Arab Academy for Science & Technology and Maritime Transport

College of Engineering and Technology

Department : Electronics and Communications

Course : Electronic Measurements **Course Code:** EC410

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Problem Set #3

Operational Amplifiers

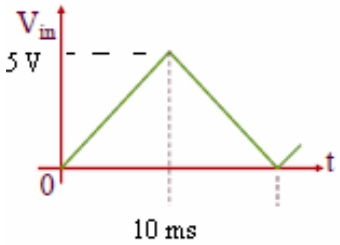
1- An input signal with 50 V (dc) is amplified using two cascaded identical inverting operational amplifiers with $R_1 = 50\text{k}\Omega$ and $R_2 = 100\,\text{k}\Omega$.
(a) Draw the connection.
(b) Calculate the total gain in dB.
(c) Calculate the input and output signal levels for each block.

2- An input signal with 10 V (dc) is amplified using two cascaded identical non-inverting operational amplifiers with $R_1 = 50\text{k}\Omega$ and $R_2 = 100\,\text{k}\Omega$ (feed back resistance).
(a) Draw the connection.
(b) Calculate the total gain in dB.
(c) Calculate the input and output signal levels for each block.

3- Given two signals v_1 and v_2, draw a connection using an operational amplifier that yields:
(a) $v_2 - v_1$
(b) $(4/3)v_2 - 3v_1$.

4- Given that $v_i(t) = 10\,\text{mv}$ for $1\,\text{ms} \le t \le 4\,\text{ms}$ and zero otherwise. This signal is fed to an integrator operational amplifier with $R = 100\,k\Omega$. What is the value of the capacitor C to get an output voltage of -40 mv at t=4 ms. Sketch the input and the output voltages.

5- The input signal shown in Figure is fed to a differentiator with $R = 1k\Omega$ and $C = 10\,\mu F$. Write expressions and draw the input and the output signals.



6- A LPF operational amplifier with $R_i = 5\,k\Omega$, $R_f = 10\,k\Omega$ and $C_f = 1nF$, is fed with a signal $v_i(t) = 10\cos(2\pi 5000t) + 15\cos((2\pi 16000t) + 5\cos((2\pi 50000t)$. Write an approximate expression for the output signal from the LPF operational amplifier. Calculate the gain in dB at frequency 1000 Hz. Comment on the result.

7- A HPF operational amplifier with $R_i = 5\,k\Omega, R_f = 10\,k\Omega$, and $C_i = 1nF$, is fed with a signal $v_i(t) = 10\cos(2\pi 100t) + 15\cos((2\pi 32000t) + 5\cos((2\pi 80000t)$. Write an approximate expression for the output signal from the HPF operational amplifier. Calculate the gain in dB at frequency 100 Hz. Comment on the result.