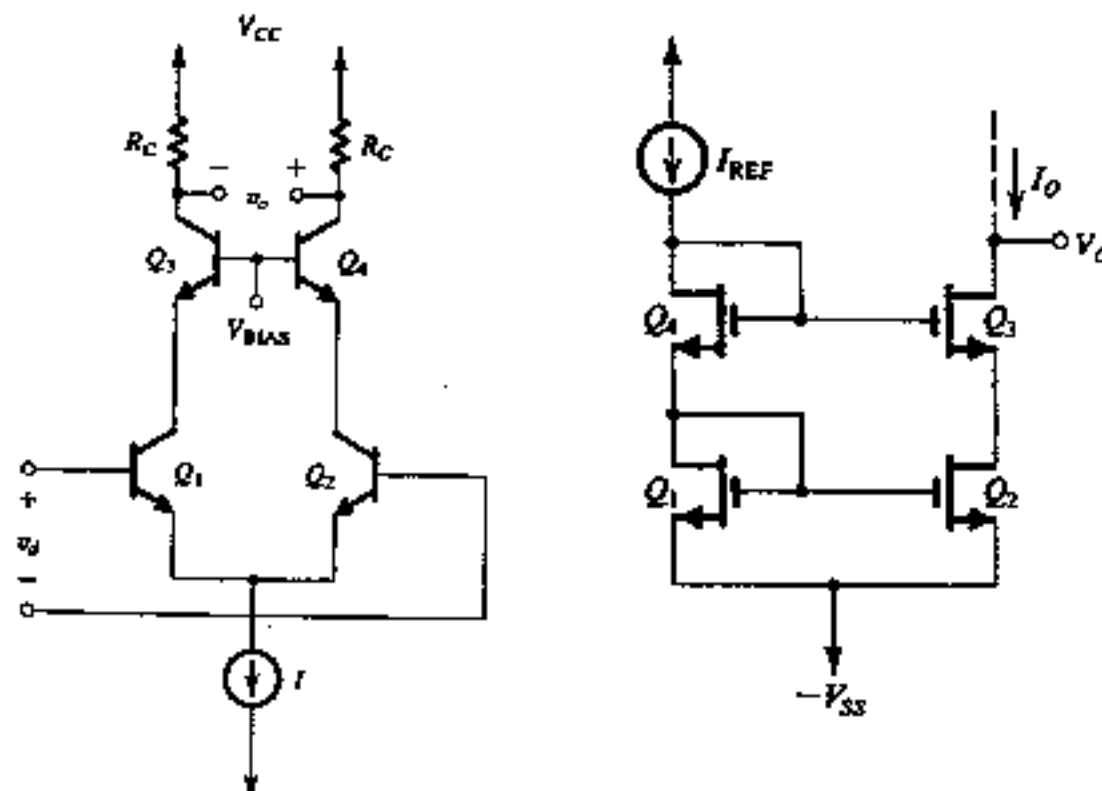
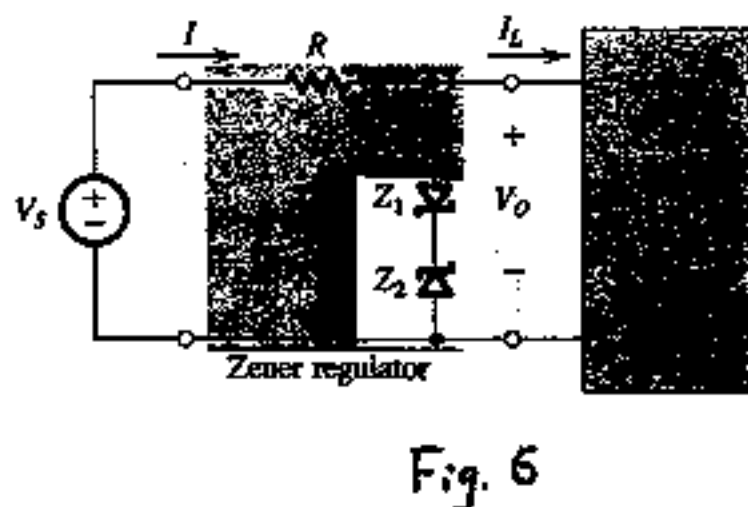
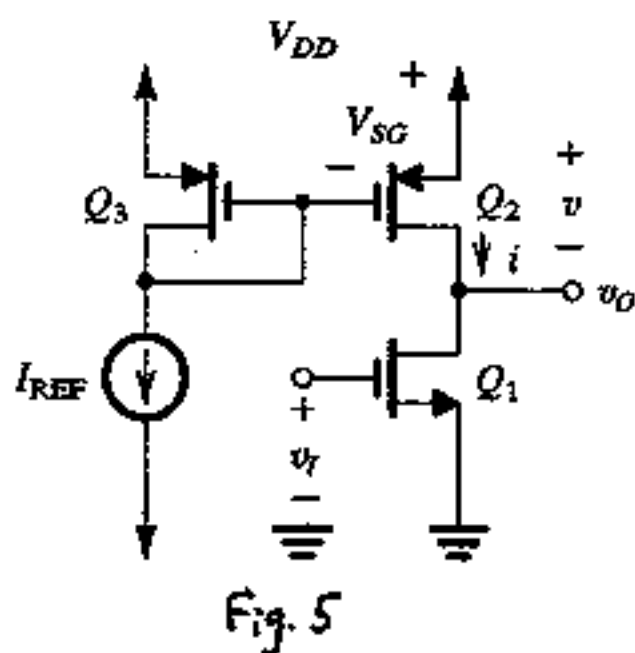


Fig. 4

5. For Fig. 5, the MOSFETs have $W/L = 100/1.6$, $K_n' = 90 \mu A/V^2$, $K_p' = 30 \mu A/V^2$, $I_{REF} = 0.1 \text{ mA}$, $V_{A0} = 12.8 \text{ V}$, $|V_{Ap}| = 19.2 \text{ V}$. Please find the voltage gain A_v and output resistance R_o . (15%)



6. A Zener Shunt Regulator is shown in Fig. 6. The Zener diode generally includes two diodes in series, which are a forward conducting and a reverse biased diode as shown. Why? Please briefly describe the response of Zener diode when the load current I_L is suddenly increased and decreased, respectively. (15%)
7. For the circuit of Fig. 7, the transistor has $\beta = 100$. Please find the small signal voltage gain V_o/V_s , the input resistance R_{in} , and the output resistance R_{of} . (15%)

