

*Heaven's Light is Our Guide*

# Rajshahi University of Engineering & Technology



## Department of Electrical & Computer Engineering

Course No : ECE 4124

Course Title : Digital Signal Processing Sessional

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## Experiment No: 02

**Experiment Name:** Write code for convolution and plot the signal using MATLAB.

### Theory:

Convolution is a mathematical way of combining two signals to form a third signal. It is the single most important technique in Digital Signal Processing. Using the strategy of impulse decomposition, systems are described by a signal called the impulse response.

In linear systems, convolution is used to describe the relationship between three signals of interest: the input signal, the impulse response, and the output signal.

Circular convolution, also known as cyclic convolution, is a special case of periodic convolution, which is the convolution of two periodic functions that have the same period.

### Code:

#### Code for linear convolution:

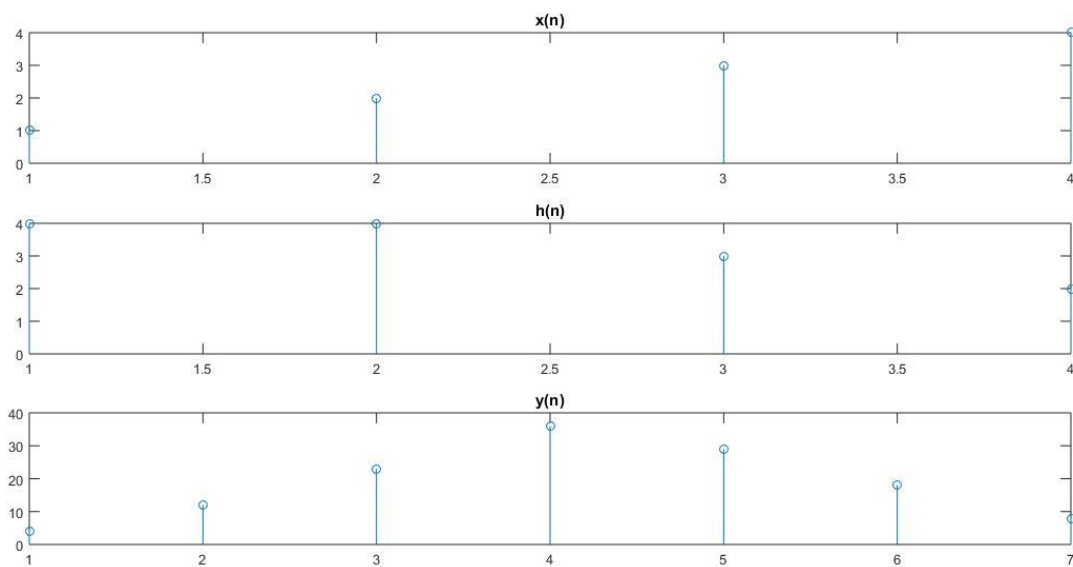
```
1. clc
2. clear all
3. xn = [1 2 3 4];
4. hn = [4 4 3 2];
5. L = length(xn);
6. M = length(hn);
7. X = [xn, zeros(1,L)];
8. H = [hn, zeros(1,M)];
9. for n = 1 : L+M-1
10.     y(n)=0;
11.     for i = 1 : L
12.         if(n-i+1>0)
13.             y(n) = y(n)+X(i)*H(n-i+1)
14.             %s (n) = H(n-i+1);
15.         end
16.     end
17. end
18. subplot(3,1,1)
19. stem (xn)
20. title('x(n)')
21. subplot(3,1,2)
22. stem (hn)
23. title('h(n)')
24. subplot(3,1,3)
25. stem (y)
26. title('y(n)')
```

### Code for circular convolution:

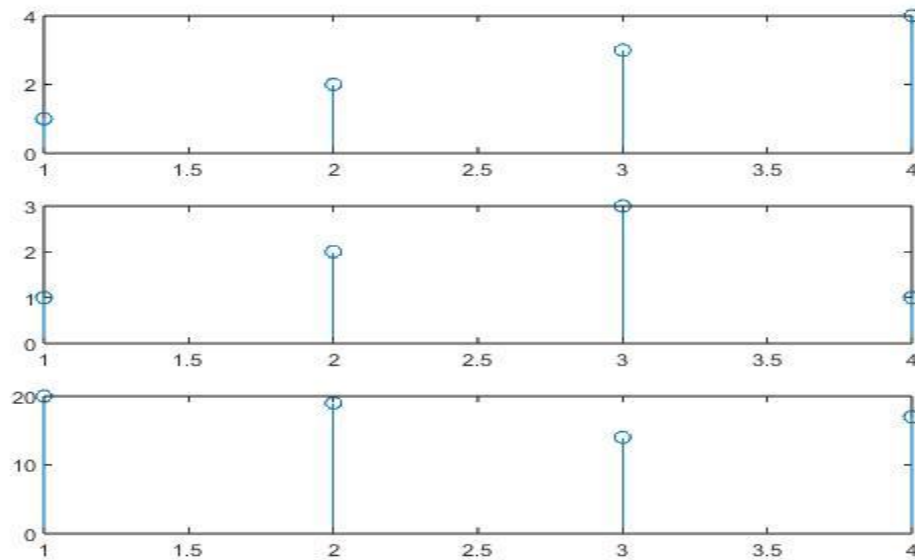
```
1. clc
2. clear all
3. x = [1 2 3 4];
4. h = [1 2 3 1];
5. N1 = length(x)
6. N2 = length(h)
7. N = max(N1, N2)
8. y = zeros(1,N)
9.
10.     for n = 0; N-1
11.         y(n+1)=0
12.         for k = 0; N-1
13.             j = mod(n-k,N)
14.             y(n+1)=y(n+1)+x(k+1)*h(j+1);
15.         end
16.     end
17.
18.     subplot(3,1,1)
19.     stem (x);
20.     subplot(3,1,2)
21.     stem (h);
22.     subplot(3,1,3)
23.     stem (y);
```

### Output:

#### Output for linear convolution:



### Output for circular convolution:



### Discussion:

In this experiment, we have implemented convolution in matlab. We have taken two discrete signals;  $x(n)$  &  $h(n)$ . Then kept one of them [ $x(n)$ ] standstill and moved another one [ $h(n)$ ] over the 1<sup>st</sup> one. That means by overlapping two discrete signals we have formed another signal. The process is called convolution. In circular convolution, the values of the second signal are changed circularly until they met all the combination.

**Conclusion:** The code was executed successfully and no errors were found.