**BASIC FUNCTIONS:**

clc;

clear all;

% Unit Impulse

n=-20:0.5:20;

x = [zeros(1,40) ones(1) zeros(1,40)];

subplot(311);

stem(n,x);

xlabel('n');

ylabel('value of function');

title('Unit Impulse Function Arya Kapoor Roll No. 101906158');

axis([-20 20 -0.5 1.5]);

grid on;

% Unit Step

y = [zeros(1,40) ones(1,41)];

subplot(312);

stem(n,y);

xlabel('n');

ylabel('value of function');

title('Unit Step Function Arya Kapoor Roll No. 101906158');

axis([-20 20 -0.5 1.5]);

grid on;

% Signum Function

n=-20:0.01:20;

z = [-1.\*ones(1,2000) zeros(1) ones(1,2000)];

subplot(313);

plot(n,z);

xlabel('n');

ylabel('value of function');

title('Signum Function Arya Kapoor Roll No. 101906158');

axis([-20 20 -1.5 1.5]);

grid on;

**% Generate a sine wave**

clc;

clear all;

close all;

A = input('Amplitude : ');

f = input('Frequency : ');

t = 0:0.01:5;

y = A\*sin(2\*pi\*f\*t);

subplot(211);

plot(t,y);

xlabel('Time(t)');

ylabel('Value of function');

title('Continous sine Wave Roll No. 101906158');

t = 0:0.05:5;

y = A\*sin(2\*pi\*f\*t);

subplot(212);

stem(t,y);

xlabel('Time(n)');

ylabel('Value of function');

title('Discrete sine Wave Roll No. 101906158');

% Amplitude : 1

% Frequency : 1

**SQUARE WAVE**

t = 0:.0001:.5;

y = square(2\*pi\*30\*t,50);

plot(t,y);

xlabel('t');

ylabel('value of function');

title('Square wave Function Arya Kapoor Roll No. 101906158');

axis([0 0.1 -1.5 1.5]);

grid on;

**LINEAR CONVOLUTION:**

clear all;

clc;

x = [2 4 6 8 10];

h = [2 4 6 8 10];

m=length(x);

n=length(h);

x = [x,zeros(1,n)];

h = [h,zeros(1,m)];

for i=1:n+m-1

    Y(i)=0;

    for j=1:m

        if (i-j+1)>0

            Y(i) = Y(i) + x(j)\*h(i-j+1);

        end

    end

end

stem(Y)%,'red')

xlabel('n')

ylabel('v[n]')

title('v[n]=x[n]\*h[n] Arya Kapoor Roll No. 101906158')

**LINEAR CONVOLUTION USING DFT AND IDFT:**

clc;

clear all;

xn = [1 3 5 7 8];

N= length(xn);

xk=zeros(1,N);

for k=0:(N-1);

for n=0:(N-1);

xk(k+1)=xk(k+1) +xn(n+1).\*exp((-j)\*2\*pi\*k\*n/N);

end

end

xk

subplot(2,2,1)

stem(abs(xk));

title('Magnitude 101906164');

subplot(2,2,2)

stem(angle(xk));

title('Phase 101906164');

%IDFTos(1,N);

xn=zeros(1,N);

for k=0:(N-1);

for n=0:(N-1);

xn(k+1)=xn(k+1) +xk(n+1).\*exp((j)\*2\*pi\*k\*n/N);

end

end

xn=xn./N

subplot(2,2,3)

stem(abs(xn));

title('Magnitude 101906164');

subplot(2,2,4)

stem(angle(xn));

title('Phase 101906164');

**CIRCULAR CONVOLUTION:**

clc;

clear all;

close all;

x = input('Input [x] : ');

h = input('Input [h] : ');

m = length(x);

n = length(h);

X = [x,zeros(1,n)];

H = [h,zeros(1,m)];

N = max(m,n);

for i=1:N

Y(i)=0;

for j=1:N

z=mod(i-j,N);

