1. Consider the circuit of Fig. 1 with V_{BB}=1.7 V, R_B=100kΩ, V_{CC}=10 V, and R_C=5 kΩ. Let the transistor β=100. The input signal υ_i is a triangular wave of 0.4 V peak-peak. (a) Find approximate values for the peak-to-peak amplitude of i_b and of υ_{be}. (10%) (b) What is the voltage gain of the amplifier? (10%)
2. The amplifier of Fig. 2 consists of two identical common-emitter amplifiers connected in cascade. For V_{CC}=15 V, R_1=100 kΩ, R_2=47 kΩ, R_E=3.9 kΩ, R_C=6.8 kΩ, R_{sig}= 5 kΩ, and R_L= 2 kΩ, find the overall voltage gain $\upsilon_o/\upsilon_{sig}$. (20%)
3. (a) Please use the power supply, capacitance and resistance to design a band pass filler circuit (10%).

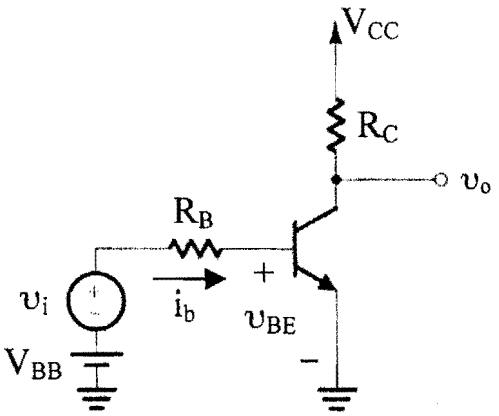

Fig. 1

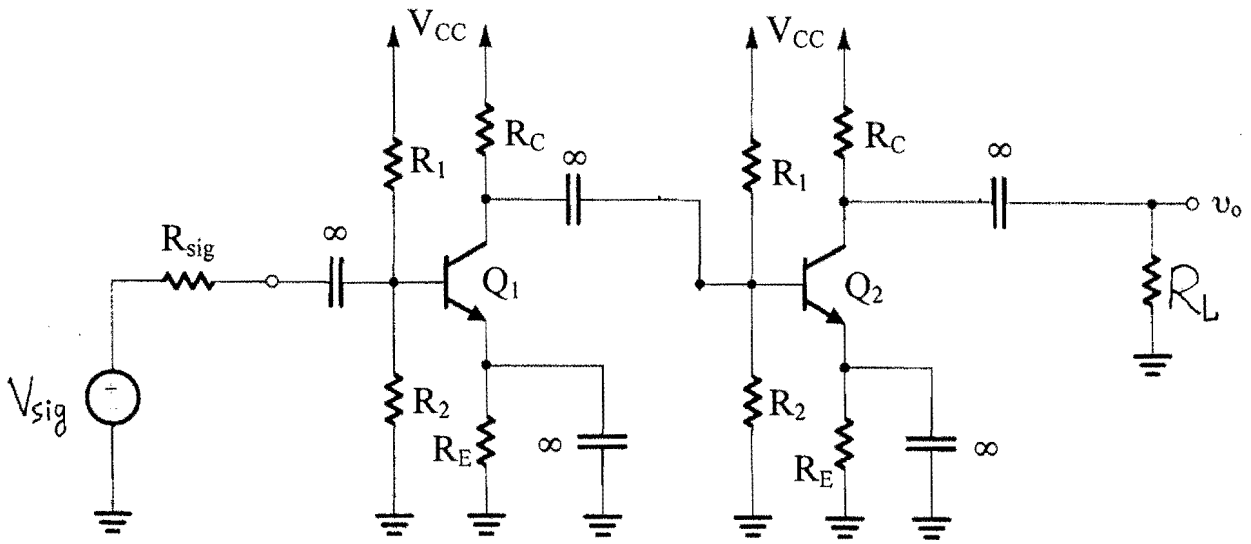

Fig. 2

(背面仍有題目,請繼續作答)

4. Figure 3 shows a MOSFETs differential circuit. Q_1 and Q_2 are matched. Q_3 in the circuit operated in the triode region. Please find

(a) With $v_{G1}=v_{G2}=0$, and assuming Q_1 and Q_2 are in saturation, what dc voltages appear at the sources of Q_1 and Q_2. Please express the dc voltages in terms of the overdrive voltage V_{OV} at which each of Q_1 and Q_2 operates, and V_t.

