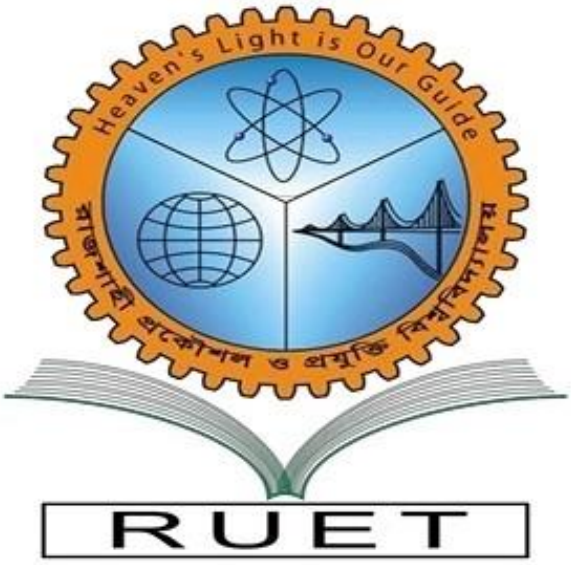
Rajshahi University of Engineering & Technology



Department of Electrical & Computer Engineering

LAB REPORT

Course No: ECE 4124

Course Title: Digital Signal Processing Sessional

Submitted To:
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Experiment Date: 30.04. 2023

Experiment No: 02

Name of the Experiment: Write a code for linear convolution and plot the signal using MATLAB.

Theory: In digital signal processing (DSP), convolution is a mathematical operation used to process signals by filtering them with a system's impulse response. It is a fundamental operation in DSP, used in various applications such as filtering, equalization, and signal analysis.Convolution involves multiplying two signals, usually the input signal and the impulse response of the system being modeled, and integrating the resulting product over time. The resulting output signal is a convolution of the two input signals. Mathematically, convolution is defined as:

$y[n] = x[n] * h[n] = \Sigma k\ x[k]\ h[n-k]$

where x[n] is the input signal, h[n] is the impulse response, y[n] is the output signal, and k is the summation index. Convolution in DSP can be performed using various methods, including direct summation, fast convolution using the FFT algorithm, and overlap-add and overlap-save methods.onvolution is a powerful tool in DSP because it allows us to model and analyze complex systems, and design filters to achieve desired signal

Code:

Code for linear convolution:

```
clc
clear all
close all
xn = [1 2 3 4];
hn = [4 4 3 2];
L = length(xn);
M = length(hn);
X = [xn, zeros(1,L)];
H = [hn, zeros(1,M)];
for n = 1 : L+M-1
y(n)=0;
for i = 1 : L
if(n-i+1>0)
y(n) = y(n)+X(i)*H(n-i+1)
%s (n) = H(n-i+1);
end
end
end
subplot(3,1,1)
```

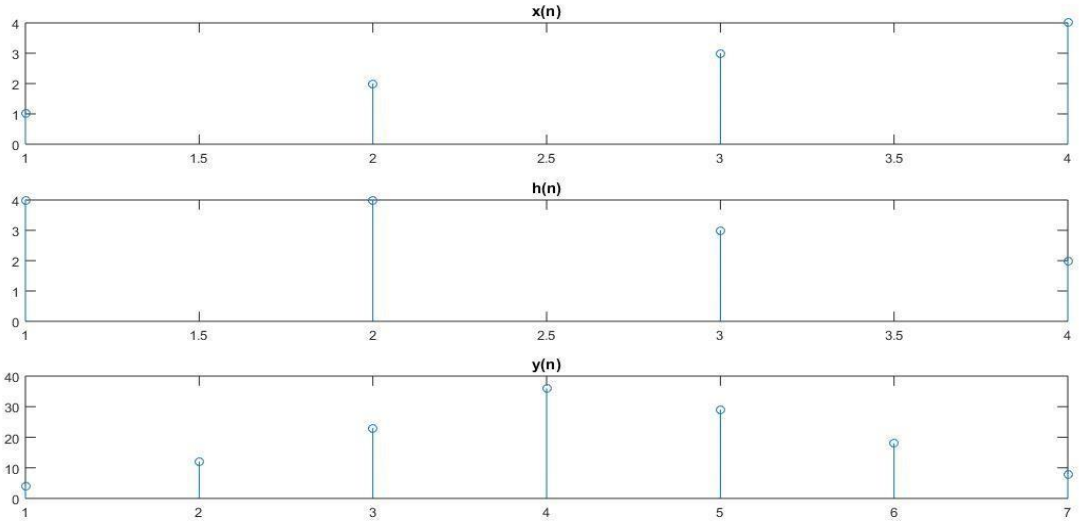
```
20.             stem (xn)
21.             title('x(n)')
22.             subplot(3,1,2)
23.             stem (hn)
24.             title('h(n)')
25.             subplot(3,1,3)
26.             stem (y)
27.             title('y(n)')
```

Output:

Output for linear convolution:

```
y =

     4    12    23    36    29    18     8
```



Discussion:

The implementation of linear convolution code using MATLAB involved the declaration of two 1x4 matrices and the use of the length function to obtain the length of the matrices. A nested for loop was then used, with the first loop running from 1 to L+M-1. In the second loop, an if condition was applied, with a formula written for the output based on this condition. After the for loop, the signal was plotted using MATLAB's subplot function, with the signal being discrete, the stem function was used for plotting.

Conclusion:

The code was executed successfully and no errors were found. Form this experiment, we had learned about linear convolution and how to plot the signal using MATALB.