Y(i)=Y(i)+X(j)\*H(z+1);

end

end

Y

subplot(221)

stem(X);

grid on

title('Input Sequence-1 101906158');

xlabel('N');

ylabel('Magnitude');

subplot(222)

stem(H);

grid on

title('Input Sequence-2 101906158');

xlabel('N');

ylabel('Magnitude');

subplot(212)

stem(Y);

grid on

title('Circular Convolution 101906158');

xlabel('N');

ylabel('Magnitude');

**LINEAR USING CIRCULAR:**

clc;

clear all;

close all;

x = input('Input [x] : ');

h = input('Input [h] : ');

m = length(x);

n = length(h);

X = [x,zeros(1,n)];

H = [h,zeros(1,m)];

N = m+n-1;

for i=1:N

Y(i)=0;

for j=1:N

z=mod(i-j,N);

Y(i)=Y(i)+X(j)\*H(z+1);

end

end

Y

subplot(221)

stem(X);

grid on

title('Input Sequence-1 101906158');

xlabel('N');

ylabel('Magnitude');

subplot(222)

stem(H);

grid on

title('Input Sequence-2 101906158');

xlabel('N');

ylabel('Magnitude');

subplot(212)

stem(Y);

grid on

title('Output sequence 101906158');

xlabel('N');

ylabel('Magnitude');

**CIRCULAR USING LINEAR:**

clc;

clear all;

close all;

x = input('Enter first sequence : ');

h = input('Enter second sequence : ');

n = length(x);

m = length(h);

N = max(n,m);

l = n+m-1;

yk = conv(x,h);

x1 =[yk(1,1:N)];

x2 =[yk(1,N+1:length(yk))];

if length(x2)<length(x1)

x2 = [x2 zeros(1,length(x1)-length(x2))];

end

y = x1+x2;

subplot(221);

stem(x);

grid on

title("First sequence 101906158");

xlabel('n');

ylabel('x[n]');

subplot(222);

stem(h);

grid on

title("Second sequence 101906158");

xlabel('n');

ylabel('x[n]');

subplot(212);

stem(y);

grid on

title("Circular convolution using linear convolution 101906158");

xlabel('n');

ylabel('x[n]');

**CIRCULAR USING FDT IDFT METHOD:**

clc;

clear all;

close all;

x = input('Input [x] : ');

h = input('Input [h] : ');

m = length(x);

n = length(h);

N = max(m,n);

X = zeros(1,N);

H = zeros(1,N);

for k=1:N

for n=1:N

X(k) = X(k) + (x(n)\*exp(-j\*2\*pi\*(k-1)\*(n-1)/N));

H(k) = H(k) + (h(n)\*exp(-j\*2\*pi\*(k-1)\*(n-1)/N));

Z(k) = X(k)\*H(k);

end

end

a = zeros(1,N);

for s=1:N

for k=1:N

a(s) = a(s) + (Z(k)\*exp(j\*2\*pi\*(k-1)\*(s-1)/N)/N);

end

end

subplot(221)

stem(x)

grid on

title('Input Sequence-1 101906158');

xlabel('N');

ylabel('Magnitude');

subplot(222)

stem(h)

grid on

title('Input Sequence-2 101906158');

xlabel('N');

ylabel('Magnitude');

subplot(212)

stem(a)

grid on

title('Output sequence 101906158');

xlabel('N');

ylabel('Magnitude');

**WINDOWS:**

clc;

clear all;

close all;

