EXPERIMENT NO : 7

AIM

To find circular convolution of two sequences and represent them in functions.

THEORY

The **circular convolution**, also known as **cyclic convolution**, of two aperiodic functions (i.e. Schwartz functions) occurs when one of them is convolved in the normal way with a periodic summation of the other function. That situation arises in the context of the Circular convolution theorem. The identical operation can also be expressed in terms of the periodic summations of both functions, if the infinite integration interval is reduced to just one period. That situation arises in the context of the discrete-time Fourier transform (DTFT) and is also called **periodic convolution**. In particular, the DTFT of the product of two discrete sequences is the periodic convolution of the DTFTs of the individual sequences.

Let x be a function with a well-defined periodic summation, x_T, where:

$$x_T(t) \stackrel{\text{def}}{=} \sum_{k=-\infty}^{\infty} x(t - kT) = \sum_{k=-\infty}^{\infty} x(t + kT).$$

If h is any other function for which the convolution $x_T * h$ exists, then the convolution $x_T * h$ is periodic and identical to**:**

$$\begin{aligned}(x_T * h)(t) &\stackrel{\text{def}}{=} \int_{-\infty}^{\infty} h(\tau) \cdot x_T(t - \tau)\, d\tau \\ &\equiv \int_{t_o}^{t_o+T} h_T(\tau) \cdot x_T(t - \tau)\, d\tau,\end{aligned}$$

where t_o is an arbitrary parameter and h_T is a periodic summation of h.

The second integral is called the **periodic convolution** of functions x_T and h_T and is sometimes normalized by $1/T$. When x_T is expressed as the periodic summation of another function, x, the same operation may also be referred to as a **circular convolution** of functions h and x.

MATLAB CODE

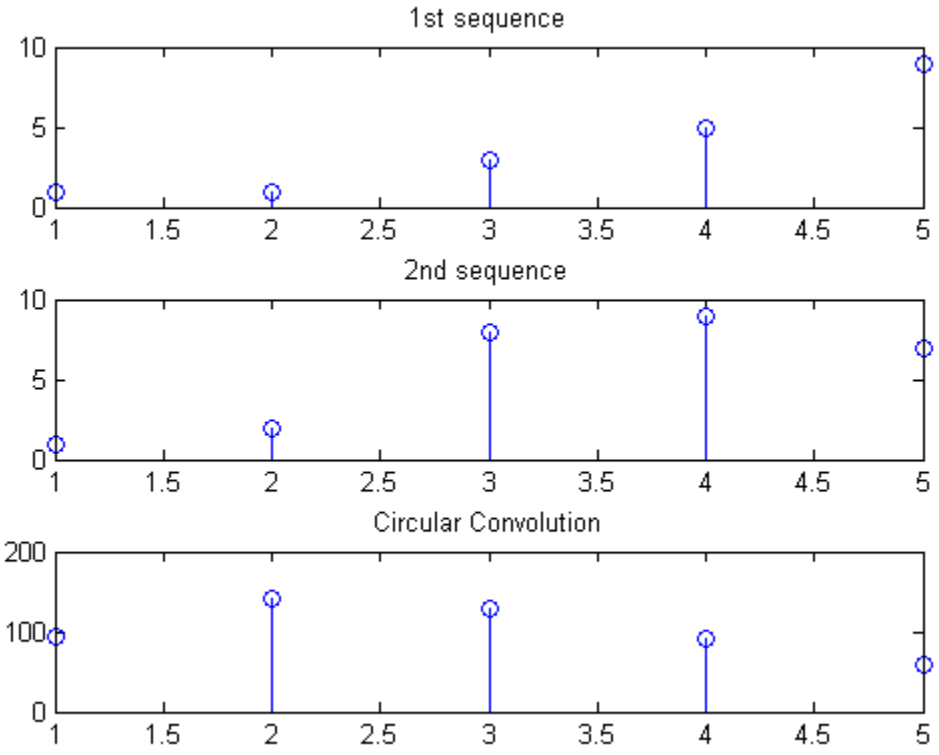
```
clc
clear all
x1= input('enter the 1st sequence ');
x2=input('enter the 2nds equence');
N1=length(x1);
N2=length(x2);
if N1~=N2
if N1>N2
x2=[x2 zeros(1,N1-N2)]
else
x1=[x1 zeros(1,N2-N1)]
end
end
N=length(x2);
x3(1)=x2(1);
x3(2:N)=fliplr(x2(2:N));
for j=1:N
sum=0;
x=circshift(x3,[1 (j-1)]);
for i=1:N
x4(i)=x1(i)*x(i);
sum=sum+x4(i)
end
result(j)=sum;
end
figure(1);
subplot(3,1,1)
```

```
stem(x1);
title('1st sequence')
subplot(3,1,2)
stem(x2);
title('2nd sequence')
subplot(3,1,3)
stem(result);
title('Circular Convolution')
```

INPUT: enter the 1 st sequence : [1 1 3 5 9]

enter the 2 nd sequence : [1 2 8 9 7]

OUTPUT



RESULT

The circular convolution of two sequences is found and represented.