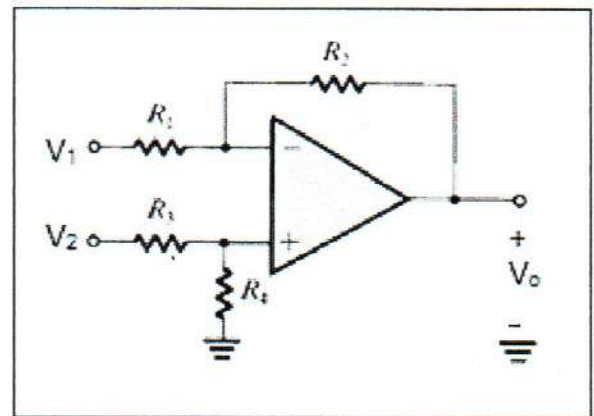




- 1) Design the best circuit to convert digital data to analog by using ideal Op Amp.
- a) **Draw** the circuit with all amount of component. [4 points]
- b) Convert (d₈ d₇ d₆ d₅ d₄ d₃ d₂ d₁:01001100) to analog signal if V_{ref} = -5V [4 points]
- 2) Design a high pass active filter by using ideal Op Amp, it has a cut-off frequency 2kHz and the maximum gain 4 v/v. (use only 10kΩ resistor)
- a) **Draw** the circuit with all amount of component of the circuit if it is second order. [8 points]
- b) Find the V_o when V_i is sine wave have 0.5v peak and 1ms period time. [2 points]
- 3) Design the square waveform oscillator has frequency 2 kHz and the gain of Schmitt trigger circuit is 5v/v. (C=5mF) **draw the circuit** [8 points]
- 4) Find the values of resistors in the difference amplifier circuit to realize a differential gain of 100, a differential input resistance of 10 kΩ, and a minimum CMRR of 60 dB. Assume the op amp to be ideal. [12 points]

Note:
$$A_c = \left(\frac{R_4}{R_4 + R_3} \right) \left(1 - \frac{R_2 R_3}{R_1 R_4} \right)$$



- 5) Design by using only one ideal op amps and resistors to provide V_o, **draw** the circuit.
- $$V_o = -2V_1 + V_2 + 2V_3$$
 [10 points]