國立中山大學102學年度碩士暨碩士專班招生考試試題

科目名稱：電子學【電機系碩士班甲組、乙組、戊組、電波領域聯合】　　題號：431005

※本科目依簡章規定「可以」使用計算機（廠牌、功能不拘）　　

1. (20%) (a) What is the amplifier configuration in Figure 1. (b) Explain why the R_S can improve the thermal stability of the amplifier. (c) Please derive R_i, R_{in}, A_{VO}, A_V, G_{VO}, G_V, R_o and R_{out} of the amplifier in Figure 1. (2%, 2%, 2%*8)

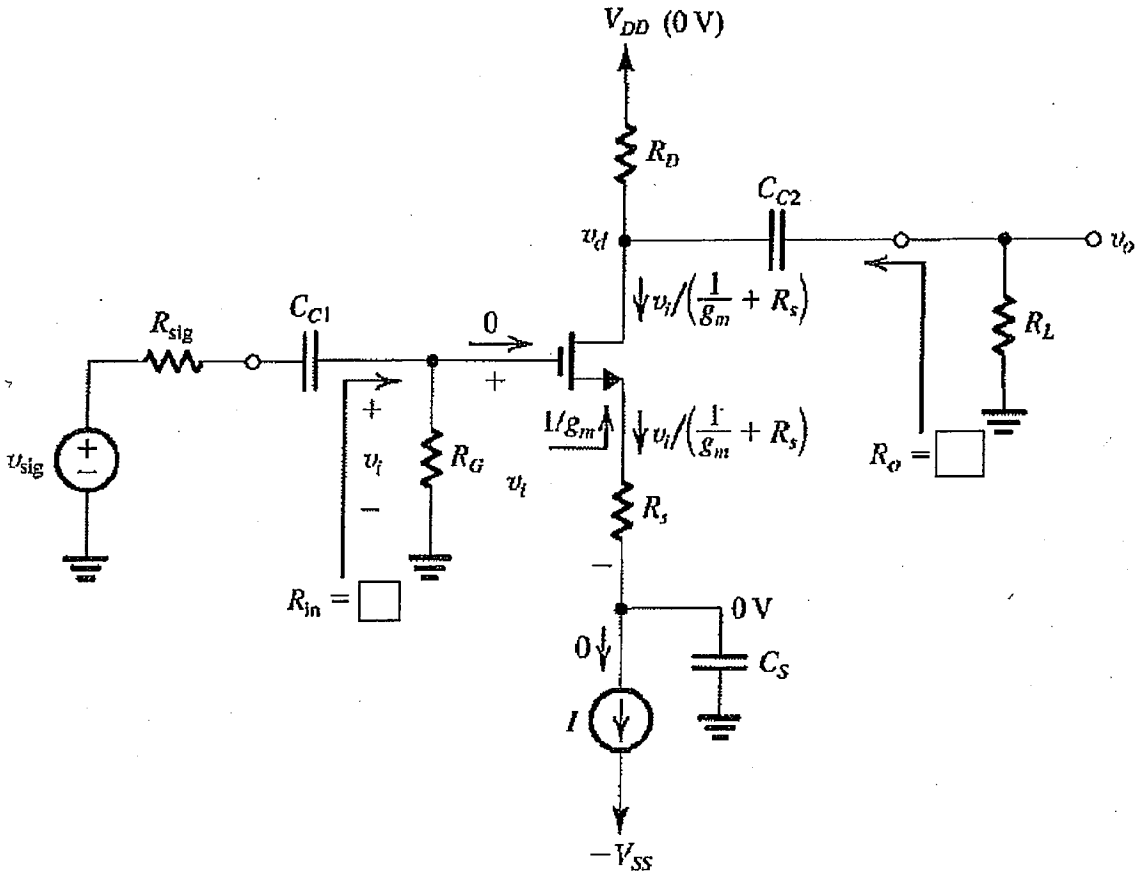

Figure 1

2. (20%) Figure 2 shows an op amp connected in the inverting configuration. The op amp has an open-loop gain $\mu = 10^4$, a differential input resistance $R_{id} = 100\text{k}\Omega$, and an output resistance $r_o = 1\text{k}\Omega$. Use the feedback method to find (a) the voltage gain V_o/V_s, (b) the input resistance R_{in}, and (c) the output resistance R_{out}. (7%, 7%, 6%)

