國 立 臺 北 科 技 大 學

101 學年度研究所碩士在職專班招生

電腦與通訊研究所

丁組：電子學試題

填准考證號碼

注意事項：

1. 本試題共【五】題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在試卷答案欄內，否則不予計分。

1. For the circuit shown in figure 1, all of the operational amplifiers are ideal, please find the gain of the circuit, $\dfrac{v_O}{v_{I2} - v_{I1}} = ?$ (20%)
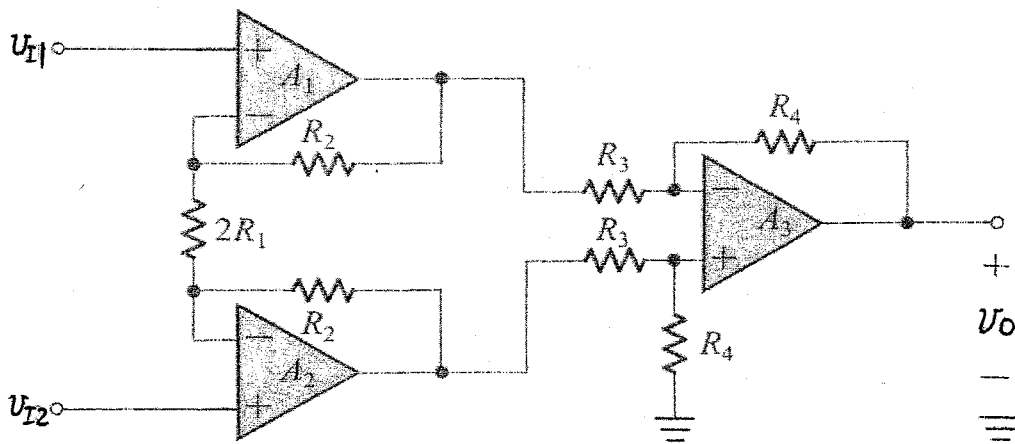

Figure 1

2. For the amplifier shown in figure 2, the MOSFET is without body effect. If the small-signal parameters of the MOSFET are $\dfrac{\partial I_D}{\partial V_{GS}} = g_m$, $\dfrac{\partial V_{DS}}{\partial I_D} = r_o = \infty$, and the capacitors C_{C1} and C_{C2} approach infinity, please find:

(1) voltage gain $\dfrac{v_o}{v_i} = ?$ (10%)

(2) input resistance $R_{in} = ?$ (5%)

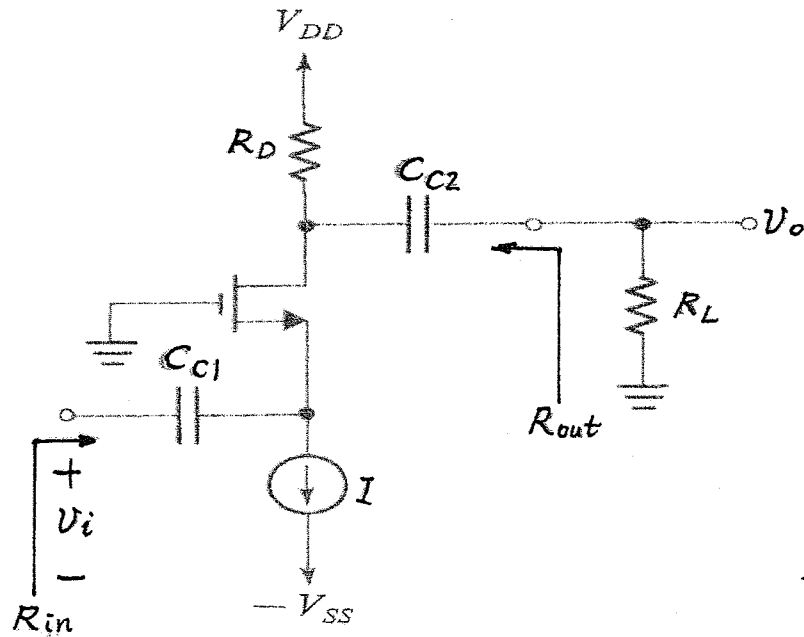(3) output resistance $R_{out} = ?$ (5%)

