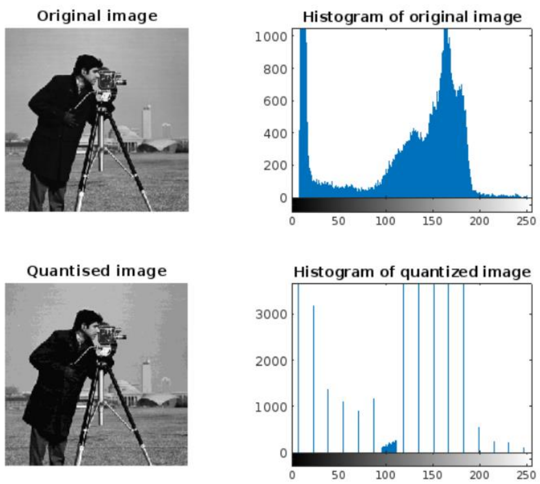
Practical 1

Aim : Image sampling and quantization

Code :

```
a=imread('cameraman.tif');
subplot(2,2,1)
imshow(a);
title('Original image');
subplot(2,2,2);
imhist(a);
title('Histogram of original image');
[m n]=size(a);
for i=1:1:m
for j=1:1:n
if a(i,j)<16 a(i,j)=7;
elseif a(i,j)>=16 && a(i,j)<32 a(i,j)=23;
elseif a(i,j)>=32 && a(i,j)<48 a(i,j)=39;
elseif a(i,j)>=48 && a(i,j)<64 a(i,j)=55;
elseif a(i,j)>=64 && a(i,j)<80 a(i,j)=71;
elseif a(i,j)>=80 && a(i,j)<96 a(i,j)=87;
elseif a(i,j)>=96 && a(i,j)<96 a(i,j)=103;
elseif a(i,j)>=112 && a(i,j)<128 a(i,j)=119;
elseif a(i,j)>=128 && a(i,j)<144 a(i,j)=135;
elseif a(i,j)>=144 && a(i,j)<160 a(i,j)=151;
elseif a(i,j)>=160 && a(i,j)<176 a(i,j)=167;
elseif a(i,j)>=176 && a(i,j)<192 a(i,j)=183;
elseif a(i,j)>=192 && a(i,j)<208 a(i,j)=199;
elseif a(i,j)>=208 && a(i,j)<224 a(i,j)=215;
elseif a(i,j)>=224 && a(i,j)<240 a(i,j)=231;
elseif a(i,j)>=240 && a(i,j)<256 a(i,j)=247;
end
end
end
subplot(2,2,3)
imshow(a);
title('Quantised image')
subplot(2,2,4)
imhist(a);
title('Histogram of quantized image')
```

output :



Practical 2

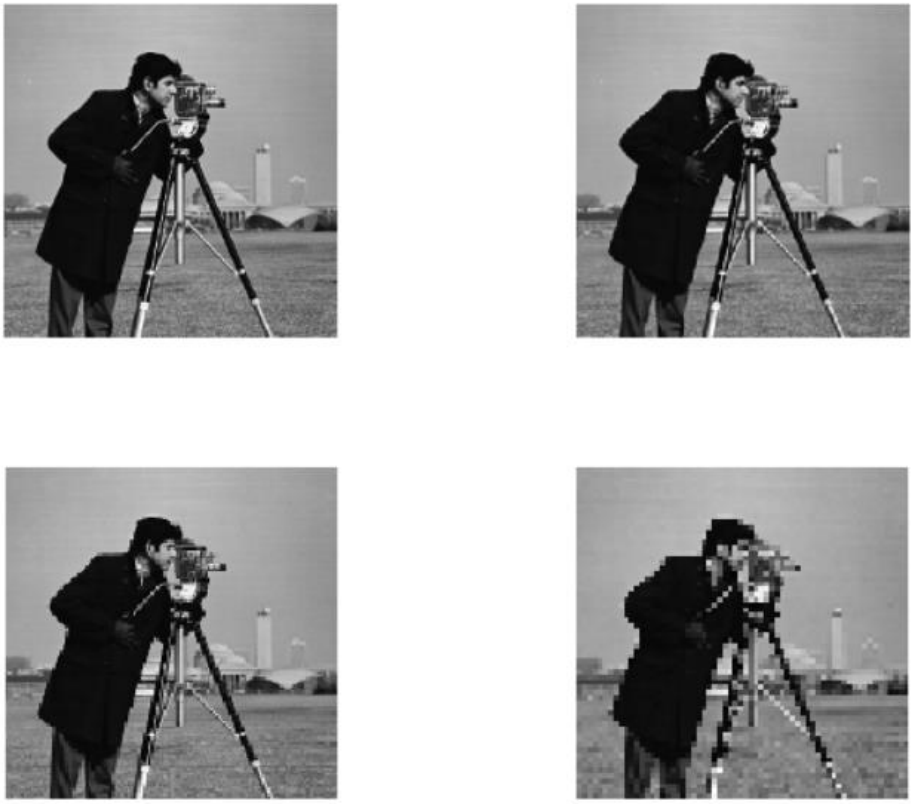
Aim : Analysis of special and intensity of resolution

Spacial resolution :

