國立臺北科技大學 105 學年度碩士班招生考試

系所組別：1521 自動化科技研究所乙組

第三節　電子學　試題　（選考）

注意事項：

1. 本試題共 4 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。

1. Write the transfer function of a second-order notch filter as shown in Fig. 1 for which the DC gain is unity, the pole frequency is 10 rad/sec, the pole Q is 0.5, and the transmission zero is at 100 rad/sec. (15%)

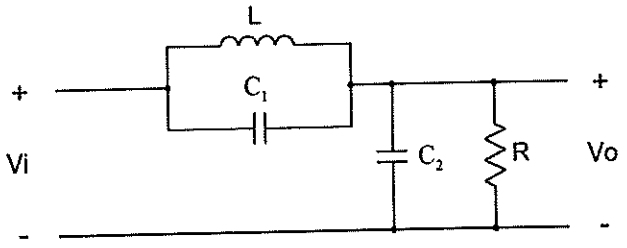

Fig. 1

2. The OP amp has an open-loop gain of 100dB and a single pole at 10 rad/sec.

(1) Sketch the Bode plot for the loop-gain. (20%)

(2) Find the frequency at which the loop-gain=1. (5%)

(3) Is it stable? (5%)

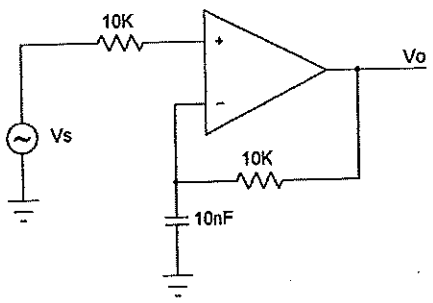

Fig. 2

3. Consider the following circuit, as shown in Fig. 3.

(1) Please calculate the midband gain (8%)

(2) Please calculate the upper 3-dB frequency (15%).

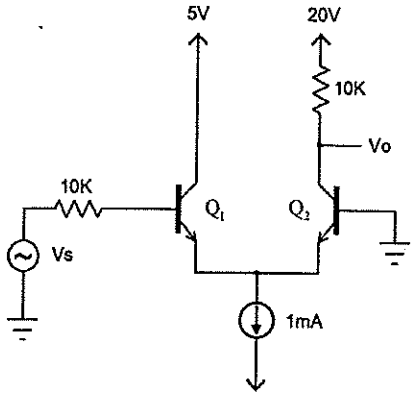

Fig. 3

4. Fig. 4 shows the circuit of a simple operational amplifier. Terminal 1 and 2, shown connected to ground, are the op amp's input terminals and terminal 3 is the output terminal.

(1) Assume $\beta \gg 1$ and $|V_{BE}| \approx 0.7V$. Please find I_1, I_2, I_3 and I_4. Note Q_6 has four times the area of each of Q_9 and Q_3. (8%)

(2) Calculate the quiescent power dissipation in this circuit. (8%)

(3) If transistors Q_1 and Q_2 have $\beta = 100$, calculate the input bias current of the op amp. (8%)

(4) What is the common-mode voltage range of this op amp? (8%)

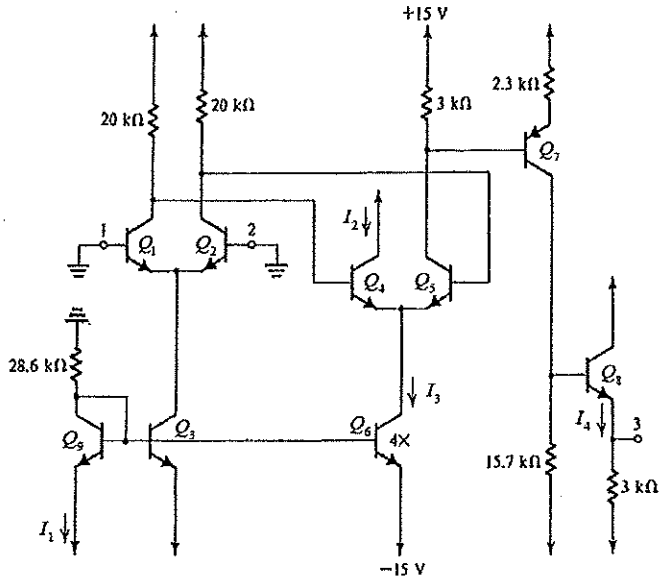

Fig. 4