CENG4480 2021F Homework 2

Due: Nov. 07, 2021

All solutions should be submitted to the blackboard in the format of **PDF/MS Word**.

Q1 (10%) A 8 bits ADC with full scale output voltage of 2.56V is designed to have a ± 0.5 LSB accuracy. If the ADC is calibrated at 50°Cand the operating temperature ranges from 0°Cto 100°C, then what's the maximum net temperature coefficient of the ADC should not exceed?
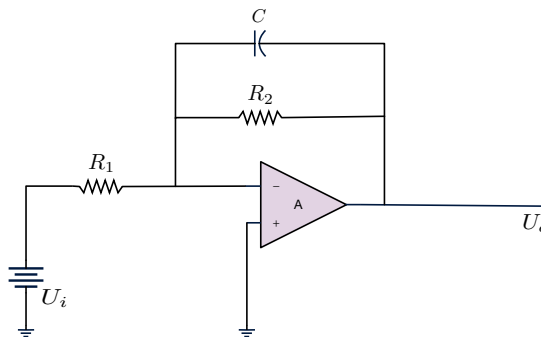
Q2 (20%) Given a low-pass filter as shown in Figure 1.

Figure 1: Q2 Circuit

1. If $R_1 = 10K\Omega$, $R_2 = 100K\Omega$, determine low-frequency gain $A_u(dB)$;
2. If cutoff frequency $f_c = 5Hz$, determine C value.

Q3 (20%) Given the the circuit shown in Figure 2, $R_1 = R_2 = 1k\Omega$, $R_3 = 10k\Omega$, $R_4 = R_5 = R_6 = 20k\Omega$, $C_1 = 0.05\mu F$, $C_2 = 0.02\mu F$, please answer the following questions.
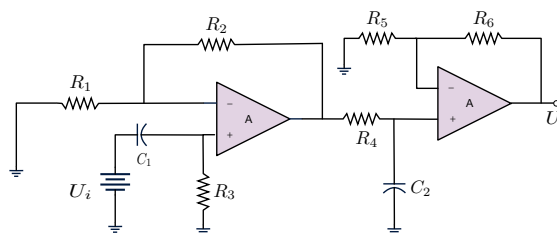

Figure 2: Q3 Circuit

(1) Which kind of filter the circuit is?

(2) Calculate the cutoff frequencies of the circuit. If it has both the lower and upper cutoff frequency, then you should calculate both.

Q4 A 5-bit D/A converter has a voltage output. For a binary input of 10100, an output voltage of 18 mV is produced. Determine the output voltage when the binary input is 11100.

Q5 For the DAC circuit shown in Figure 3 (using an ideal op-amp), what value of R_F will give an output range of $-10 \leq V_0 \leq 0V$? Assume that logic $0 = 0V$ and logic $1 = 5V$.
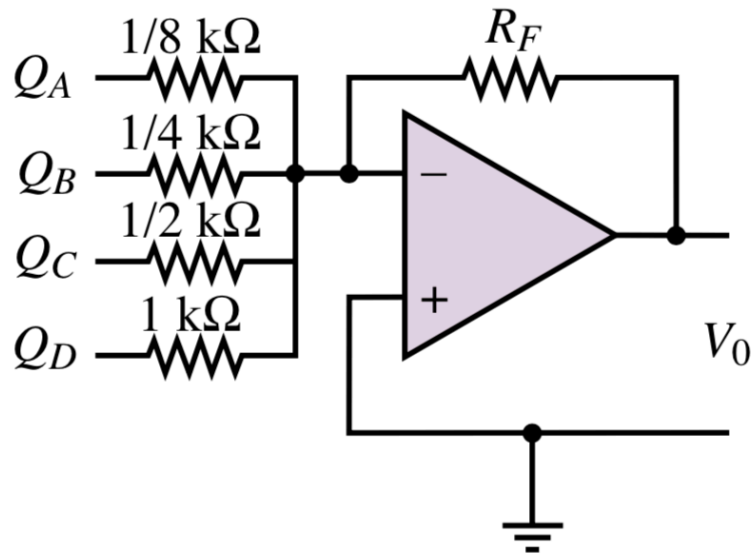

Figure 3: Q5 Circuit

Q6 For the 4-bit R-2R DAC shown in Figure 4, calculate V_0 in terms of $V_{b,0} - V_{b,4}$ if V_{ref} is grounded.
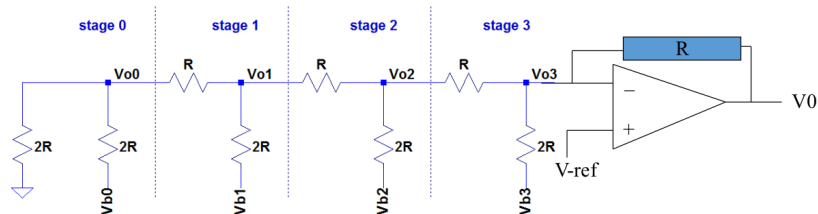

Figure 4: Q6 Circuit