Code :

```
z=imread('cameraman.tif');
z=imresize(z,[1024,1024]);
[r c]=size(z);
l=1;
for i=1:2:r
k=1;
for j=1:2:c
a(l,k)=z(i,j);
k=k+1;
end
l=l+1;
end
l=1;
for i=1:4:r
k=1;
for j=1:4:c
b(l,k)=z(i,j);
k=k+1;
end
l=l+1;
end
l=1;
for i=1:8:r
k=1;
for j=1:8:c
e(l,k)=z(i,j);
k=k+1;
end
l=l+1;
end
l=1;
for i=1:16:r
k=1;
for j=1:16:c
d(l,k)=z(i,j);
k=k+1;
end
l=l+1;
end
subplot(2,2,1),imshow(a)
subplot(2,2,2),imshow(b)
subplot(2,2,3),imshow(e)
subplot(2,2,4),imshow(d)
```

output :



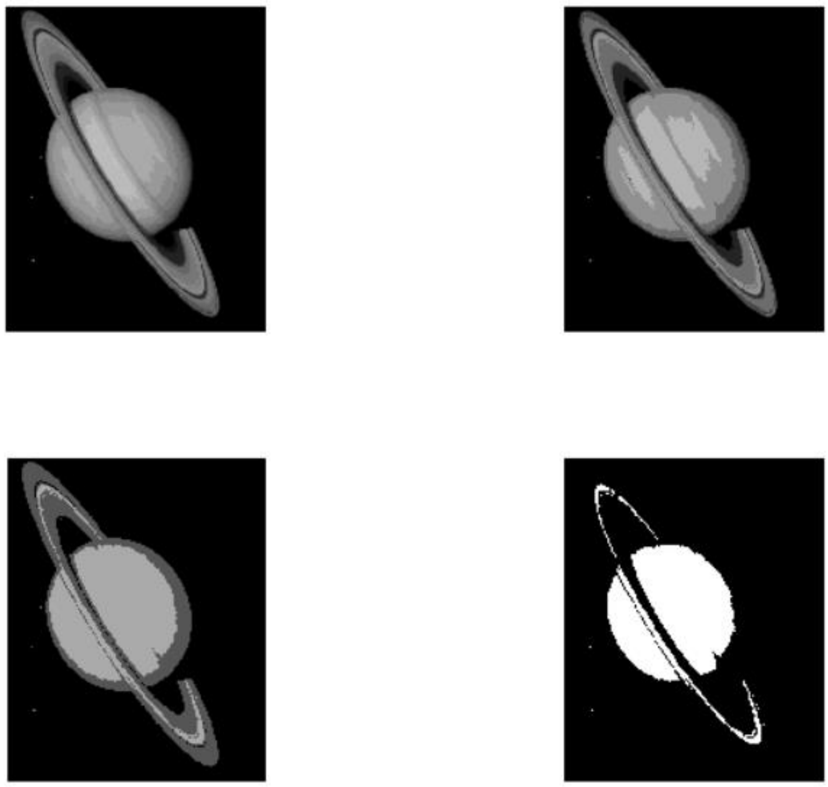
Intensity resolution

Code :

```
% Reading the image and converting it to a gray-level image.
I=imread('saturn.png');
I=rgb2gray(I);
% A 256 gray-level image:
[I256,map256]=gray2ind(I,256);
subplot(2,2,1);
imshow(I256,map256);
% A 128 gray-level image:
[I128,map128]=gray2ind(I,128);
subplot(2,2,2);
imshow(I128,map128);
% A 64 gray-level image:
[I64,map64]=gray2ind(I,64)
subplot(2,2,3);
imshow(I64,map64);
% A 32 gray-level image:
[I32,map32]=gray2ind(I,32);
subplot(2,2,4);
imshow(I32,map32);
% A 16 gray-level image:
[I16,map16]=gray2ind(I,16);
```

```
figure,
subplot(2,2,1);
imshow(I16,map16);
% A 8 gray-level image:
[I8,map8]=gray2ind(I,8);
subplot(2,2,2);
imshow(I8,map8);
% A 4 gray-level image:
[I4,map4]=gray2ind(I,4);
subplot(2,2,3);
imshow(I4,map4);
% A 2 gray-level image:
[I2,map2]=gray2ind(I,2);
subplot(2,2,4);
imshow(I2,map2);
```

Output :



Practical 3

Aim : Information transformation of images

1. photographic negative

Code :

```
I=imread('cameraman.tif');
imshow(I)
J=imcomplement(I);
figure, imshow(J)
```

Output :

2. Gamma transformation

Code :

```
I=imread('tire.tif');
subplot(2,2,1);
imshow(I)
J=imadjust(I,[],[],1);
J2=imadjust(I,[],[],3);
J3=imadjust(I,[],[],0.4);
subplot(2,2,2);
imshow(J);
subplot(2,2,3);
imshow(J2);
subplot(2,2,4);
imshow(J3);
```

output :

3. Logarithmic transformation

Code :

```
tire = imread('tire.tif');
d = im2double(tire);
figure, imshow(d);
%log on domain [0,1]
f = d;
c = 1/log(1+1);
j1 = c*log(1+f);
figure, imshow(j1);
%log on domain [0, 255]
f = d*255;
c = 1/log(1+255);
j2 = c*log(1+f);
figure, imshow(j2);
%log on domain [0, 2^16]
f = d*2^16;
c = 1/log(1+2^16);
j3 = c*log(1+f);
figure, imshow(j3);
```

Output :

