1. (20%) (a) (5%) The amplifier in a feedback circuit as shown in **Fig. 1(a)** has a transfer function of

$$A(s) = \frac{100}{\frac{s}{10^5} + 1}.$$

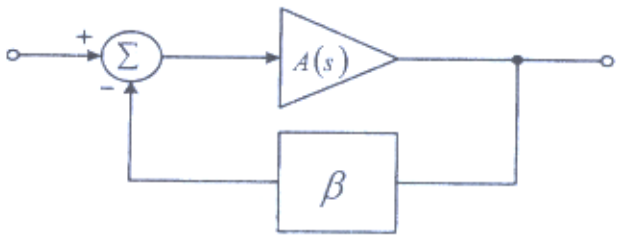

Fig. 1(a)

What value of β will increase the upper $-3db$ frequency by a factor of 10 for the closed-loop circuit? What is the low frequency gain of the closed-loop circuit?

(b) (15%) (i) Please find the transfer function, $V_{out}(s)/V_{in}(s)$, of the circuit as shown in **Fig. 1(b)** and identify the location of the poles and zeros. (ii) Sketch the asymptotic (straight-line) plot for the magnitude of the transfer function. (iii) What is the gain in the region where the transfer function is independent of frequency?

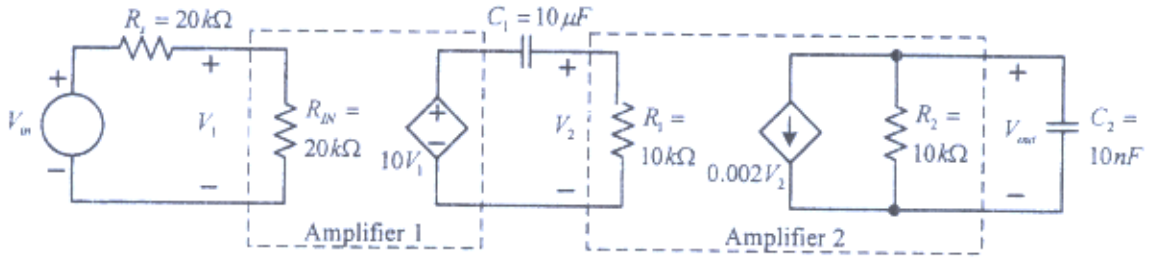

Fig. 1(b)

2. (20%) Assume that the op amps are ideal in the circuit as shown in **Fig. 2**; please find $i_{out}/(v_1 - v_2)$ and the input resistance defined as $R_{in} = (v_2 - v_1)/i_{in}$.

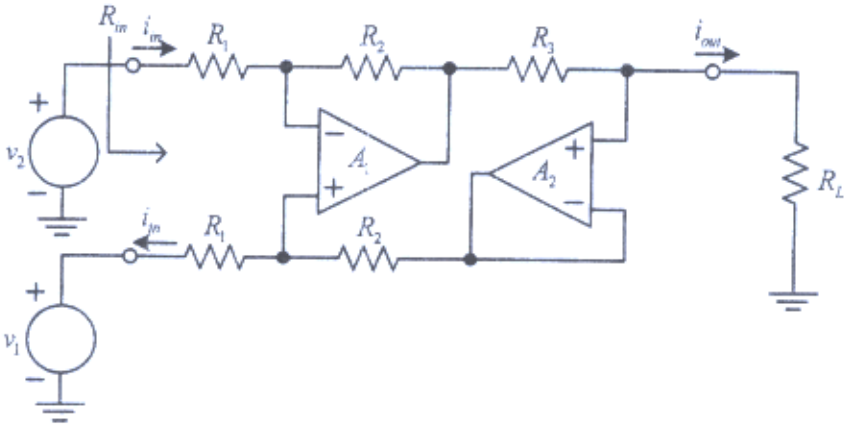

Fig. 2

(背面仍有題目,請繼續作答)

3. (20%) A shunt-shunt feedback amplifier is shown in **Fig. 3.** Please use the methods of feedback analysis to find the values of v_2/v_1, v_1/i_1 and v_2/i_2. Assume that all transistors are matched and that $V_T = 25mV$, $\beta = 100$ (of the BJT), $I_{C_1} = I_{C_2} = 100\mu A$ and $r_o = \infty$.

