國立臺北科技大學 106 學年度碩士班招生考試

系所組別：1503 自動化科技研究所

第二節　電子學　試題　（選考）

注意事項：

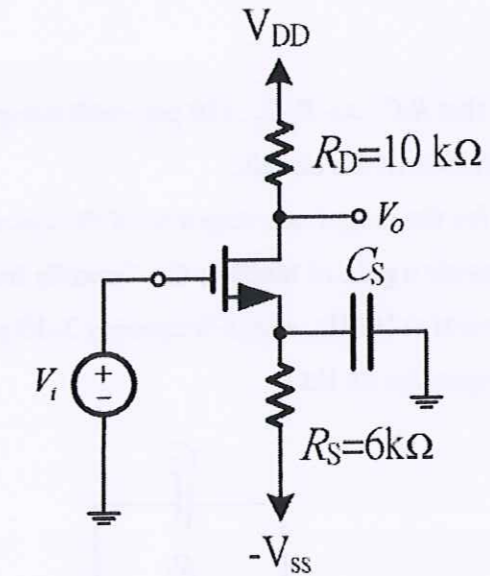1. 本試題共 5 題，共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

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1. Figure 1 shows a circuit having an input resistance of 100 kΩ and a gain that can be varied from -1 V/V to -10 V/V using the 10-kΩ potentiometer R_4. What is the voltage gain when the potentiometer is set exactly at its middle value? (15 pts)
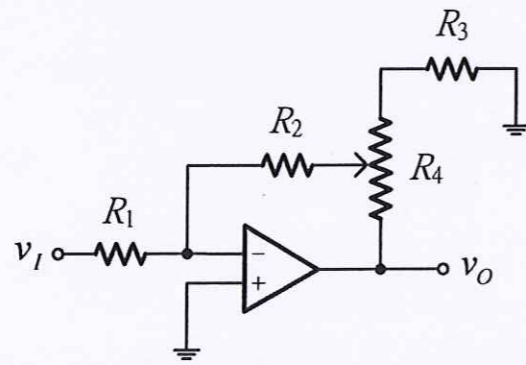

Figure 1

2. The amplifier shown in Fig. 2 is biased to operate at I_D =1mA, g_m =1 mA/V. Neglecting r_O. (20 pts, each sub-problem is 10 pts)

   (a) Find the midband gain.

   (b) Find the value of C_S that places f_L (the low 3-dB frequency) at 10Hz.

Figure 2

3. For each of the circuits shown in Figure 3, find the emitter, base, and collector voltages and currents. Use β =30, but assume $|V_{BE}|$ = 0.7 V independent of current level. (20 pts, each sub-problem is 5pts)
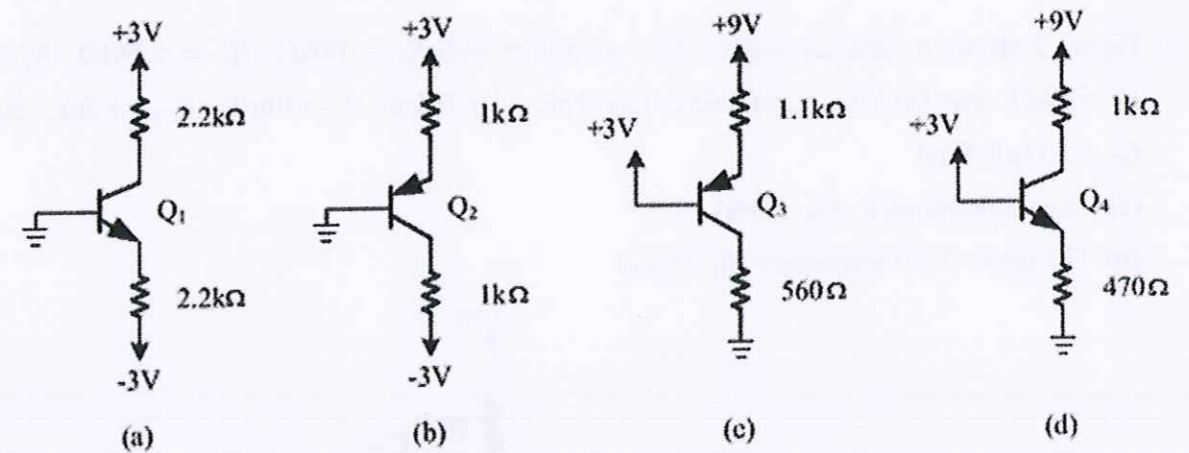

Figure 3

注意：背面尚有試題

4. See Figure 4 and assume that $R_1C_1 \gg R_2C_2$. (30 pts, each sub-problem is 10pts)

   (a) Derive the transfer function of the circuit.

   (b) Sketch the Bode plot for the magnitude response of the circuit.

   (c) Design a circuit to provide a gain of 60dB in the ``middle frequency range,'' a low-frequency 3-dB point at 100Hz, a high-frequency 3-dB point at 10kHz, and an input resistance (at high frequency) of 1kΩ.
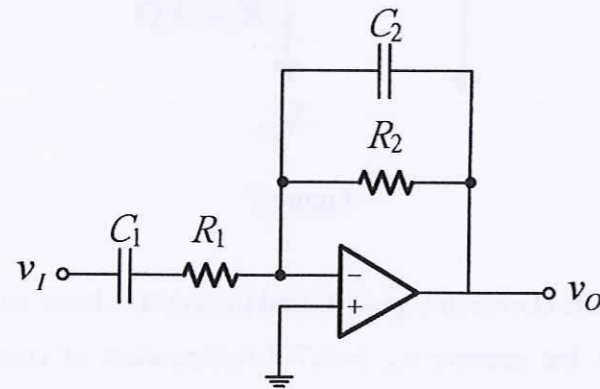

Figure 4

5. Figure 5 shows a common-source (CS) amplifier with R_{sig}=100kΩ, $R_G = 4.7$MΩ, $R_D = R_L$ =15kΩ, g_m=1mA/V, r_o =150kΩ, C_{gs}=1pF, C_{gd}=0.4pF, C_S =1.6µF, C_{C1} =3.3nF, and C_{C2}=0.53µF. Find

   (a) The midband gain A_M. (7pts)

   (b) The upper 3-dB frequency f_H. (8pts)

Figure 5