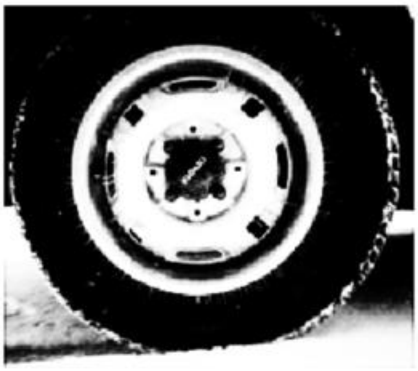
4. Contrast stretching with changing E

Code :

```
I=imread('tire.tif');
I2=im2double(I);
m=mean2(I2)
contrast1=1./(1+(m./(I2+eps)).^4);
contrast2=1./(1+(m./(I2+eps)).^5);
contrast3=1./(1+(m./(I2+eps)).^10);
imshow(I2)
figure,imshow(contrast1)
figure,imshow(contrast2)
figure,imshow(contrast3)
```

Output :



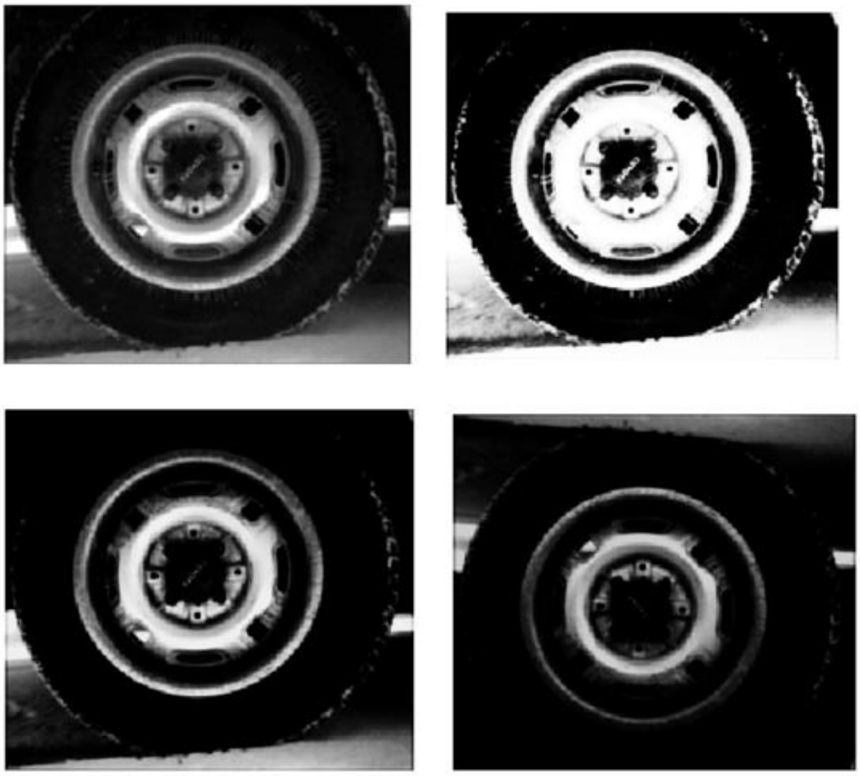



5. Contrast stretching with changing m

Code :

```
I=imread('tire.tif');
I2=im2double(I);
contrast1=1./(1+(0.2./(I2+eps)).^4)
contrast2=1./(1+(0.5./(I2+eps)).^4);
contrast3=1./(1+(0.7./(I2+eps)).^4);
imshow(I2)
figure,imshow(contrast1)
figure,imshow(contrast2)
figure,imshow(contrast3)
```

Output :