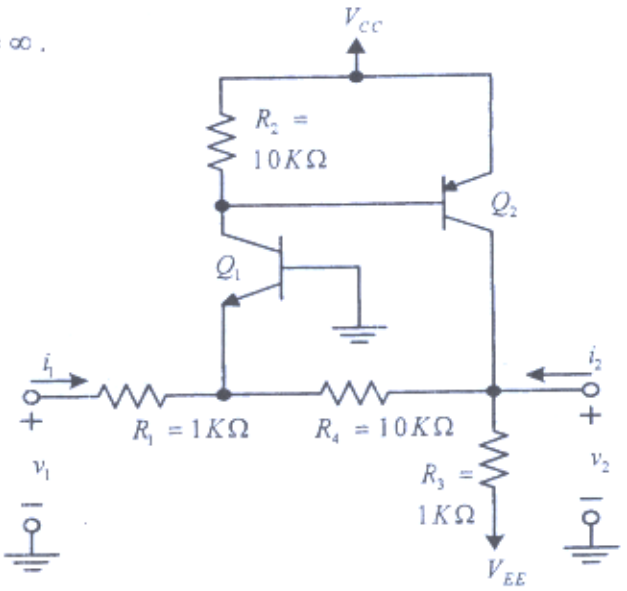

Fig. 3

4. (20%) A pnp BJT circuit is shown in **Fig. 4**. (a) Find the dc values of I_E, I_C, I_B, V_E, V_C and V_B if $\beta = 50$ and $V_{EB}(on) = 0.65$. (b) For what value of R_C does the BJT become saturated?

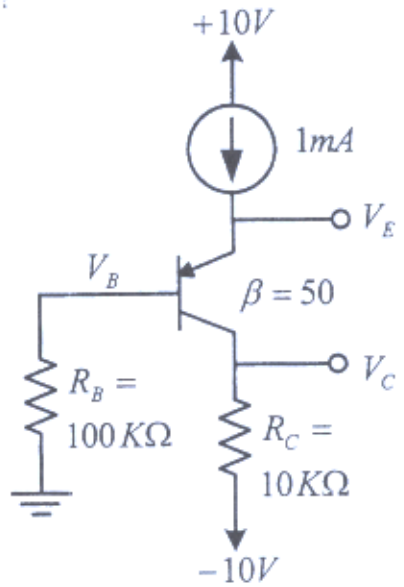

Fig. 4

5. (20%) Assume that the op amp is ideal and the diodes have a drop voltage $V_D = 0.7V$ in the circuit of **Fig. 5**. (a) Please find and sketch the voltage transfer (V_o with respect to V_i) characteristics of the circuit. (b) If $V_i(t) = 15\sin(2\pi t)$, please plot the output voltage $V_o(t)$ in the time domain.

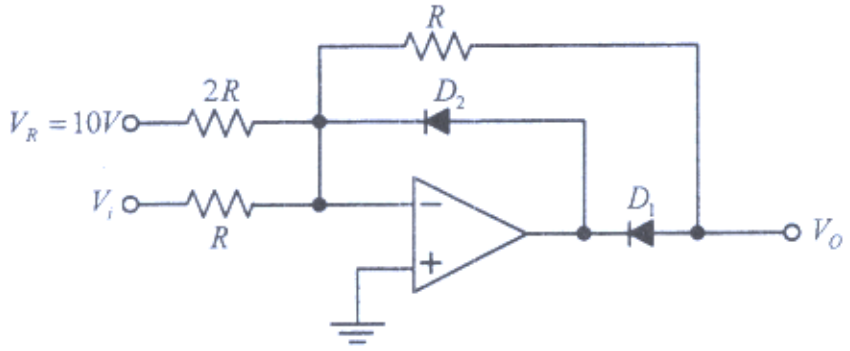

Fig. 5