

## **Assignment No. 3**

Total Marks. 20

### **Instructions for Submission:**

1. Implement all the activities using MATLAB or Python.
2. Show the code and the output results for each activity (original image + filtered/enhanced image).
3. The print should be **neat and clearly visible**. If any image or result is **not clear or blurry**, the assignment will **not be accepted**.
4. Submitted to Mehran Ahmad
5. Submission Deadline: The hard copy of this assignment must be submitted **on or before the day of the Digital Image Processing (DIP) Paper**.

### **Question 1: Frequency Domain Smoothing (Lowpass Filtering)**

Apply and compare frequency domain **smoothing filters** on a grayscale image using Python/MATLAB. Understand the behavior of each filter in terms of noise reduction and image blurring.

#### **Instructions:**

1. Implement and apply the following **Lowpass Filters** in the frequency domain:
  - Ideal Lowpass Filter (ILPF)
  - Butterworth Lowpass Filter (BLPF) with order = 2
  - Gaussian Lowpass Filter (GLPF)
2. Cutoff frequency  $D_0 = 50$
3. Perform inverse FFT to get the filtered image.
4. Display and compare:
  - Original image
  - Filtered outputs
  - Their corresponding magnitude spectra

#### **Analysis:**

- Compare the visual smoothness and edge preservation.
- Discuss which filter best reduces noise and why.