Practical 4

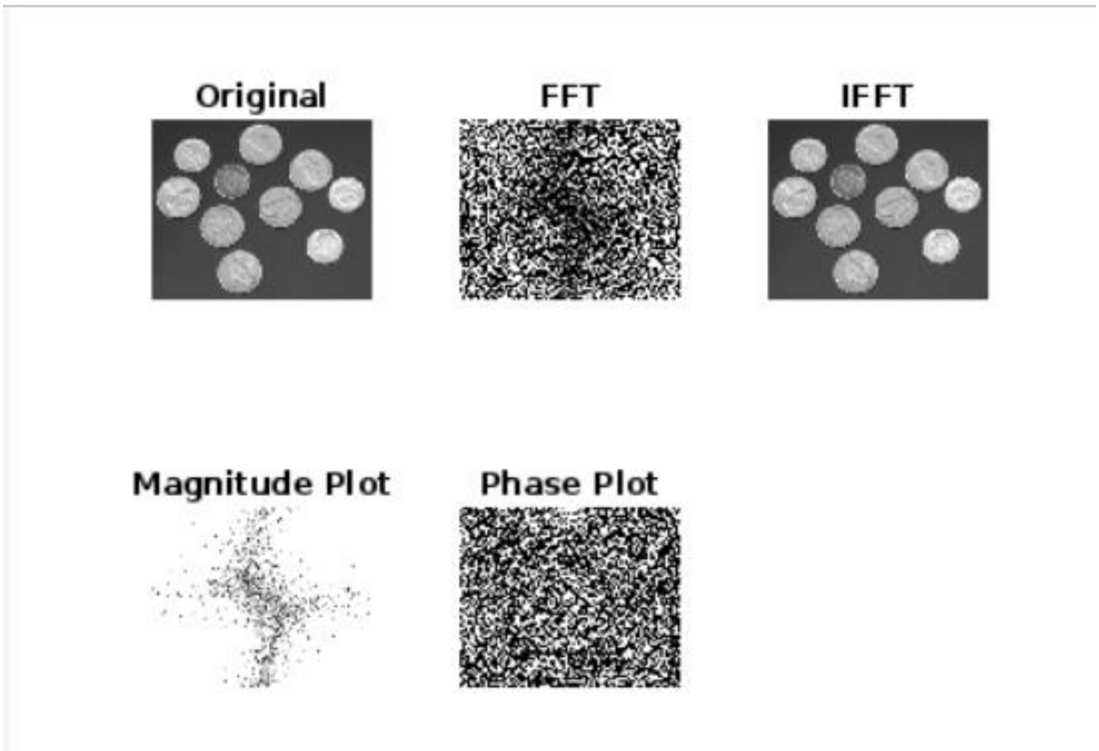
Aim : DFT

analysis of image

Code :

```
a=imread('coins.png');
subplot(2,3,1);
imshow(a);
title('Original');
b=im2double(a);
c=fft2(b);
subplot(2,3,2);
imshow(c);
title('FFT');
d=ifft2(c);
subplot(2,3,3);
imshow(d);
title('IFFT');
mag=abs(c);
subplot(2,3,4);
imshow(mag);
title('Magnitude Plot');
ang=angle(c);
subplot(2,3,5);
imshow(ang);
title('Phase Plot');
```

Output :

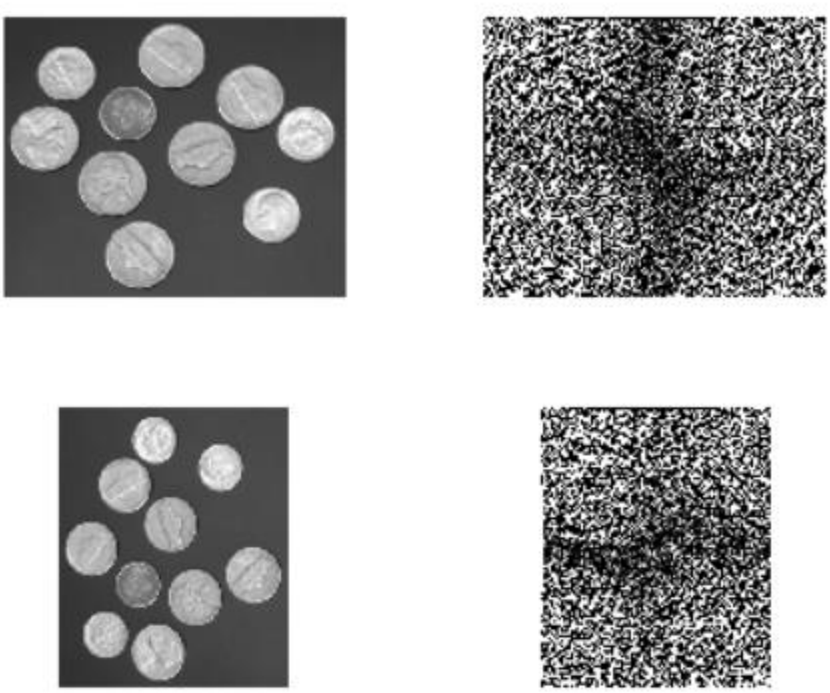


2. Rotation property

Code :

```
a=imread('coins.png');
subplot(2,2,1);
imshow(a);
a1=im2double(a);
b=fft2(a1);
subplot(2,2,2);
imshow(b);
c=imrotate(a1,90);
subplot(2,2,3);
imshow(c);
d=fft2(c);
subplot(2,2,4);
imshow(d);
```

Output :



