# Experiment 4
# Frequency Domain Processing

**Q 1.** Read the image dip.tiff, and perform the following operation on the image.

1. Multiply the image by $(-1)^{x+y}$
2. Compute the FFT
3. Compute the Complex Conjugate of resultant FFT.
4. Compute Inverse FFT (iFFT) of the Complex Conjugate. (Which you got in step 3.)
5. Multiply the real part of the result by $(-1)^{x+y}$

**Write your own function for computing FFT and inverse FFT, do not use the inbuilt function**

**Output**: Show the resultant image. Explain the rationality behind the output.
**Bonus**: **Can you show any alternative algorithm for generating the same output using Fourier transform.** (Code and output)

**Q 2.** Perform the following frequency domain filtering writing your own function. (LPF= Low Pass Filter, HPF = High Pass Filter)

a. **Ideal_LPF, Ideal_HPF**
b. **Gaussian_LPF ,Gaussian_HPF**
c. **Butterworth_LPF, Butterworth_HPF**

**Input:** Image filename as input arguments, and cut of frequency.

**Output:** Display the (shifted) magnitude spectrums of the input, the filter and the filtered output. Make use of the tracker/slider function to 1) choose images, 2) filter types and 3) cut-off frequencies.

***Note***

1. Do not hardcode the filenames and/or image size into the code.
2. Use proper code commenting and documentation.
3. Use self-explanatory identifiers for variables/functions etc.

***References***

1. Gonzalez, Woods "Digital image processing" 3/e, Chapter 3, Prentice Hall.
2. NPTEL Lectures on Digital Image Processing by Prof. P.K.Biswas.