Sri Sivasubramaniya Nadar College of Engineering, Chennai
(An autonomous Institution affiliated to Anna University)

Department of Computer Science and Engineering

Assignment-I, II

Degree & Branch	B.E. Computer Science & Engineering	Semester	V
Subject Code & Name	UCS2523 & Image Processing and Analysis		
Academic year	2025-2026 (Odd)	Batch:2023-2027	**Due date:18-09-2025 (Assignment 1) 24-10-2025(Assignment 2)**

- **Instructions:** You are expected to complete the assignment independently. While you are free to engage in discussions with your peers, do not copy from one another. If we identify submissions from two or more students that are significantly similar in content, all students involved will receive zero marks for this assignment. All submissions will be checked for plagiarism using standard tools. Please adhere to the following submission guidelines:
  - Use Python for all coding tasks.
  - Submit your code in the form of a Jupyter Notebook (.ipynb).

Objective

This assignment aims to provide students with a comprehensive understanding of the digital image processing pipeline. Students will critically evaluate and justify each step, including image acquisition, noise modeling, preprocessing, filtering, segmentation, and visualization, using real-world images and practical use-case simulations.

Assignment Task

Design and evaluate a complete digital image processing system by following the steps below. Your goal is not only to implement each step but also to justify and evaluate the effectiveness of your choices. [CO1,CO2, CO3, CO4, CO5, K5, 1.3.1, 2.1.3, 4.1.2, 10.1.2, 13.3.1]

1. **Image Acquisition:** Capture a real-world image using a webcam, smartphone, or any imaging device. Justify your choice of scene based on lighting, object diversity, and relevance to analysis [CO1, K4, 1.3.1, 13.3.1].
2. **Noise Simulation:** Add artificial noise (e.g., Gaussian, Salt-and-Pepper, or Speckle). Evaluate the nature and impact of the noise [CO3, K5, 2.1.3, 13.3.1].
3. **Preprocessing and Enhancement:** Convert the image to grayscale, resize it, and apply enhancement techniques such as histogram equalization or contrast stretching. Justify each preprocessing step and explain its role [CO2, K5, 1.3.1, 13.3.1].
4. **Noise Filtering and Denoising:** Apply at least two different spatial domain filters (e.g., median vs. Gaussian). Evaluate and compare their performance both qualitatively and quantitatively (e.g., PSNR, SSIM)[CO2, K5, 4.1.2, 13.3.1].

5. **Segmentation and Object Isolation:** Segment objects using thresholding or edge-based techniques. Critically analyze the segmentation results and justify your method selection [CO4, K5, 4.1.2,13.3.1].

6. **(Optional) Feature Evaluation:** Extract features such as area, centroid, or color histogram. Evaluate their relevance for object recognition or classification [CO5, K5, 4.1.2,13.3.1].

7. **Result Visualization and Reflection:** Display all major processing stages and annotate outputs. Evaluate the complete pipeline: What worked well? What would you improve? What did you learn [CO5, K5, 13.3.1]?

Note

Assignment 1: Tasks 1 to 4 (Image Acquisition to Noise Filtering and Denoising) will be evaluated under Assignment 1.
Assignment 2: Tasks 5 to 7 (Segmentation to Reflection and Visualization) will be evaluated as part of Assignment 2.

Report and Analysis

- Document the methodology, experimental results, visualizations (graphs), and key observations.
- The report should be prepared using the IEEE conference template IEEE Conference Template on Overleaf.
- The LaTeX document templates will be provided in the LMS for your reference.

Evaluation scheme:

Assignnment	**Component**	**Marks**
Assignment 1	Justification of Image Acquisition and Noise Type	10
	Preprocessing and Enhancement Techniques (Clarity and Justification)	10
	Filtering Methods: Comparison and Evaluation (PSNR, SSIM, etc.)	20
	Report and Analysis	10
Total (A1)		**50**
Assignment 2	Segmentation Approach and Critical Evaluation	15
	Result Visualization and Pipeline Reflection	15
	Programming	10
	Report and Analysis	10
Total (A2)		**50**
Total (A1+A2)		**100**