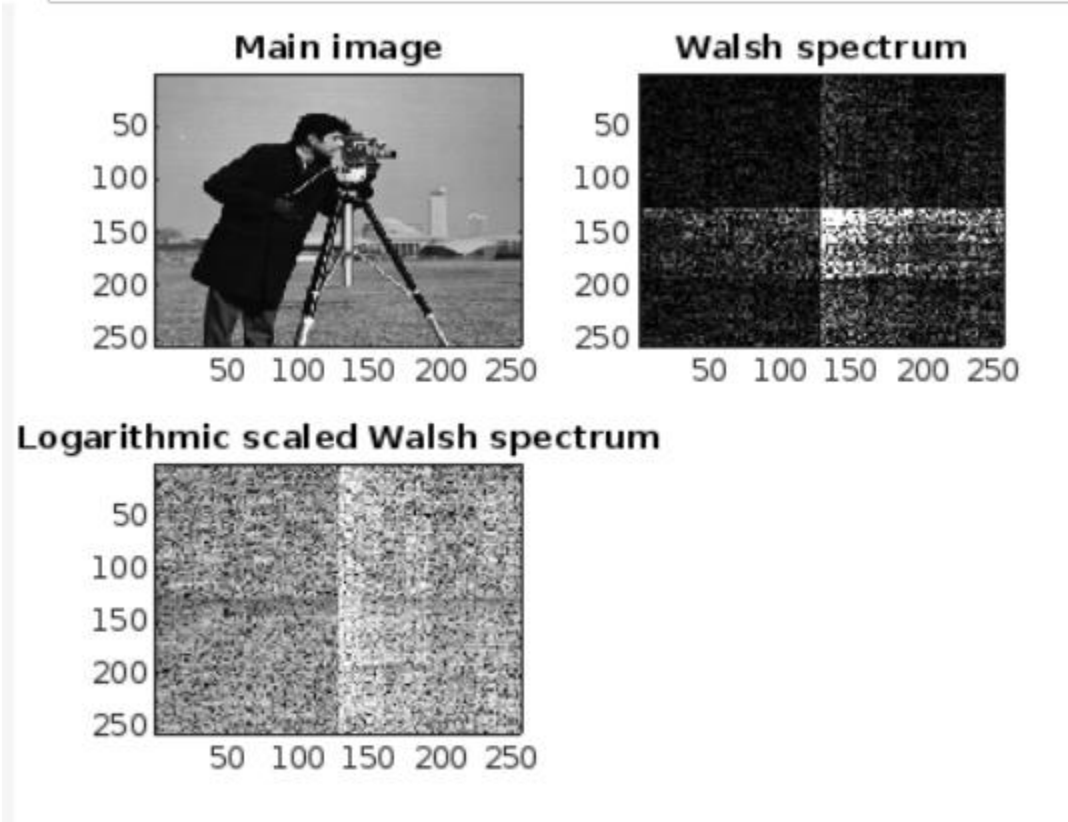
Practical 5

Aim : Walsh transformation

Code :

```
% Getting the name and extension of the image file from the user.
a=imread('cameraman.tif');
N=length(a);
% Computing Walsh Transform of the image file.
n=log2(N);
n=1+fix(n);
f=ones(N,N);
for x=1:N;
for u=1:N
p=dec2bin(x-1,n);
q=dec2bin(u-1,n);
for i=1:n;
f(x,u)=f(x,u)*((-1)^(p(n+1-i)*q(i)));
end;
end;
end;
F=(1/N)*f*double(a)*f;
% Shifting the Fourier spectrum to the center of the frequency square.
for i=1:N/2; for j=1:N/2
G(i+N/2,j+N/2)=F(i,j);
end;
end
for i=N/2+1:N;
for j=1:N/2
G(i-N/2,j+N/2)=F(i,j);
end;
end
for i=1:N/2;
for j=N/2+1:N
G(i+N/2,j-N/2)=F(i,j);
end;
end
for i=N/2+1:N;
for j=N/2+1:N;
G(i-N/2,j-N/2)=F(i,j);
end;
end;
% Computing and scaling the logarithmic Walsh spectrum.
H=log(1+abs(G));
for i=1:N
H(i,:)=H(i,:)*255/abs(max(H(i,:)));
end
% Changing the color map to gray scale (8 bits).
colormap(gray(255));
% Showing the main image and its Walsh spectrum.
subplot(2,2,1),image(a),title('Main image');
subplot(2,2,2),image(abs(G)),title('Walsh spectrum');
subplot(2,2,3),image(H),title('Logarithmic scaled Walsh spectrum');
```

Output :



b. Hadamard transformation

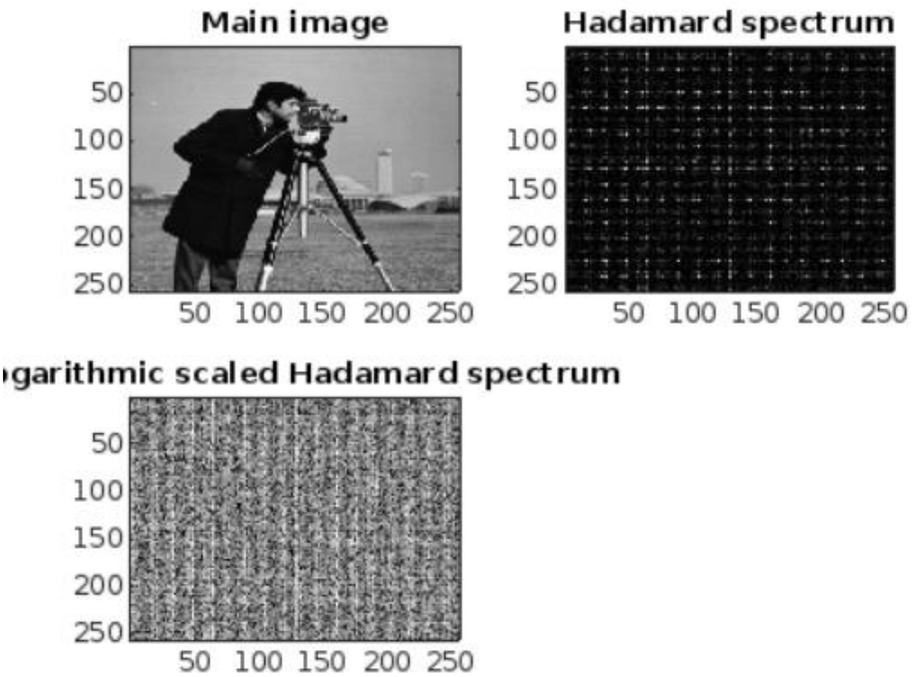
code :

```
% Getting the name and extension of the image file from the user
a=imread('cameraman.tif');
N=length(a);
%Computing Hadamard Transform of the image file
n=log2(N);
n=1+fix(n);
f=ones(N,N);
for x=1:N;
for u=1:N
p=dec2bin(x-1,n);
q=dec2bin(u-1,n);
for i=1:n;
f(x,u)=f(x,u)*((-1)^(p(n+1-i)*q(n+1-i)));
end;
end;
end;

F=(1/N)*f*double(a)*f;
% Shifting the Fourier spectrum to the center of the frequency square.
```

```
for i=1:N/2;
for j=1:N/2
G(i+N/2,j+N/2)=F(i,j);
end;
end
for i=N/2+1:N;
for j=1:N/2
G(i-N/2,j+N/2)=F(i,j);
end;
end
for i=1:N/2;
for j=N/2+1:N
G(i+N/2,j-N/2)=F(i,j);
end;
end
for i=N/2+1:N;
for j=N/2+1:N;
G(i-N/2,j-N/2)=F(i,j);
end;
end;
% Computing and scaling the logarithmic Hadamard spectrum.
H=log(1+abs(G));
for i=1:N
H(i,:)=H(i,:)*255/abs(max(H(i,:)));
end
% Changing the color map to gray scale (8 bits).
colormap(gray(255));
% Showing the main image and its Hadamard spectrum.
subplot(2,2,1),image(a),title('Main image');
subplot(2,2,2),image(abs(G)),title('Hadamard spectrum');
subplot(2,2,3),image(H),title('Logarithmic scaled Hadamard spectrum');
```

