## Problem 2

for this problem I have used a picrture of a window curtain with some kind of pattern .

Neccessary library imports for this problem . I will use numpy, math and pandas as the previus problem.

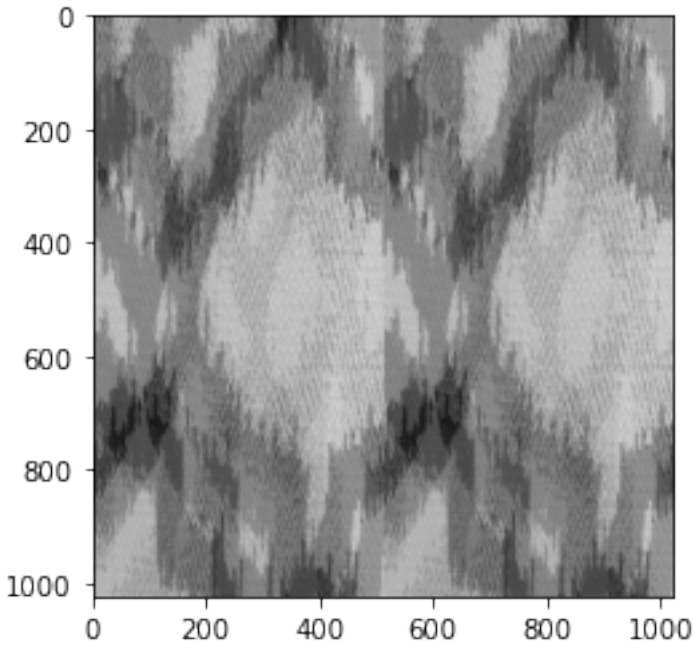
```
import math
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
%load_ext pycodestyle_magic
%pycodestyle_on
```

```
The pycodestyle_magic extension is already loaded. To reload it, use:
  %reload_ext pycodestyle_magic
```

I will also use PIL is the Python Imaging Library , I have taken the example from G4G

```
from PIL import Image, ImageOps
bilayer = np.array(ImageOps.grayscale(Image.open('2d_fft.jpeg')))
bilayer = np.resize(bilayer, [1024, 1024])
plt.imshow(bilayer, "gray")
bilayer.shape
```

```
(1024, 1024)
```



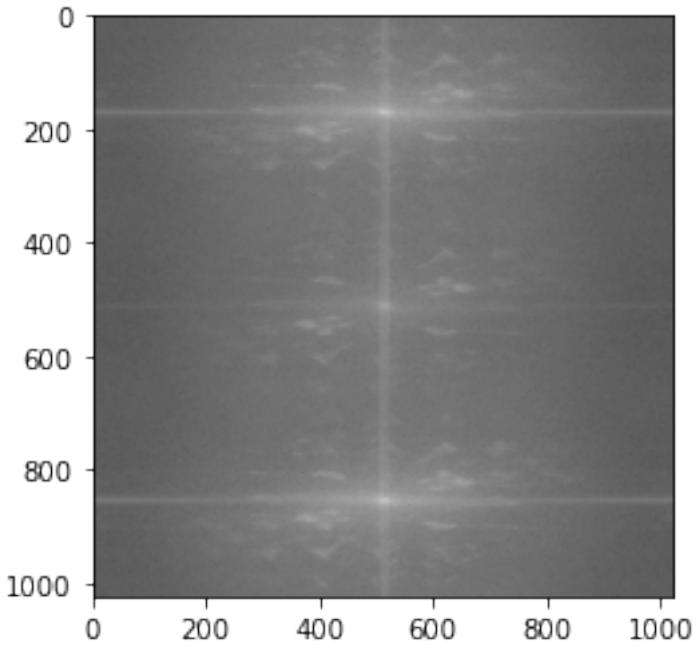

This is the Original picture taken by my phone. I have resized it as 1024/ 1024 so that I can use it for fft.

## FFT of the image

I am using numpy fft for this transfor.

```
Fbilayer = np.fft.fft2(bilayer)
Fbilayercenter = np.fft.fftshift(Fbilayer)
plt.imshow(np.log(1+np.abs(Fbilayercenter)), "gray")
```

```
<matplotlib.image.AxesImage at 0xffff74e73c40>
```

