



**Arab Academy for Science & Technology and Maritime Transport**  
**College of Engineering and Technology**

**Department** : Electronics and Communications

**Course** : Electronic Measurements

**Course Code:** EC416

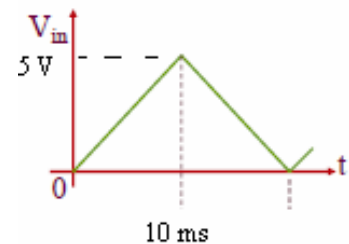
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## Problem Set #3

### 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  $1\text{ms} \leq t \leq 4\text{ms}$  and zero otherwise. This signal is fed to an integrator operational amplifier with  $R = 100\text{k}\Omega$ . What is the value of the capacitor  $C$  to get an output voltage of  $-40\text{mv}$  at  $t = 4\text{ms}$ . Sketch the input and the output voltages.
- 5- The input signal shown in Figure is fed to a differentiator with  $R = 1\text{k}\Omega$  and  $C = 10\mu\text{F}$ . Write expressions and draw the input and the output signals.



- 6- An input signal with 100 mV (dc) is amplified using an inverting operational amplifier followed by a non-inverting operational amplifier. The inverting operational amplifier has a resistance of  $20\text{k}\Omega$  and a feed back resistance of  $50\text{k}\Omega$ . The non-inverting operational amplifier has a resistance of  $10\text{k}\Omega$  and a feed back resistance of  $30\text{k}\Omega$ .
  - (a) Draw the connection.
  - (b) Calculate the total gain in dB.
  - (c) Calculate the input and output signal levels for each block.