Output :

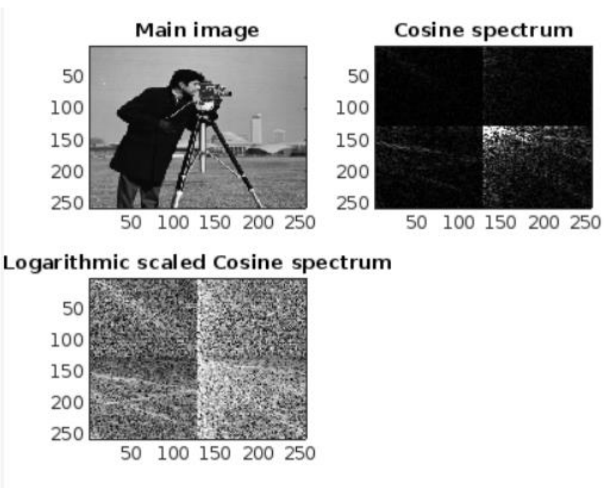


c. descrete consine transformation

code :

```
a=imread('cameraman.tif');
N=length(a);
F=dct2(double(a));
% Shifting the Fourier spectrum to the center of the frequency square.
for i=1:N/2;
for j=1:N/2
G(i+N/2,j+N/2)=F(i,j);
end;
end
for i=N/2+1:N;
for j=1:N/2
G(i-N/2,j+N/2)=F(i,j);
end;
end
for i=1:N/2;
for j=N/2+1:N
G(i+N/2,j-N/2)=F(i,j);
end;
end
for i=N/2+1:N;
for j=N/2+1:N;
G(i-N/2,j-N/2)=F(i,j);
end;
end;
% Computing and scaling the logarithmic Cosine spectrum.
H=log(1+abs(G));
for i=1:N
H(i,:)=H(i,:)*255/abs(max(H(i,:)));
end
% Changing the color map to gray scale (8 bits).
colormap(gray(255));
% Showing the main image and its Cosine spectrum.
subplot(2,2,1),image(a),title('Main image');
subplot(2,2,2),image(abs(G)),title('Cosine spectrum');
subplot(2,2,3),image(H),title('Logarithmic scaled Cosine spectrum');
```

output :

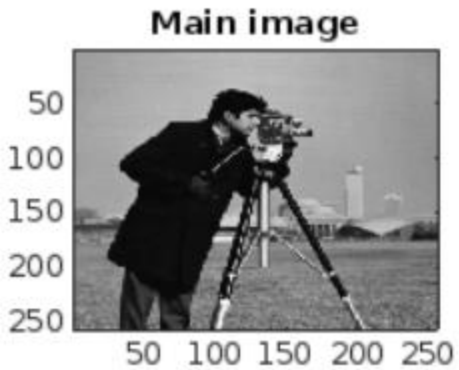


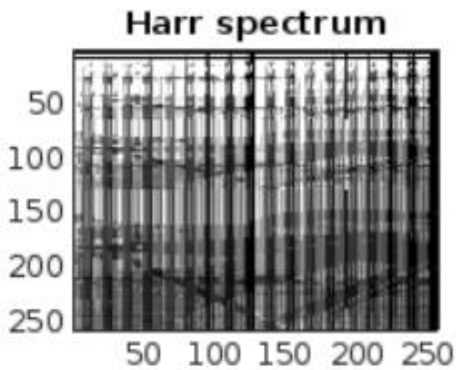
d. Farr transformation

code :

```
a=imread('cameraman.tif');
N=length(a);
for i=1:N;
p=fix(log2(i));
q=i-(2^p);
for j=1:N
z=(j-1)/N;
if(z>=(q-1)/(2^p))&&(z<(q-1/2)/2^p)
f(i,j)=(1/(sqrt(N)))*(2^(p/2));
elseif(z>=(q-1)/(2^p))&&(z<(q/2)/2^p)
f(i,j)=(1/(sqrt(N)))*(-2^(p/2));
else f(i,j)=0;
end;
end;
end;
F=f*double(a)*f
% Changing the color map to gray scale (8 bits).
colormap(gray(255));
% Showing the main image and its Harr spectrum.
subplot(2,2,1),image(a),title('Main image');
subplot(2,2,2),image(abs(F)),title('Harr spectrum');
```

Output :





Practical 6

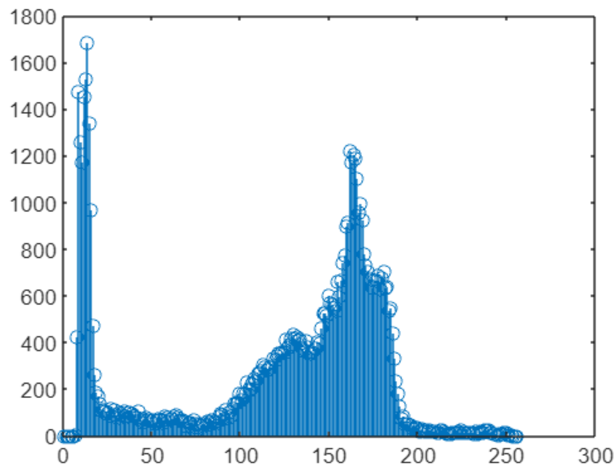
Aim : To study the histogram and histogram equalization

