Program: BS (Computer Science)
Course Name: Digital Image Processing
Course Code: CSE-601
Credit Hours: 03
Total Weeks: 16
Total Hours: 48

Course Objectives:

This course introduces the fundamental concepts of digital image processing, including techniques for image enhancement, restoration, compression, and segmentation. It equips students with practical skills to analyze and process digital images using algorithms and tools commonly used in computer science and related fields.

Weekly Breakdown:

Week 1:

- Introduction to Digital Image Processing
- History and Applications of Image Processing
- Components of an Image Processing System

Week 2:

- Digital Image Fundamentals
- Image Representation and Formation
- Basic Concepts in Sampling and Quantization

Week 3:

- Image Enhancement in the Spatial Domain
- Basic Gray Level Transformations
- Histogram Processing

Week 4:

- Spatial Filtering
- Smoothing and Sharpening Filters

Week 5:

- Image Enhancement in the Frequency Domain

- Fourier Transform and Its Applications
- Frequency Domain Filtering

Week 6:

- Image Restoration
- Noise Models and Their Effects
- Restoration Techniques

Week 7:

- Color Image Processing
- Color Models: RGB, CMY, HSI
- Pseudocolor and Full-Color Image Processing

Week 8:

- Wavelet Transform
- Introduction to Wavelets
- Applications in Image Compression and Denoising

Week 9:

- Image Compression
- Fundamentals of Compression: Lossless and Lossy
- Popular Compression Standards (JPEG, PNG)

Week 10:

- Image Segmentation
- Thresholding Techniques
- Region-Based Segmentation

Week 11:

- Morphological Image Processing
- Erosion, Dilation, Opening, and Closing
- Applications in Shape Analysis

Week 12:

- Image Representation and Description
- Boundary and Regional Descriptors
- Feature Extraction Techniques

Week 13:

- Object Recognition
- Matching and Pattern Recognition
- Applications in Face and Object Detection

Week 14:

- 3D Image Processing
- Basics of 3D Image Representation
- 3D Reconstruction Techniques

Week 15:

- Advanced Topics in Image Processing
- Deep Learning for Image Processing
- Convolutional Neural Networks (CNNs)

Week 16:

- Case Studies and Applications
- Medical Imaging, Remote Sensing, and Industrial Inspection
- Final Review and Assessment

Total Marks: 100

Recommended Books:

1. *Digital Image Processing* by Rafael C. Gonzalez and Richard E. Woods
2. *Fundamentals of Digital Image Processing* by Anil K. Jain