國立彰化師範大學 100 學年度碩士班招生考試試題
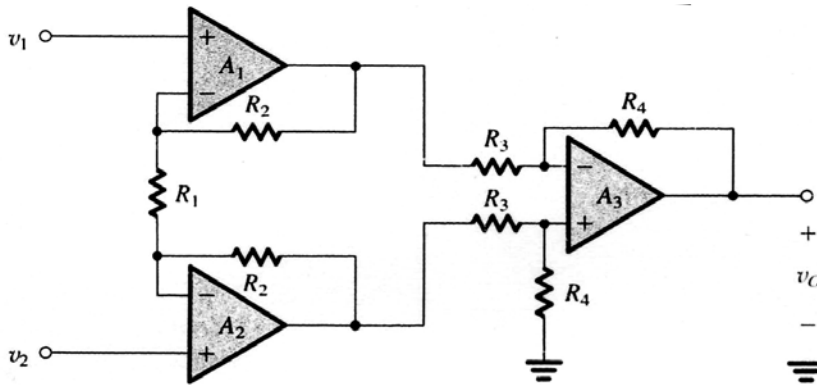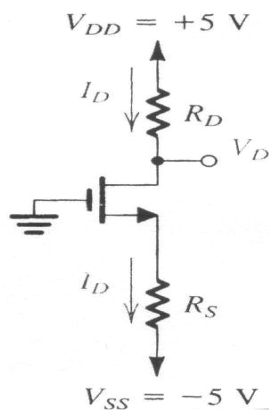
1. (15%) For the circuit shown in the following figure, express v_o as a function of v_1 and v_2. Assume all op amps are ideal operational amplifiers.

2. (15%)　For a *pn* junction with $N_A = 10^{17}/cm^3$ and $N_D = 10^{16}/cm^3$, find, at T = 300 K, the built-in voltage, the width of the depletion region, and the distance it extends in the *p* side and the *n* side of the junction. Use $n_i = 1.5 \times 10^{10}/cm^3$, $\varepsilon_s = 1.04 \times 10^{-12}$ F/cm, $V_T = 25$ mV.

3. （20%）Design the values of R_D and R_S for the following circuit so that the transistor operates at $I_D = 0.4$ mA and $V_D = +1$ V. The NMOS transistor has $V_t = 2$ V, $\mu_n C_{ox} = 20$ μA/V^2, $L = 10$ μm, and $W = 400 \mu$m. Neglect the channel-length modulation effect.
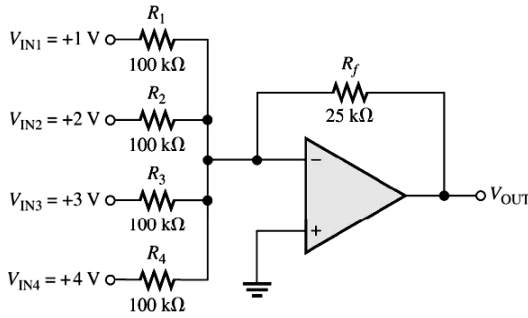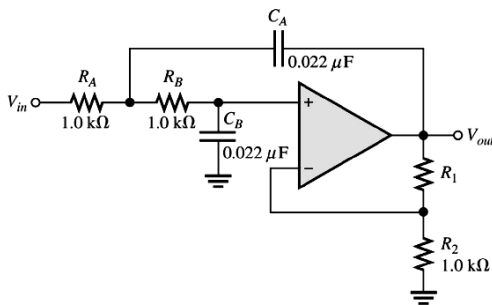
系所：資訊工程學系積體電路設計碩士班　　　　　　　科目：電子學

☆☆請在答案紙上作答☆☆　　　　　　　　　　　　　共 2 頁，第 2 頁

4. (15%) What is the output voltage for the averaging amplifier in the following figure.

5. (15%) Determine the critical frequency of the Sallen-Key low-pass filter in the following figure and set the value of R1 for an approximate Butterworth response.

6. For the amplifier in the following figure. (Vin = 10 mv)
   甲、Determine the dc collector voltage. (10%)
   乙、Determine the ac collector voltage. (10%)