Histogram without inbuilt function

Code :

```
histo=zeros(1,256);
I=imread('cameraman.tif');
imshow(I);
si=size(I);
for i=1:si(1)
for j=1:si(2)
for g=1:256
if I(i,j)==g
histo(g)=histo(g)+1;
end
end
end
end
figure,stem(histo)
```

Output :

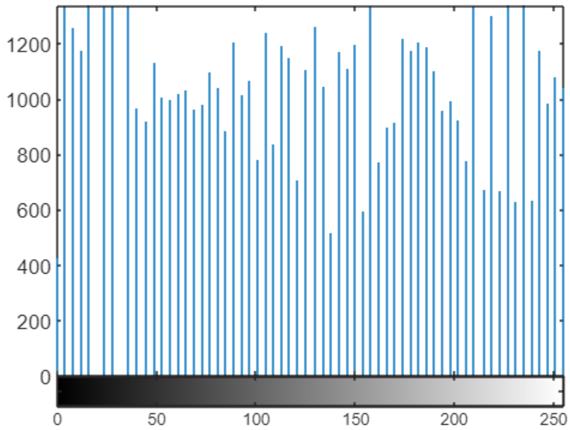


2. histogram equalization

Code :

```
I=imread('cameraman.tif');
a=histeq(I);
imshow(a);
figure,imhist(a)
```

Output :



Practical 7

Aim : To perform image enhancement by spacial filtering

a. Average

Code :

```
i=imread('cameraman.tif');
imshow(i);
w=fspecial('average',[3 3]);
g=imfilter(i,w,'symmetric');
figure,imshow(g,[])
```

Output :

b. Guassian

code :

```
i=imread('cameraman.tif');
w=fspecial('gaussian',[3 3],0.5);
g=imfilter(i,w,'symmetric');
imshow(g,[])
```

Output :

c. Laplacian

Code :

```
i=imread('cameraman.tif');
w=fspecial('laplacian', 0.5);
g=imfilter(i,w,'symmetric');
imshow(g,[])
```

Output :

d. sobel

Code :

```
i=imread('cameraman.tif');
w=fspecial('sobel');
g=imfilter(i,w,'symmetric');
imshow(g,[])
```

Output :

e. non linear order static filter

Code :

```
i=imread('cameraman.tif');
h=ordfilt2(i,1,ones(3,3));
h1=ordfilt2(i,3*3,ones(3,3));
h2=ordfilt2(i,median(1:3*3),ones(3,3));
subplot(2,2,1)
imshow(i);
subplot(2,2,2)
imshow(h,[]);
subplot(2,2,3)
imshow(h1,[]);
subplot(2,2,4)
imshow(h2,[]);
```

Output :

f. Median filter

Code :

```
g=imread('cameraman.tif');
m=medfilt2(g,[3 3]);
imshow(m,[]);
```

Output :

Practical 8

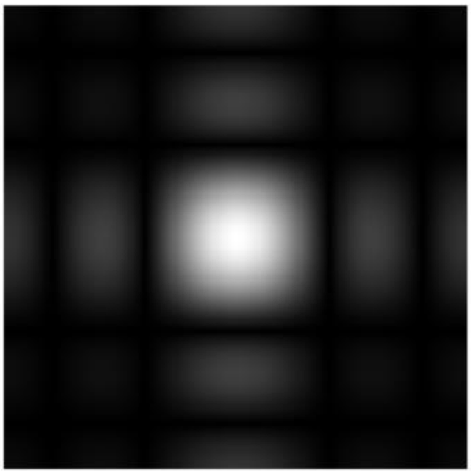
Aim : To obtain frequency domain filters from spacial domain

a. average

code :

```
f=imread('cameraman.tif');
h=fspecial('average',[5 5]);
Fs=size(f);
F=fft2(f);
H=freqz2(h,Fs(1),Fs(2));
G=F.*H;
g=ifft2(G);
imshow(real(g),[]);
figure,imshow(abs(H));
```

Output :

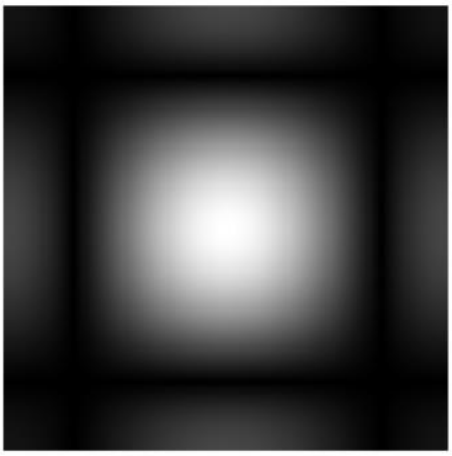


b. Guassian

Code :

```
f=imread('cameraman.tif');
h=fspecial('gaussian',[3 3],2);
Fs=size(f);
F=fft2(f);
H=freqz2(h,Fs(1),Fs(2));
G=F.*H;
g=ifft2(G);
imshow(real(g),[]);
figure,imshow(abs(H));
```

Output :

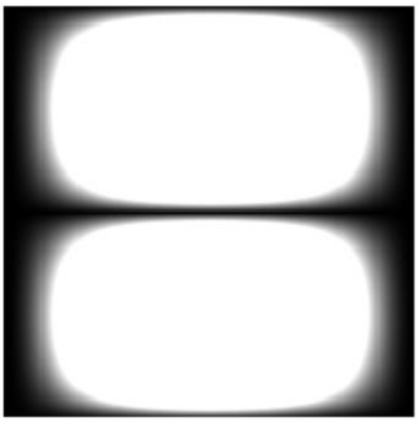


c. sobel

code :

```
f=imread('cameraman.tif');
h=fspecial('sobel');
Fs=size(f);
F=fft2(f);
H=freqz2(h,Fs(1),Fs(2));
G=F.*H;
g=ifft2(G);
imshow(real(g),[]);
figure,imshow(abs(H));
```