Figure 2

3. As shown in figure 3, the circuit is an oscillator, If all of the operational amplifiers are ideal, please derive the oscillation frequency $\omega_o = ?$ (20%)
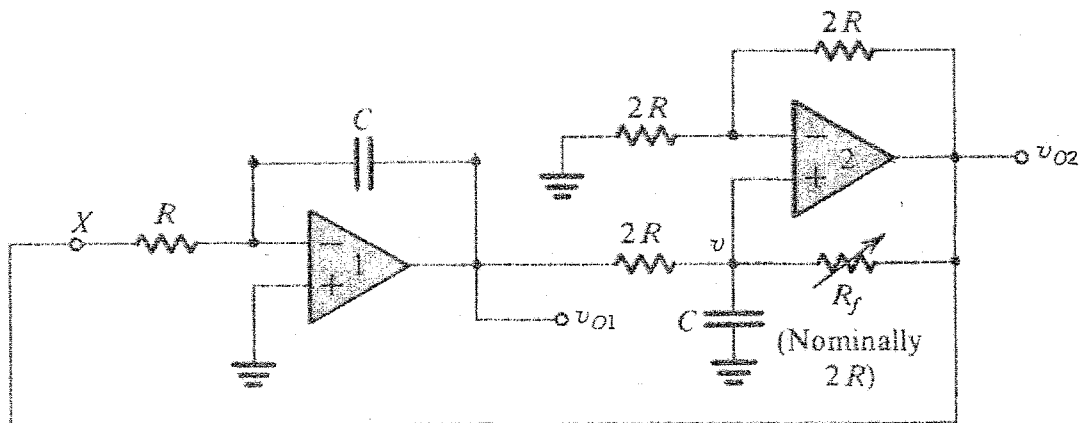

Figure 3

4. For the circuit shown in figure 4, if the parameters of the transistor $\beta= 100$,

$V_{BE}= 0.7V$，and its small-signal output resistance $r_o=\infty$, please find:

(1) voltage gain $\dfrac{V_o}{V_S}$ = ? (10%)

(2) input resistance R_{in} = ? (5%)

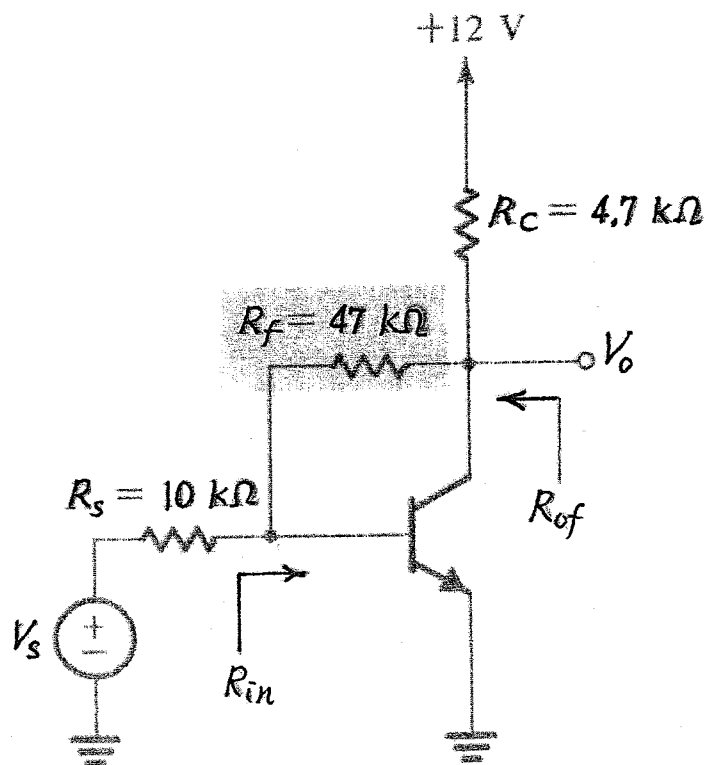(3) output resistance R_{of} = ? (5%)

Figure 4

5. As shown in figure 5, the circuit is a CMOS inverter, the relationship of Q_N and Q_P can be described as $\mu_n C_{ox} \left(\dfrac{W_N}{L_N} \right) = \mu_p C_{ox} \left(\dfrac{W_P}{L_P} \right)$, $V_{tn} = |V_{tp}| = V_t$. Please find the noise margins NM_H and NM_L。 (20%)
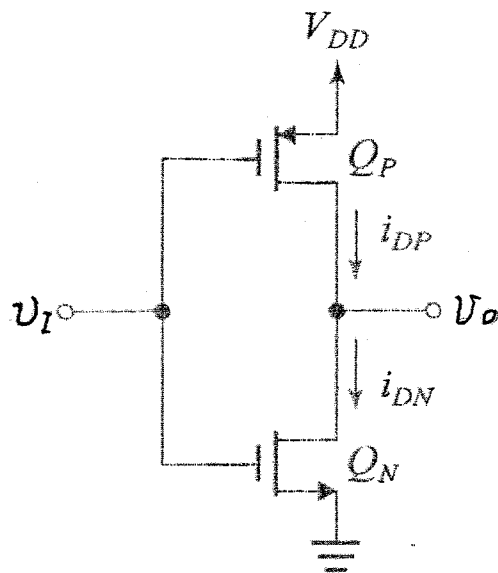

Figure 5