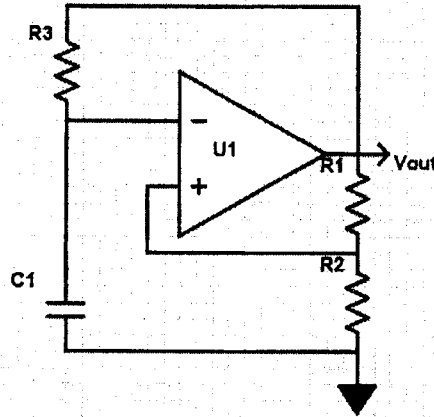※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Given the following self oscillation circuit. Let $R_1 = R_2 = R_3 = 10K\ \Omega$. (a) If the required oscillatory frequency is set to 2 KHz, find the value of the capacitor C_1. (15%) (b) Draw the output waveform, V_{out}. (10%)

2. Given the following high pass filter circuit. Let Let $R_1 = R_2 = 10K\ \Omega$, $C_1 = 0.1\mu f$ and $C_2 = 0.2\mu f$. (a) Find the cut-off frequency. (10%) (b) Give the transfer function. (10%) (c) Sketch its Bode-plot with respect to the input and output voltages. (10%) (d) Give the Q factor. (5%)
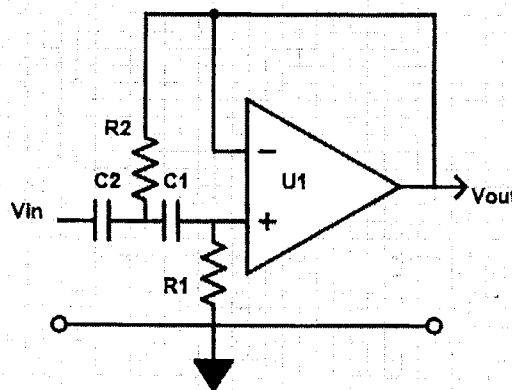
3. Given the following circuit which contains a current source. Let $V_{cc} = 5V$, the saturation current $Is_1 = Is_2 = Is_3 = 10^{-12}A$, $\beta_1 = \beta_2 = \beta_3 = 50$, the thermal voltages of the transistors be 26 mV, $R_1 = R_4 = 50\ \Omega$, and $R_2 = R_3 = 0.5\ \Omega$. (a) Find the collector output current of Q_1. (15%) (b) Draw the small signal model of the complete circuit. (15%) (c) Find the output impedance of the current source and the output impedance of the complete circuit (10%).