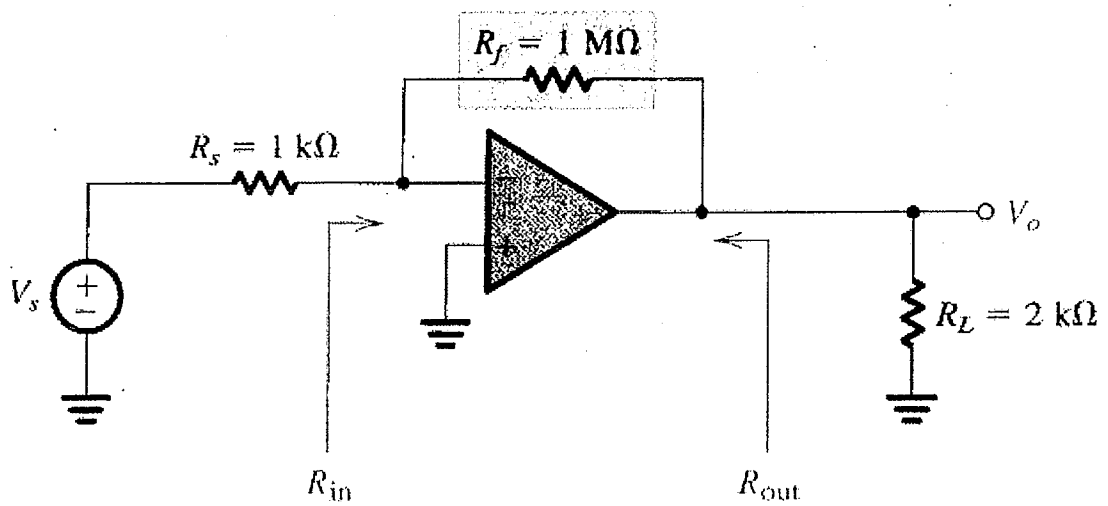

Figure 2.

3. (20%) (a) Draw an ENH mode NMOS (enhancement nMOSFET) and a DEP mode NMOS (depletion nMOSFET) respectively. Please explain what are the differences of (b) their fabrication processes and the differences between (c) their input characteristics I_{Ds}-V_{Gs} and (d) their output characteristics I_{Ds}-V_{Ds}, respectively. (5%, 5%, 5%, 5%)

4. (20%) (a) Using a simple (r_π and g_m) model for each of the two transistors Q_{18} and Q_{19} in Figure 4.a, find the small-signal resistance between A and A'. Where I_{C18} = 165 μA and I_{C19} = 16 μA. (b) Figure 4.b shows the circuit for determine the 741 op-amp output resistance when v_O is positive and Q_{14} is conducting most of the current. Using the resistance of the Q_{18} and Q_{19} network calculated in 4.(a) and neglecting the large output resistance of Q_{13A}, find R_o when Q_{14} is sourcing an output current of 5mA. (10%, 10%)

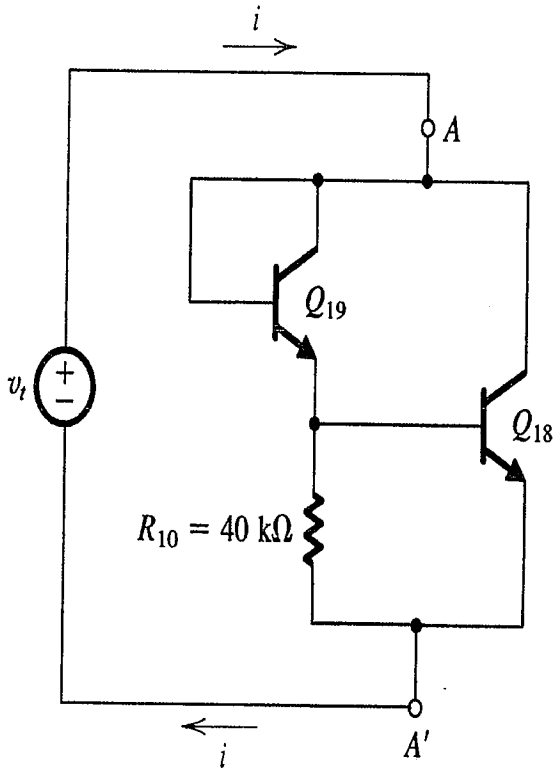

Figure 4.a

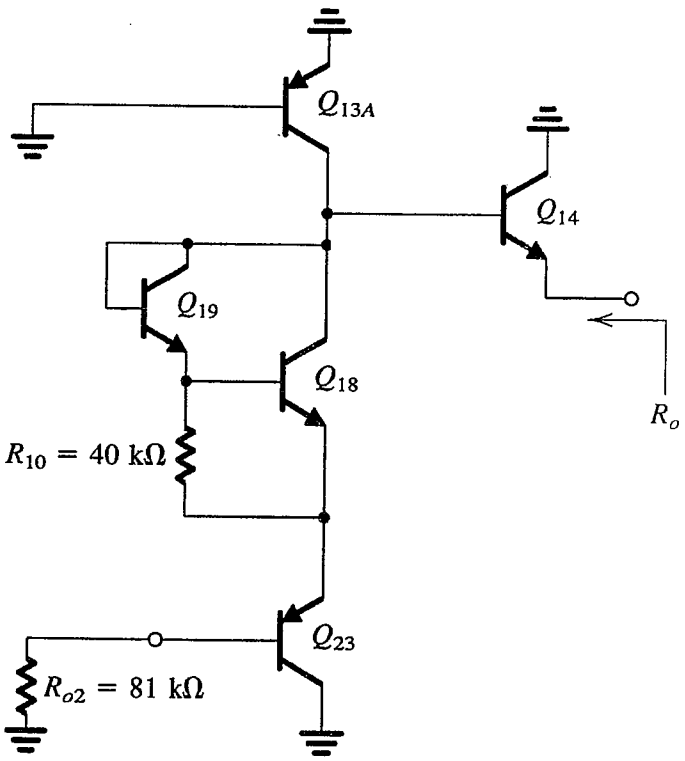

Figure 4.b

5. (20%) (a) Plot a Bridge full-wave rectifier and (b) explain the operation principle of it. Also, (c) please describe how to drive the PIV (peak inverse voltage) of the diodes used. (7%, 7%, 6%)