Outupt :



4b. To generate filters directly in the frequency domain’

a. Butterworth LowPass filter

code :

```
clear;
clc;
img=imread('Coins.png');
[X,Y]=size(img);
N=input('Order of Filter=');
x=ceil(X/2);
y=ceil(Y/2);
rad=26;
for i=1:X
for j=1:Y
d(i,j)=sqrt((i-x).^2+(j-y).^2);
h(i,j)=1/(1+((d(i,j))/rad).^(2*N));
end
end
fft1=fftshift(fft2(img));
fil=h.*fft1;
fin=ifft2(fil);
fin1=uint8(fin);
subplot(2,2,1);
imshow(img);
title('Original');
subplot(2,2,2);
imshow(fin1);
title('After LPF');
subplot(2,2,3);
surf(h);
title('LPF in 3D');
subplot(2,2,4);
imshow(h);
title('LPF as Image');
```

b. Butterworth high pass :

Code :

```
clear;
clc;
img=imread('Coins.png');
[X,Y]=size(img);
N=input('Order of Filter=');
x=ceil(X/2);
y=ceil(Y/2);
rad=26;
for i=1:X
for j=1:Y
d(i,j)=sqrt((i-x).^2+(j-y).^2);
h(i,j)=1/(1+(rad/d(i,j)).^(2*N));
end
end
```

```
fft1=fftshift(fft2(img));
fil=h.*fft1;
fin=ifft2(fil);
fin1=uint8(fin);
subplot(2,2,1);
imshow(img);
title('Original');
subplot(2,2,2);
imshow(fin1);
title('After HPF');
subplot(2,2,3);
surf(h);
title('HPF in 3D');
subplot(2,2,4);
imshow(h);
title('HPF as Image');
```

C . Guassian low pass :

Code :

```
clear;
clc;
img=imread('Coins.png');
[X,Y]=size(img);
N=input('Order of Filter=');
x=ceil(X/2);
y=ceil(Y/2);
rad=26;
for i=1:X
for j=1:Y
d(i,j)=sqrt((i-x).^2+(j-y).^2);
h(i,j)=exp(-(d(i,j).^2)/(2*((rad).^2)));
end
end
fft1=fftshift(fft2(img));
fil=h.*fft1;
fin=ifft2(fil);
fin1=uint8(fin);
subplot(2,2,1);
imshow(img);
title('Original');
subplot(2,2,2);
imshow(fin1);
title('After Gaussian LPF');
subplot(2,2,3);
surf(h);
title('Gaussian LPF in 3D');
subplot(2,2,4);
imshow(h);
title('Gaussian LPF as Image');
```

d. Gussian high pass filter :

code :

```
clear;
clc;
img=imread('Coins.png');
[X,Y]=size(img);
N=input('Order of Filter=');
x=ceil(X/2);
y=ceil(Y/2);
rad=26;
for i=1:X
for j=1:Y
d(i,j)=sqrt((i-x).^2+(j-y).^2);
h(i,j)=1-exp(-(d(i,j).^2)/(2*((rad).^2)));
end
end
fft1=fftshift(fft2(img));
fil=h.*fft1;
fin=ifft2(fil);
fin1=uint8(fin);
subplot(221);
imshow(img);
title('Original');
subplot(2,2,2);
imshow(fin1);
title('After Gaussian HPF');
subplot(2,2,3);
surf(h);
title('Gaussian HPF in 3D');
subplot(2,2,4);
imshow(h);
title('Gaussian HPF as Image');
```

e. Ideal Low Pass filter :

Code :

```
clear;
clc;
img=imread('Coins.png');
[X,Y]=size(img);
N=input('Order of Filter=');
x=ceil(X/2);
y=ceil(Y/2);
rad=26;
for i=1:X
for j=1:Y
d(i,j)=sqrt((i-x).^2+(j-y).^2);
h(i,j)=double(d(i,j)<=rad);
end
end
fft1=fftshift(fft2(img));
fil=h.*fft1;
fin=ifft2(fil);
fin1=uint8(fin);
```

```
subplot(2,2,1);
imshow(img);
title('Original');
subplot(2,2,2);
imshow(fin1);
title('After LPF');
subplot(2,2,3);
surf(h);
title('LPF in 3D');
subplot(2,2,4);
imshow(h);
title('LPF as Image');
```

f. Ideal high pass filter :

Code :

```
clear;
clc;
img=imread('Coins.png');
[X,Y]=size(img);
N=input('Order of Filter=');
x=ceil(X/2);
y=ceil(Y/2);
rad=26;
for i=1:X
for j=1:Y
d(i,j)=sqrt((i-x).^2+(j-y).^2);
h(i,j)=double(d(i,j)>rad);
end
end
fft1=fftshift(fft2(img));
fil=h.*fft1;
fin=ifft2(fil);
fin1=uint8(fin);
subplot(2,2,1);
imshow(img);
title('Original');
subplot(2,2,2);
imshow(fin1);
title('After HPF');
subplot(2,2,3);
surf(h);
title('HPF in 3D');
subplot(2,2,4);
imshow(h);
title('HPF as Image');
```