N = input('Enter the size of window : ');

n = -(N-1)/2:(N-1)/2;

y = ones(1,N);

hann = @(n)0.5 + 0.5\*cos((2\*pi\*n)/(N-1));

a = fftshift(fft(hann(n),1000));

subplot(521)

plot(20\*log10(abs((a)/max(a))));

title('Hanning Window Frequency domain 101906158');

xlabel('Normalised frequency');

ylabel('Magnitude');

subplot(522)

stem(hann(n));

title('Hanning Window Time domain 101906158');

xlabel('time');

ylabel('amplitude');

hamm = @(n) 0.54 + 0.46\*cos(2\*pi\*n/(N-1));

a = fftshift(fft(hamm(n),1000));

subplot(523)

plot(20\*log10(abs((a)/max(a))));

title('Hamming Window Frequency domain 101906158');

xlabel('Normalised frequency');

ylabel('Magnitude');

subplot(524)

stem(n,hamm(n));

title('Hamming Window Time domain 101906158');

xlabel('time');

ylabel('amplitude');

for(i=1:length(n))

rect(i) = 1;

end

subplot(526)

stem(n,rect);

title('Rectangular Window Time domain 101906158');

xlabel('time');

ylabel('amplitude');

a = fftshift(fft(rect,1000));

subplot(525)

plot(20\*log10(abs((a)/max(a))));

title('Rectangular Window Frequency domain 101906158');

xlabel('Normalised frequency');

ylabel('Magnitude');

Blackmann = @(n) 0.42 + 0.5\*cos(2\*pi\*n/(N-1)) + 0.08\*cos(4\*pi\*n/(N-1));

a = fftshift(fft(Blackmann(n),1000));

subplot(527)

plot(20\*log10(abs((a)/max(a))));

title('Blackmann Window Frequency domain 101906158');

xlabel('Normalised frequency');

ylabel('Magnitude');

subplot(528)

stem(n,Blackmann(n));

title('Blackmann Window Time domain 101906158');

xlabel('time');

ylabel('amplitude');

n = 0:N-1;

bartlett = @(n) 1 - abs(2\*n-N+1)/(N-1);

a = fftshift(fft(bartlett(n),1000));

subplot(529)

plot(20\*log10(abs((a)/max(a))));

title('Bartlett Window Frequency domain 101906158');

xlabel('Normalised frequency');

ylabel('Magnitude');

subplot(5,2,10)

stem(n,bartlett(n));

title('Bartlett Window Time domain 101906158');

xlabel('time');

ylabel('amplitude');

**LPF USING RECTANGULAR:**

clc;

clear all;

close all;

% parameters

wp = input('Pass band frequency : ')%0.5\*pi;

ws = input('Stop band frequency : ')%0.75\*pi;

tr\_width = abs(ws - wp);

wc = (wp+ws)/2;

% Window Function

M = ceil(1.8\*pi/tr\_width)+1;

w\_n = (rectwin(M));

% Low Pass filter coefficients

n = -(M-1)/2 : (M-1)/2;

fc = wc/(2\*pi);

hd = 2\*fc\*(sinc(2\*fc\*n));

% Multiplication in time domain

h = hd.\*w\_n';

% Frequency response

[HW, WW] = freqz(h,1);

% Plots

subplot(221);

stem(n,w\_n);

title({'Arya Kapoor';'101906158';'Window Function (Rectangular)'});

xlabel('n');

ylabel('W[n]');

grid on;

subplot(222);

plot(n,w\_n);

title({'Arya Kapoor';'101906158';'Window Function (Rectangular)'});

xlabel('n');

ylabel('W[n]');

grid on;

subplot(212);

plot(WW./pi,abs(HW));

title({'Arya Kapoor';'101906158';'Low pass filter'});

xlabel('Normalized Frequency (\omega/\pi)');

ylabel('Magnitude Response of LPF |H(\omega)|');

grid on;

**LPF USING TRIANGULAR:**

clc;

clear all;

close all;

% parameters

wp = input('Pass band frequency : ')%0.5\*pi;

ws = input('Stop band frequency : ')%0.75\*pi;

tr\_width = abs(ws - wp);

wc = (wp+ws)/2;

% Window Function

M = ceil(1.8\*pi/tr\_width)+1;

w\_n = (bartlett(M));

