**Elective IV: Digital Image Processing**

**Unit I:** Introduction: What is Digital Image Processing, Applications of Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of Image Processing System. Digital Image Fundamentals: Elements of Visual Perception, Image Sampling and Quantization, Basic Relationships between Pixels. Intensity Transformations: Basic Intensity Transformation Functions, PiecewiseLinear Transformations.

**Unit II:** Spatial Filtering: Histogram Processing – Histogram Equalization, Histogram Specification, Using Histogram Statistics for Image Enhancement, Fundamental of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters. Color Image Processing: Color Fundamentals, Color Models – RGB Model, CMY and CMYK Model, HSI Model, Pseudo-color Image Processing – Intensity Slicing, Intensity-to-Color Transformations.

**Unit III:** Filtering in Frequency Domain: Preliminary Concepts, Discrete Fourier Transform of One Variable, Extensions to Functions of Two Variables, Properties of 2-D DFT, Basics of Filtering in Frequency Domain, Image Smoothing using Frequency Domain Filters, Image Sharpening using Frequency Domain Filters; Selective Filtering.

**Unit IV:** Image Restoration and Reconstruction: Model of Image Degradation/Restoration Process, Noise Model, Restoration in the Presence of Noise only – Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear Position Invariant Degradations, Inverse Filtering, Wiener Filtering; Constrained Least Squares Filtering, Geometric Mean Filter.

**Unit V:** Image Compression: Fundamentals – Coding Redundancy, SpatialTemporal Redundancy, Measuring Image Information, Fidelity Criteria, Image 40 Compression Models, Basic Compression Methods – Huffman Coding, Arithmetic Coding, Run-length Coding, LZW Coding; Digital Image Watermarking.

**Unit VI:** Image Segmentation: Point, Line and Edge Detection – Detection of Isolated Points, Line Detection, Edge Models, Basic Edge Detection, The MarrHildreth Edge Detector, The Canny Edge Detector, Edge Linking and Boundary Detection; Thresholding – Basic Global Thresholding, Otsu's Method; RegionBased Segmentation – Region Growing, Region Splitting and Merging. Representation and Description: Boundary Following; Chain Codes; Polygonal Approximations using MPP; Signatures; Skeletons; Shape Numbers; Topological Descriptors.

**Text Books:** 1. Digital Image Processing; Rafael C. Gonzalez and Richard E. Woods; Third Edition; Pearson Education (India); 2014.

2. Digital Image Processing and Analysis; B. Chanda and D. Dutta Majumdar; Prentice Hall of India, 2001.

3. Digital Image Processing; S. Jayaraman, S. Essakkirajan and T. Veerakumar; Tata McGraw Hill; 2009.

**Reference Books:** 1. Digital Image Processing and Computer Vision; Milan Sonka, Vaclav Hlavac and Roger Boyle; Cengage Learning; 2008.

 2. Digital Image Processing; Kenneth R. Castleman; Pearson Education (India); 1996.

3. Fundamentals of Digital Image Processing; Anil K. Jain; PHI Learning; 2013.