(b) For the situation in (a), what current flows in Q_3? What overdrive voltage V_{OV3} is Q_3 operating at, in terms of V_C, V_{OV}, and V_t?

(c) For $v_{G1}=v_{id}/2$, and $v_{G2}=-v_{id}/2$ where v_{id} is a small signal please describe the status of the Q_3. Now if all transistors have the same W/L, express r_{DS} of Q_3 in terms of V_{OV}, V_{OV3}, and $g_{m1,2}$.

(25%)

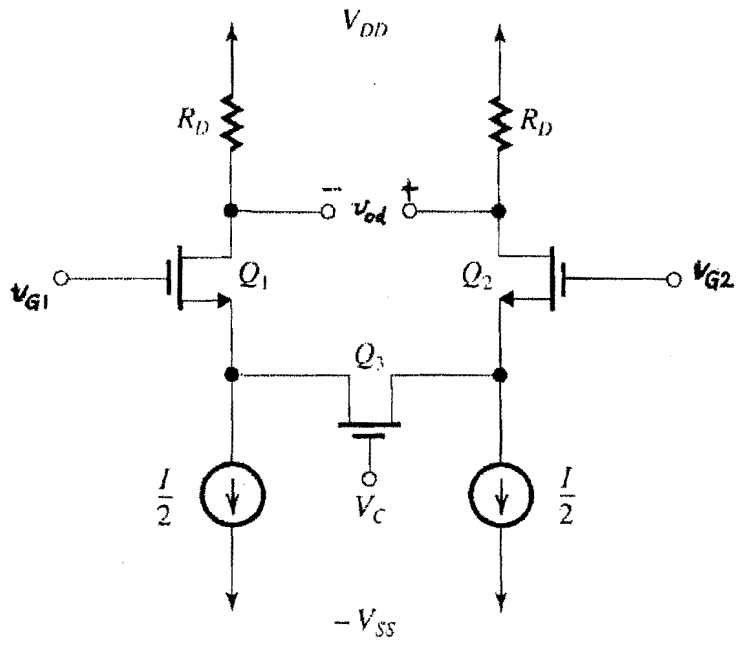

Fig. 3

5. Figure 4 shows an amplifier formed by cascading two CS stages. Each of Q_1 and Q_2 is operated at an overdrive voltage of 0.2V and $|V_A|$=10V. The transistor capacitances are as follows: C_{gs}=20fF, C_{gd}=5fF, and C_{db}=5fF

(a) Find the dc voltage gain.

(b) Find the input capacitance at the gate of Q_1, using the Miller approximation.

(c) Use the capacitance in (b) to determine the frequency of the pole formed at the amplifier input. Let R_{sig}=10kΩ.

(d) Use the Miller approximation to find the input capacitance of Q_2 and hence determine the total capacitance at the drain of Q_1.

(e) Use the capacitance found in (d) to get the frequency of the pole formed at the interface between the two stages.

(f) Determine the total capacitance at the output node and find the frequency of the pole formed at the output node.

(g) Does the amplifier have a dominant pole? If so, at what frequency?

(25%)

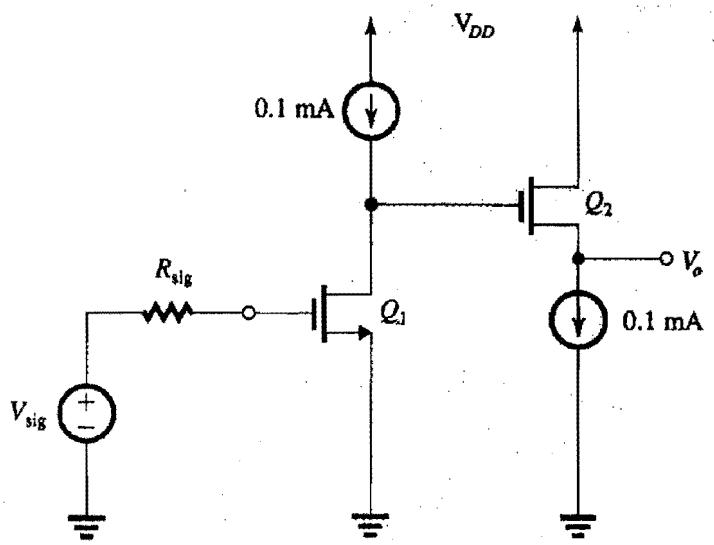

Fig. 4