% Low Pass filter coefficients

n = -(M-1)/2 : (M-1)/2;

fc = wc/(2\*pi);

hd = 2\*fc\*(sinc(2\*fc\*n));

% Multiplication in time domain

h = hd.\*w\_n';

% Frequency response

[HW, WW] = freqz(h,1);

% Plots

subplot(221);

stem(n,w\_n);

title({'Arya Kapoor';'101906158';'Window Function (Bartlett)'});

xlabel('n');

ylabel('W[n]');

grid on;

subplot(222);

plot(n,w\_n);

title({'Arya Kapoor';'101906158';'Window Function (Bartlett)'});

xlabel('n');

ylabel('W[n]');

grid on;

subplot(212);

plot(WW./pi,abs(HW));

title({'Arya Kapoor';'101906158';'Low pass filter'});

xlabel('Normalized Frequency (\omega/\pi)');

ylabel('Magnitude Response of LPF |H(\omega)|');

grid on;

**HPF USING HANNING:**

clc;

clear all;

close all;

% parameters

wp = input('Pass band frequency : ')%0.47\*pi;

ws = input('Stop band frequency : ')%0.51\*pi;

tr\_width = abs(ws - wp);

wc = (wp+ws)/2;

% Window Function

M = ceil(6.2\*pi/tr\_width)+1;

if (rem(M,2)==0)

M = M+1;

end

w\_n = (hann(M));

% Low Pass filter coefficients

n = -(M-1)/2 : (M-1)/2;

fc = wc/(2\*pi);

hd = -2\*fc\*(sinc(2\*fc\*n));

hd((M-1)/2+1) = 1-2\*fc;

% Multiplication in time domain

h = hd.\*w\_n';

% Frequency response

[HW, WW] = freqz(h,1);

% Plots

subplot(221);

stem(n,w\_n);

title({'Arya Kapoor';'101906158';'Window Function (Hanning)'});

xlabel('n');

ylabel('W[n]');

grid on;

subplot(222);

plot(n,w\_n);

title({'Arya Kapoor';'101906158';'Window Function (Hanning)'});

xlabel('n');

ylabel('W[n]');

grid on;

subplot(212);

plot(WW./pi,abs(HW));

title({'Arya Kapoor';'101906158';'High pass filter'});

xlabel('Normalized Frequency (\omega/\pi)');

ylabel('Magnitude Response of LPF |H(\omega)|');

grid on;

**HPF USING HAMMING:**

clc;

clear all;

close all;

% parameters

wp = input('Pass band frequency : ')%0.47\*pi;

ws = input('Stop band frequency : ')%0.51\*pi;

tr\_width = abs(ws - wp);

wc = (wp+ws)/2;

% Window Function

M = ceil(6.2\*pi/tr\_width)+1;

if (rem(M,2)==0)

M = M+1;

end

w\_n = (hamming(M));

% Low Pass filter coefficients

n = -(M-1)/2 : (M-1)/2;

fc = wc/(2\*pi);

hd = -2\*fc\*(sinc(2\*fc\*n));

hd((M-1)/2+1) = 1-2\*fc;

% Multiplication in time domain

h = hd.\*w\_n';

% Frequency response

[HW, WW] = freqz(h,1);

% Plots

subplot(221);

stem(n,w\_n);

title({'Arya Kapoor';'101906158';'Window Function (Hamming)'});

xlabel('n');

ylabel('W[n]');

grid on;

subplot(222);

plot(n,w\_n);

title({'Arya Kapoor';'101906158';'Window Function (Hamming)'});

xlabel('n');

ylabel('W[n]');

grid on;

subplot(212);

plot(WW./pi,abs(HW));

title({'Arya Kapoor';'101906158';'High pass filter'});

xlabel('Normalized Frequency (\omega/\pi)');

ylabel('Magnitude Response of LPF |H(\omega)|');

grid on;