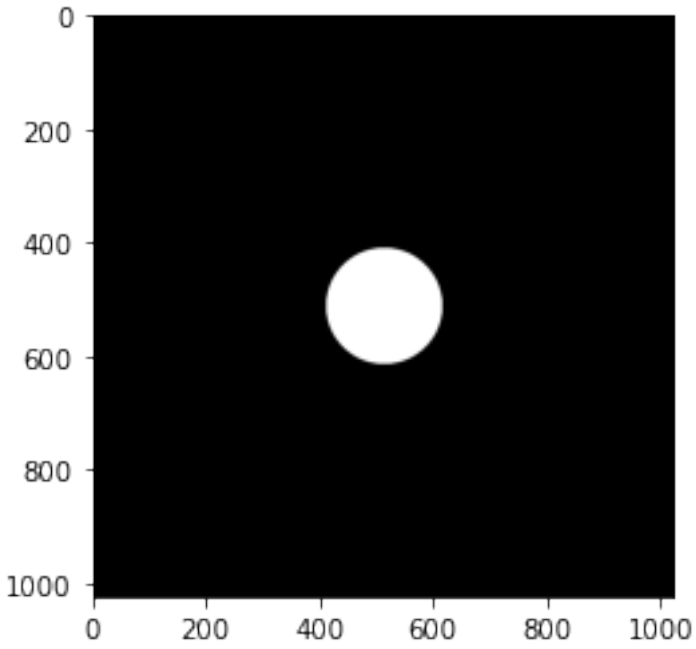



## Filtering

Now I am going to use a low pass filter ( I will use the codes from example used in class)

```
# This is formatted as code
N = 1024
x_size = 10
y_size = x_size  # make it square
x = np.linspace(-x_size/2, x_size/2, N)  # and symmetric around 0,0
y = np.linspace(-y_size/2, y_size/2, N)
R = 1
xx, yy = np.meshgrid(x, y, sparse=True)
lowpass = (np.sqrt(xx**2 + yy**2) <= R)*1
plt.imshow(lowpass, "gray")
```

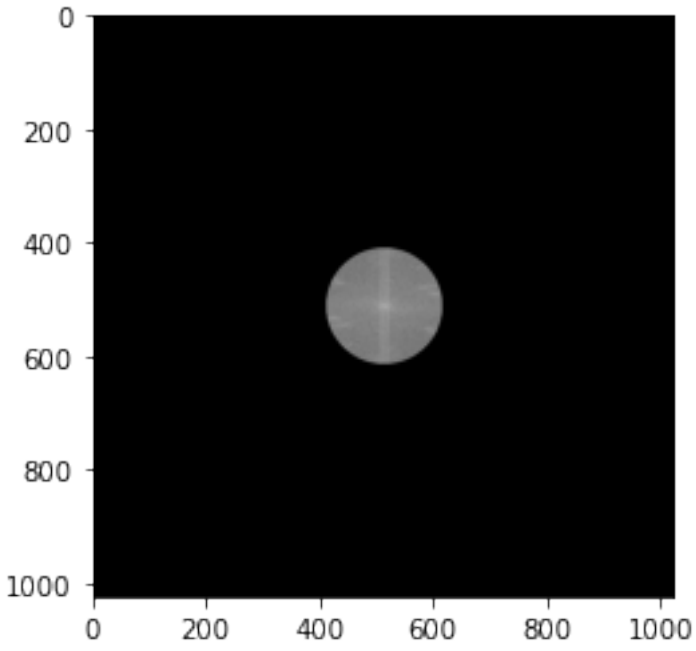
```
<matplotlib.image.AxesImage at 0xffff74296910>
```




Now I am going to apply the filter to the image after transform. I

```
plt.imshow(np.log(1+np.abs(lowpass*Fbilayercenter)), "gray")
```

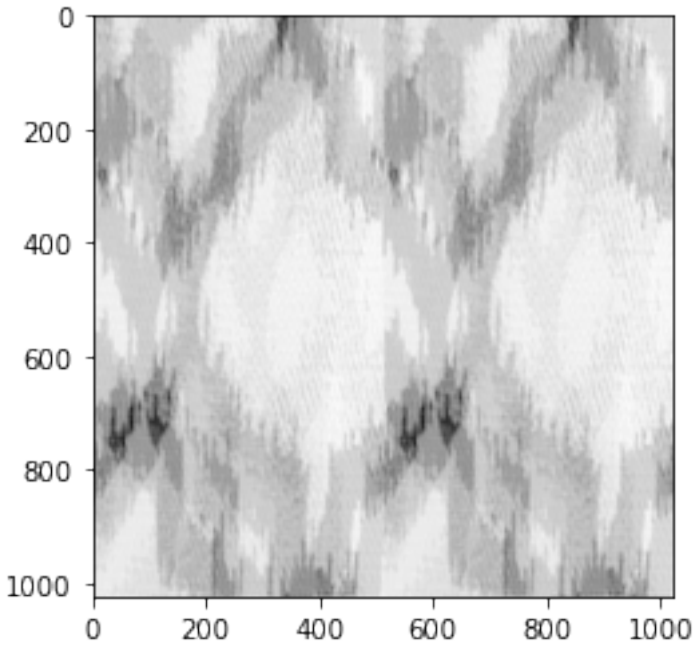
```
<matplotlib.image.AxesImage at 0xffff7450aa00>
```




Lets have a look after passing our filter .

```
filtered = np.fft.ifft2(lowpass*Fbilayercenter)
plt.imshow(np.log(1+np.abs(filtered)), "gray")
```

```
<matplotlib.image.AxesImage at 0xffff74246700>
```




Well, to me it looks like the filter had removed lot of patterns around the big pattern, makes it look little brighter.